FLORISTIC DIVERSITY OF TIGER RESERVES OF INDIA

Edited by

M SANJAPPA

DK SINGH

PARAMJIT SINGH

RAJESH GOPAL

Supported by

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Cover Photo : Sundarban Tiger Reserve , Tidal swamp Forest *(Photo : HS Debnath)*. Inset. (Left to Right) : *Gloriosa superba, Panthera tigris tigris, Mimosa hamata*

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எஸ். ரகுபதி
S. REGUPATHY
Tel. : 24391727
Fax : 24362222

राज्य मंत्री
पर्यावरण एवं वन
भारत सरकार
Minister of State
Environment & Forests
Government of India
New Delhi-110 003

MESSAGE

The implementation of Project Tiger has resulted in the *in-situ* conservation of several species of wild flora and fauna in our tiger reserves, apart from the tiger. This compendium of floristic surveys of the Botanical Survey of India relating to tiger reserves provides a wealth of information on our floral biodiversity.

The conservation strategy of Project Tiger involves setting up of core or critical tiger habitats free from biotic disturbance, surrounded by a buffer or peripheral area having ecologically sustainable land use.

I am confident this publication brought out in collaboration with the Project Tiger (now the National Tiger Conservation Authority) would be of immense use to our field managers for preparing the Tiger Conservation Plan.

(S. Regupathy)

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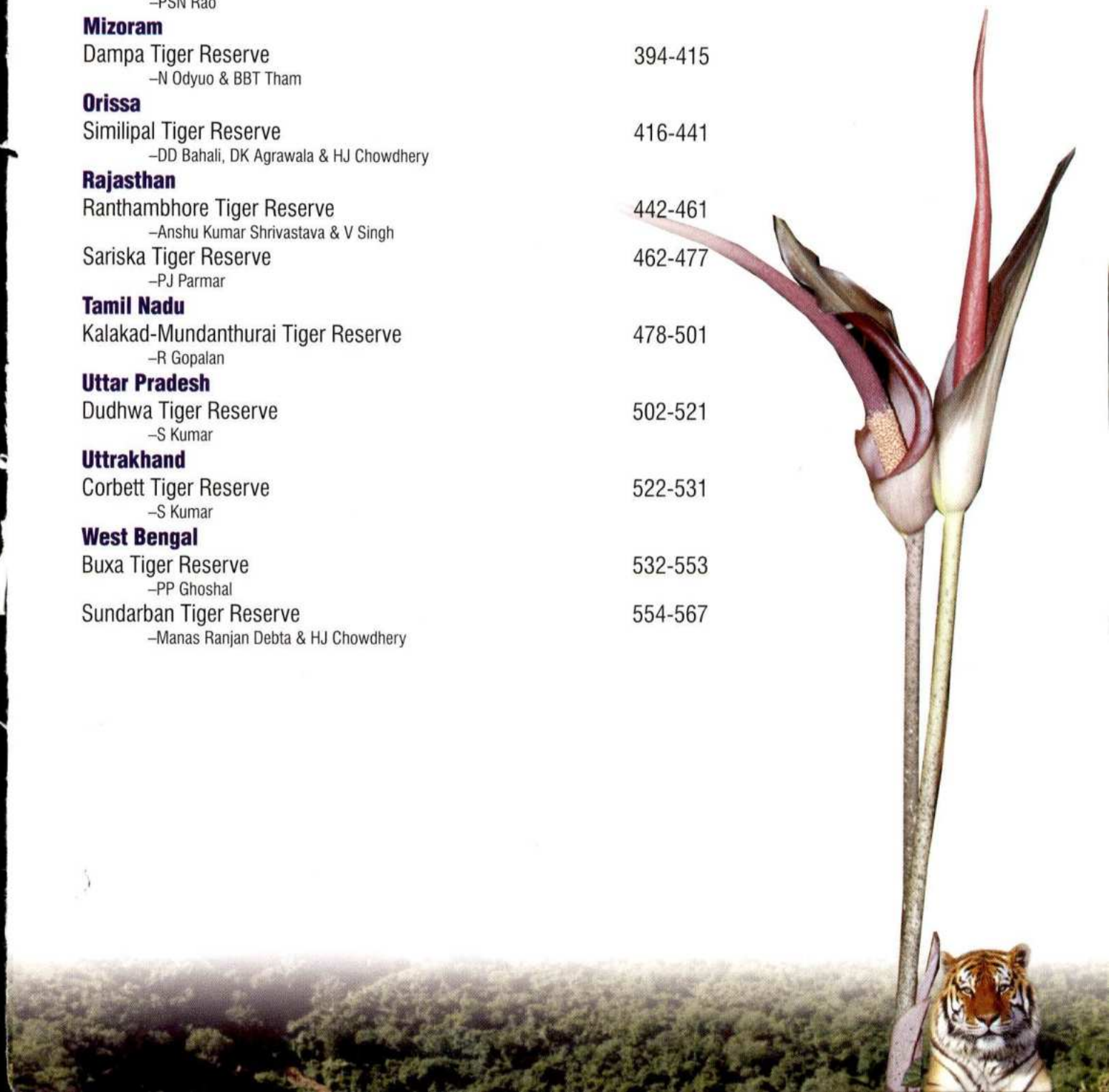


Floristic Diversity of Tiger Reserves of India – An Overview

M Sanjappa, DK Singh, Paramjit Singh
Botanical Survey of India,
CGO Complex, 5th & 6th Floor, Salt Lake City, Kolkata-700 064
&
Rajesh Gopal
National Tiger Conservation Authority,
Bikaner House, New Delhi- 110 001

The Indian tiger (*Panthera tigris tigris*) has been associated with our civilization and culture since time immemorial. The Indian mythology is full of references to them wherein it has been variously portrayed as 'provider', 'protector' and the 'guardian' of the people and the forests. No wonder the tiger is revered and worshiped by the people across the religious and cultural spectrum of our country, and is our 'national animal'. It is the most glamorous keystone species because of its majestic magnificence and the highest position in the 'food chain'. Unfortunately, the population of this big cat, which once roamed freely across its range, declined alarmingly during the better part of 20th century due to pleasure hunting and unabated poaching for illicit trade in its various organs and body-parts. This resulted in the populations of this charismatic species getting confined to few isolated and relatively undisturbed habitats of the country. To reverse this trend and conserve the tigers in their natural habitats Government of India launched 'Project Tiger' in 1973, one of the largest and most ambitious single species conservation programmes. Initially nine Tiger reserves were established in different states during the period 1973-74, by pooling the state and central resources. The number gradually increased to 28 by the year 2002 (Table I). In 2006 some more suitable habitats, with viable tiger populations, have been identified and proposed as potential 'Tiger Reserves' viz.

1. Anamalai Wildlife Sanctuary - Parambikulam Wildlife Sanctuary, Tamil Nadu & Kerala
2. Udanti Wildlife Sanctuary and Sita Nadi Wildlife Sanctuary, Chattisgarh
3. Satkosia Wildlife Sanctuary, Orissa
4. Kaziranga National Park, Assam
5. Achanakmar Wildlife Sanctuary, Chattisgarh
6. Dandeli Wildlife Sanctuary and Anshi National Park, Karnataka
7. Sanjay Gandhi National Park and Sanjay Dubri Wildlife Sanctuary, Madhya Pradesh
8. Mudumalai Wildlife Sanctuary, Tamil Nadu

Table I. Tiger Reserves in India with states, year of creation and area

STATE	TIGER RESERVE		YEAR	AREA(sq km)
Andhra Pradesh	1.	Nagarjunsagar-Srisailam	1983	3568
Arunachal Pradesh	2.	Namdapha	1983	1985
	3.	Pakke	2002	862
Assam	4.	Manas	1973	2840
	5.	Nameri	1998	344
Bihar	6.	Valmiki	1989	840
Chhattisgarh	7.	Indravati	1983	2799
Jharkhand	8.	Palamau	1973	1026
Karnataka	9.	Bandipur	1973	866
		Nagarhole (extension)	1999	643
	10.	Bhadra	1998	492
Kerala	11.	Periyar	1978	777
Madhya Pradesh	12.	Bandhavgarh	1993	1162
	13.	Bori-Satpura	1999	1486
	14.	Kanha	1973	1945
	15.	Panna	1994	542
	16.	Pench	1992	757
Maharashtra	17.	Melghat	1974	1677
	18.	Pench	1999	257
	19.	Tadoba-Andhari	1995	620
Mizoram	20.	Dampa	1994	500
Orissa	21.	Similipal	1973	2750
Rajasthan	22.	Ranthambhore	1973	1334
	23.	Sariska	1978	866
Tamil Nadu	24.	Kalakad-Mundanthurai	1988	800
Uttar Pradesh	25.	Dudhwa	1987	811
		Katerniaghat (extension)	1999	551
Uttrakhand	26.	Corbett	1973	1316
West Bengal	27.	Buxa	1983	759
	28.	Sundarban	1973	2585
Total Area				**37,761**

The Project Tiger has come a long way in not only resurrecting the declining tiger populations in these Tiger Reserves, but has also ensured the conservation of entire ecosystem in these reserves with its associated faunal and floral diversity. Besides, these reserves provided ideal natural laboratories for the study and understanding of 'plant-animal' relationship in its most pristine state. For scientific management of these reserves, however, base-line information on components of biodiversity, both plants and animals, is an important prerequisite.

The Botanical Survey of India, with an on going prioritized programme of survey and documentation of plant diversity of protected areas and fragile ecosystems, has, twice in the past, reviewed and published the status of floristic wealth in such reserves. In view of the increase in the number of tiger reserves over the past decade, and in order to assess the impact of conservation measures on the plant resources in these reserves, the present review has been taken up. These tiger reserves range in habitat from semi-arid climate in Sariska and Ranthambore (Rajasthan) to mangroves of Sunderban (West Bengal), grasslands of Manas (Assam) and Dipterocarp forests in Namdapha (Arunachal Pradesh), from sub Himalayan vegetation in Corbett (Uttarakhand) and Dudhwa (Uttar Pradesh) to tropical, wet evergreen forests and montane temperate forests and grasslands in Periyar (Kerala) and Kalakad-Mundathurai (Tamil Nadu).

PRESENT WORK

India is seventh largest country in the world having geographical area of about 329 million ha and more than 6000 km long coastline. It embraces very wide range of topography, including world's highest mountains- the Himalayas, low lying swamps and mangroves, island systems, luxuriant tropical rain forests, fertile alluvial plains, arid areas and high altitude cold deserts. On one hand there are wettest places of the Earth at Cheerapunji and Mawsynram in Meghalaya, and on other extreme western Rajasthan is one of the hottest region of the World. This diversity of topography, latitude, altitude and climate has probably led to widest variety of vegetation types anywhere on Earth. These forests range from Tropical wet evergreen and semi-evergreen forests to Alpine forest and scrubs with all possible combinations in between and are rich in floristic diversity. More than 80 percent of Indian flora finds refuge in these forests. About 11 percent of world species are found in India. It is estimated that India is tenth among the plant rich countries and sixth among the centres of diversity and origin of agro-horticultural crops.

Of all the species known from India, more than 8000 species are used as folk medicines and in different medical systems, nearly 3000 species have edible value, above 700 species are traditionally used in social and religious ceremonies , around 500 species are fibre yielding, 400 species have fodder value, 300 species yield gum, resins, tannins and dyes and ca 100 species yield different types of fragrances and essential oils.

The Convention on Biological Diversity (1992), to which India is a signatory, dwell a great deal on the need to document biological diversity. Article-7 of the Convention in particular emphasizes on identification and monitoring of the biodiversity. Assessment and documentation of plant resources of these reserves, therefore, will help in better understanding of ecological relationships, plant animal interactions, and analysis of environmental impact. These indicators may play an important role in effective planning and management of these tiger reserves.

The present work tries to compile available data on plant diversity in these protected areas, based on available literature and collections deposited in various internationally recognised herbaria of the Botanical Survey of India. The present book includes the botany of 28 tiger reserves. Some of the tiger reserves, like Namdapha in Arunachal Pradesh, have been well explored and include the inventory of all plant forms from Cryptogams (non flowering) to Angiosperms (flowering). Due to scarcity of specialist taxonomists, the study in most of the tiger reserves is mainly restricted to Angiosperms. This book highlights the various vegetation types

found in these tiger reserves along with floristic analysis, and glimpses of economically important, rare and threatened plants conserved in these reserves. These tiger reserves have been arranged State-wise in alphabetical order.

The comparative information on the forest types in these tiger reserves along with the important elements has been presented in Table II below.

Table II : Forest types and important elements

TIGER RESERVE	FOREST TYPES	IMPORTANT ELEMENTS
Andhra Pradesh		
NAGARJUNASAGAR	Mainly tropical dry deciduous forests. The vegetation can be broadly classified into four main types. 1.The plain vegetation comprises herbs and some shrubs such as *Cassia auriculata, Tephrosia hirta, Lepidagathis cristata, Securingea leucopyrus, Capparis stylosa, Helicteres isora, Ziziphus mauritiana, Vitex negundo, Waltheria indica, Melhania hamiltoniana* and *Solanum pubescens*. There are few trees including *Wrightia tinctoria, Salvadora persica* and *Borassus flabellifer*. Marshes with sedges and herbs occur near the river. 2. Scrub forests in the foothills with *Acacia horrida, A. chundra* and *Dichrostachys cinerea* as the dominant thorny xerophytic plants. Undershrubs include *Waltheria indica, Pavonia zeylanica* and *Indigofera hirsuta*. 3. Thorn forests on the well-drained hill slopes dominated by *Grewia rotundifolia*. Associates include *Euphorbia antiquorum, E. rivulia, Premna latifolia, Ziziphus oenoplia*. Less common shrubs are *Grewia orientalis, Helicteres isora* and *Capparis sepiaria*. 4. Dry deciduous forests on the hilltops comprise *Bauhinia racemosa, Albizzia amara, Cassia fistula* and *Commiphora roxburghii, Mundulea sericea*, a shrubby tree is frequent with large populations. Shrubs include *Barleria acuminata, Carissa spinarum* and the grassland formation is a noteworthy feature. Three forest types occur in Nallamalais, viz., Scrub, Dry deciduous and Moist deciduous with a few isolated types like Boswellia-type, Acacia-type, Hardwickia-type, Calamus rotang-type and some patches of evergreen type along perennial water sources. (*Suregada angustifolia* and *Memecylon umbellatum*).	*Jasminum auriculatum, Maeruva apetala, Ziziphus xylopyrus, Cissus vitiginea* and *Pterolobium indicum* are some of the rare plants in the area. Girdling of trees of *Cochlospermum religiosum*, and *Sterculia urens* for extraction of gum has been causing damage to trees. The fruits collected by Chenchus seasonally are *Bauhinia vahlii, Tamarindus indicus, Buchanania latifolia* (February-March), *Ficus infectoria, F. glomerata, Diospyros melanoxylon* (March-April). The chenchus very much love the flowers of *Bassia latifolia* (Mahuva tree). The flowers are eaten raw or boiled. They also extract liquor from the sun dried flowers. During the month of May, they collect wild mangoes and fruits of *Ficus benghalensis*. Chenchus are expert in honey collection, and are fond of honey collected during flowering of *Boswellia serrata* and *Albizzia procera*.
Arunachal Pradesh		
NAMDAPHA	Vegetation of the Namdapha Tiger Reserve may be broadly classified into tropical, temperate and alpine and tropical evergreen forests are perhaps the largest remaining *Dipterocarpus* forests in the whole of India. The dominant tall trees are *Albizia julibrissin* var. *mollis, A. procera, Alnus nepalensis, Anthocephalus chinensis, Artocarpus chama, A. heterophyllus, Canarium strictum, Castanopsis echinocarpa, C. kurzii, C. tribuloides, Celtis tetranda , Dipterocarpus retusus, Duabanga grandiflora, Elaeocarpus aristatus E. sphaericus, Exbucklandia populnea, Ficus altissima, F. elastica, F. drupacea, F. nervosa , F. rigida, Mangifera sylvatica, Nauclea griffithii, Quercus lamellose, Q. semiserrata, Shorea assamica, Terminalia myriocarpa* and *Toona ciliata*. The other trees forming middle storey, which is almost obscure, comprises *Altingia excelsa, Bruismia polysperma, Castanopsis indica, Dalbergia assam*ica, *Dillenia indica , D. pentagyna, Docynia indica, Dysoxylum binectariferum, D. gobara, Elaeocarpus tectaricus, Syzygium kurzii, Euodia trichotoma, Kydia calycina* var. *glabrescens, Magnolia griffithii, Schima wallichii, Terminalia chebula, T. citrina*, and *Turpinia*	It shows considerable presence of endemics e.g. *Aconitum lethale, Begonia aborensis, B. iridescens, Ceratostylis subulata, Chirita mishmiensis, Cymbidium eburneum* var. *parishii, Euonymus glaber, Phaius rubra, Piper clarkei, Rubus burkillii, Symplocos pealii* and *Wallichia triandra*, etc. Besides, a number of wild relatives of cultivated plants, ethnobotanically important and medicinal plants and plants of great horticultural value are found here like *Zanthoxylum armatum, Tacca integrifolia, Mastersia assamica, Musa velutina, Costus speciosus, Alpinia allughas, Setaria pumila*, etc.

TIGER RESERVE	FOREST TYPES	IMPORTANT ELEMENTS
	pomifera, etc. *Actephila excelsa, Actinodaphne obovata, Alangium chinense, Beilschmiedia roxburghiana, Cinnamomum bejolghata, C. tamala, Drypetes assamica, Ficus semicordata, Garcinia cowa, Griffithianthus fuscus, Gynocardia odorata, Litsea cubeba, L. monopetala, L. salicifolia, Macropanax undulatum, Magnolia hodgsonii* and *Styrax serrulatum* form a third storey of the canopy.	
PAKKE	Tropical semi evergreen forests seen along the lower plains and foothills of the reserve. The major tree species include *Aesculus assamica, Aglaia hiernii, Altingia excelsa, Anthocephalus chinensis, Artocarpus lacucha, Bischofia javanica, Bombax ceiba, Canarium strictum, Castanopsis indica, C. tribuloides, Chukrasia tabularis, Dillenia indica, D. pentagyna, Duabanga grandiflora, Dysoxylum binectariferum, D. gobara, Elaeocarpus aristatus, Gmelina arborea, Phoebe goalparensis, Pterospermum acerifolium, Sterculia villosa, Sterospermum chelonoides, Terminalia myriocarpa, Tetrameles nudiflora.* Tropical evergreen forest: The upper canopy mainly consist of tall tree species like *Aglaia hiernii, Altingia excelsa, Artocarpus chama, Bischofia javanica, Bombax ceiba, Callicarpa arborea, Canarium bengalense, Castanopsis indica, Chukrasia tabularis, Dillenia indica, Dipterocarpus retusus, Duabanga grandiflora, Echinocarpus* sp., *Lagerstroemia reginae, Mesua ferrea, Shorea assamica,* Subtropical broad leaved forest: The main tree are *Quercus lamellosa, Castanopsis tribuloides, C. purpurella, Quercus* sp., *Alnus nepalensis, Betula alnoides, Michelia* spp., *Magnolia* spp., *Engelhardia spicata, Albizia* spp., *Lindera* spp., *Litsea* spp. Bamboo forest: *Dendrocalamus hamiltonii* is common. *Bambusa pallida, Schizostachyum polymorphum, Chimonobambusa callosa, Schizostachyum latifolium, S. capitatum, Arundinaria* sp., *Phyllostachys* sp., are other bamboos found in the reserve. Riparian forest: Confined along the river like Khari, Pakke, Upper Dikorai, Kameng, etc. The top canopy is dominated by the species like *Alstonia scholaris, Albizia lebbeck, A. lucida, Bischofia javanica, Bombax ceiba, Dalbergia sissoo, Dillenia indica, Duabanga grandiflora, Lagerstroemia reginae, Sterculia villosa, Terminalia myriocarpa, Ficus* spp., *Litsea* spp., *Meliosma* spp., *Turpinia pomifera* , *Villebrunea* sp. etc. are commonly found. Various grass species are also common here.	*Balanophora diocia* is commonly found, associated with the roots of several tree species. Saprophytic orchids *Epipogium indicum, E. roseum* are found in dense humid forest floor. From the mixed deciduous forest of the reserve *Epipogium africanus* is discovered as new record for India. The reserve has been refuge for some rare and endangered species like *Angiopteris evecta, Gnetum scandens, Galeola lindleyana,* etc. Some of the wild relatives of cultivated plants are known from the reserve, e.g. *Artocarpus chama, Coffea bengalensis, Mangifera sylvatica, Musa velutina,* etc.
Assam MANAS	Tropical semi-evergreen forests: common tall trees are *Ailanthus grandis, Artocarpus chama, Aphanamixis polystachya, Anthocephalus chinensis, Canarium strictum, Dysoxylum binectariferum, Dipterocarpus retusus, Gynocardia odorata, Hydnocarpus kurzii, Kayea assamica, Kadsura heteroclita, Mesua ferrea, Mangifera sylvatica, Michelia doltsopa, Magnolia pterocarpa, Phoebe attenuata, P. lanceolata, P. goalparensis, Syzygium cumini, S. formosum, S. oblatum, Shorea assamica, Tetrameles nudiflora, Magnolia hodgsonii* and *Vatica lanceaefolia,* etc. The second story of the vegetation comprises of *Aglaia hiernii, Actinodaphne obovata, Cinnamomum tamala, Dillenia indica, Garcinia cowa, Ficus rhumphii, Lagerstroemia parviflora, Mallotus philippensis* and *Terminalia* sp., etc. Tropical moist and dry deciduous forests: dominating trees of these forests are *Haldina cordifolia, Aesculus assamicus, Albizia odoratissima, Anthocephalus chinensis, Bombax ceiba, Butea monosperma, B. parviflora, Callicarpa arborea, Careya arborea, Cassia fistula, Cordia dichotoma, Duabanga grandiflora, Gmelina arborea, Kydia calycina, Macaranga denticulata, Marsdenia tenacissima, Oroxylum indicum, Radermachera gigantea, Sterculia villosa, Sapium baccatum, Toona ciliata* and many species of *Ficus,* etc.	About 622 species under 394 genera and 129 families of vascular plants of which 591 species under 372 genera belonging to angiosperms, 1 to gymnosperms and 30 species to pteridophytes. Amongst the rare and endemic species collected from the reserve are *Curcumorpha longiflora, Parakaempferia synantha, Elaeocarpus assamicus, Paspalum longifolium* var. *lorirhachis* .

TIGER RESERVE	FOREST TYPES	IMPORTANT ELEMENTS
	Riparian forests: mostly extend over all alluvial formation along rivers and rivulets in the area. Common tree species are *Alstonia scholaris, Bischofia javanica, Dillenia indica,* inter mixed with *Dillenia pentagyna, Callicarpa arborea, Dalbergia sissoo, Glycosmis arborea, Holmskioldia sanguinea, Premna bengalensis, Sapium baccatum* and many species of *Ficus. Bombax ceiba, Oroxylum indicum* and *Cassia fistula* grow gregariously on the river banks and slopes. Alluvial grasslands: comprises *Arundinella bengalensis, Arundo donax, Saccharum longisetosum, S. ravennae, Imperata cylindrica* var. *major, Phragmitis karka, Saccharum arundinaceum, S. procerum, S. spontaneum, Themeda arundinacea, T. villosa, Thysanolaena maxima, Vetiveria zizanioides,* etc. Swamps: there are many pools and large 'beels' harbouring hydrophytes such as *Azolla pinnata, Eichhornia crassipes, Monochoria hastata, Alternanthera philoxeropides, Limnophiia sessiliflora, Ottelia alismoides, Nymphaea nouchali* and the swamps with clumps of tall *Typha elephantina, Lasia spinosa* and several other sedges like *Cyperus* and *Kyllinga.*	
NAMERI	Tropical evergreen forest: Tree species like *Altingia excelsa, Artocarpus chama, A. lacucha, Canarium bengalense, Dysoxylum binectariferum, Mesua ferrea, Stereospermum chelonoides, Vatica lanceaefolia* form the main canopy and primarily dominate this forest type. Smaller trees and shrub species include *Bauhinia purpurea, Cinnamomum bejolghota, Ixora acuminata, Saurauia roxburghii, Pavetta indica.* Tropical semievergreen forest: The common tree species in this forest type are *Albizia lebbeck, A. procera, Dillenia indica, Gmelina arborea, Magnolia hodgsonii, Phoebe goalparensis, Toona ciliata, Tetrameles nudiflora, Sterculia villosa,* etc. Other small tree species are *Bauhinia purpurea, Callicarpa arborea, Mallotus philippensis.* Tropical moist desiduous forest: dominated by many species like *Bischofia javanica, Bombax ceiba, Dalbergia sissoo, Duabanga grandiflora, Lagerstroemia speciosa, Pterospermum acerifolium, Pterygota alata, Sterculia villosa, Trewia nudiflora, Zizyphus mauritiana,* etc. *Antidesma acidum, Buddleja asiatica, Clerodendrum serratum, C. viscosum, Litsea salicifolia, Maesa indica, Mussaenda roxburghii,* etc. Riparian forest: primarily confined to various riverbanks and dominated by species like *Albizia lebbeck, Alstonia scholaris, Bischofia javanica, Bombax ceiba, Dalbergia sissoo, Dillenia indica, Duabanga grandiflora, Lagerstroemia speciosa* are found. Grassland: species that are growing abundantly are *Arundo donax, Imperata cylindrica, Phragmites karka, Saccharum spontaneum, Axonopus compressus, Thysanolaena maxima, Fimbristylis dichotoma, Cyperus rotundus, Cyperus halpan, Carex fuscifructus.*	Some rare, endangered and endemic plants of the reserve are: *Acorus calamus, Aquilaria malaccensis, Costus speciosus, Cyathea gigantea, Livistona jenkinsiana, Phoebe goalparensis, Tacca laevis,* etc. There are many plant species that are directly or indirectly consumed by wildlife. Some of them are *Antidesma acidum, Baccaurea ramiflora, Dillenia indica, Dysoxylum binectariferum, D. gobara, Emblica officinalis, Maesa indica, Syzygium* spp., *Terminalia chebula, T. bellirica, Musa* sp., *Ficus* spp. and different grass species. Many tall trees, like *Gmelina arborea, Bombax ceiba, Sterculia villosa, Dysoxylum gobara, Pterospermum acerifolium,* etc. provide shelter for different animals and birds.
Bihar		
VALMIKI	Tropical dry deciduous forests: The area is characterized by the presence of trees like *Shorea robusta, Kydia calycina, Butea monosperma, Anogeissus latifolia, Aegle marmelos, Lagerstroemia parviflora, Bauhinia malabarica, B. purpurea, B. racemosa, Dalbergia sissoo, Bombax ceiba, Mangifera indica, Sterculia urens, S. villosa, Terminalia bellirica, T. alata, T. chebula, Careya arborea, Haldina cordifolia, Neolamarckia cadamba, Mitragyna parviflora, Nyctanthus arbor-tristis, Holarrhena pubescens, Trema orientalis, Ficus semicordata, Salix tetrasperma, Albizia procera, Phyllanthus emblica, Syzygium cumini, Acacia catechu, Tamarindus indica,* etc. Terai grasslands and Alluvial grasslands are characterized by grasses like *Arundo donax, Phragmites vallatoria, Cymbopogon* spp., *Eragrostis* spp., *Saccharum arundinaceum, S. procerum, S. spontaneum, Themeda arundinacea, T. caudata, T. laxa, Vitiveria zizanoides, Rottboellia cochinchinensis,* etc. while *Acacia* spp., *Grewia* spp., *Terminalia* spp.,	Out of the 122 families of flowering plants the most dominant families in the area are - Poaceae, Leguminosae, Asteraceae, Euphorbiaceae, Rubiaceae and Acanthaceae. Out of 723 species 487 genera of angiosperms *Cyperus, Eragrostis, Desmodium, Ficus, Blumea* and *Crotalaria* are most dominant genera. *Leucas helicterifolia* and *Trachyspermum villosum* are endemic in West-Champaran district and are also found in the tiger reserve area.

TIGER RESERVE	FOREST TYPES	IMPORTANT ELEMENTS
	Calotropis procera, C. gigantea, etc. are some common trees and shrubs. Tropical moist deciduous forests: trees characteristic of these forests are *Shorea robusta, Terminalia alata, T. bellirica, Dalbergia sissoo, D. latifolia, Schlrichera oleosa, Haldina cordifolia, Bombax ceiba, Lagerstroemia parviflora, Antidesma ghaesembilla, Gmelina arborea, Mallotus philippensis, Kydia calycina, Aphanamixis polystachya,* etc. Fresh water swamp forests: Some of the common associates in this type are *Barringtonia acutangula* mixed with *Syzygium cumini, Salix tetrasperma, Ficus racemosa, Streblus asper, Calamus tenuis, C. viminalis, Phragmites vallatoria, Leersia hexandra, Arundo donax, Vetiveria zizanioides, Saccharum spontaneum,* etc. Aquatic and marshy vegetation: *Pistia stratiotes, Lemna gibba, L. perpusilla, Spirodela polyrrhiza, S. punctata, Trapa natans, Eichhornia crassipes,, Ceratophyllum demersum* and *Urticularia aurea.*	Rare elements of the Tiger reserve area are *Abrus pulchellus, Agrostemma sarmentosum, Coffea khasiana, Lobelia nicotianaefolia, Naravelia zeylanica, Olax scandens, Pterospermum acerifolium, Saraca asoca, Trevesia palmata, Xantolis tomentosa, Leucas helicterifolia, Trachyspermum villosum* and *Peucedanum nagpurense.*
Chhattisgarh		
INDRAVATI	Southern tropical moist deciduous forests : These forests are confined to lower hill slopes and are dense. Common tree species present in the top canopy are *Dillenia pentagyna., Gmelina arborea., Haldina cordifolia, Lannea coromandelica, Pterocarpus marsupium, Schleichera oleosa, Terminalia alata, T. bellirica* , etc. Southern tropical dry deciduous forests : Common trees are *Anogeissus latifolia, Alangium salvifolium, Boswellia serrata, Butea monosperma, Buchnania lanzan, Careya arborea, Cleistanthus collinus, Cassia fistula, Casearia graveolens, Cochlospermum religiosum, Dendrocalamus strictus, Diospyros melanoxylon, Dolichandrone falcata, Eriolaena hookeriana, Flacourtia indica, Garuga pinnata, Hardwickia binata, Holarrhena pubescens, Hymenodictyon orixense, Lagerstroemia parviflora, Mitragyna parvifolia, Oroxylum indicum, Pterocarpus marsupium, Semecarpus anacardium , Streblus asper, Terminalia bellirica , Wrightia tinctoria,* etc. Dry evergreen forests: some noticeable species are *Diospyros malabarica, Ficus racemosa , Manilkara hexandra , Memecylon umbellatum, Syzygium heyneanum* and *Vitex leucoxylon* Grasslands: Dominant species found in the grasslands are *Apluda mutica , Aristida setacea, Bothriochloa intermedia, B. pertusa, Chionachne koenigii, Chrysopogon fulvus, Digitaria ciliaris, Heteropogon contortus, Imperata cylindrica, Iseilema anthephoroides, I. laxa, Menesithea laevis, Pennisetum pedicellatum, Setaria intermediat, S. pumila, Sorghum halepense, Themeda laxa, T. quadrivalvis* and *Vetiveria zizanioides.*	Angiospermic diversity in the area comprises 561 species distributed in 355 genera and 101 families. Out of these 393 species in 265 genera and 81 families belong to dicotyledons and 168 species in 90 genera and 20 families to monocotyledon. Rare plants are *Hygrophila balsamica, Rhinacanthus nasuta, Staurogyne glauca, Amorphophallus sylvaticus, Heterophragma quadriloculare, Calycopteris floribunda, Cyperus platystylis, C. procerus, Fimbristylis argentea, Scleria annularis, Drosera burmanni, D. indica , Indigofera nummularifolia, Canscora heteroclita, Leucas stricta, Osbeckia muralis, Cansjera rheedii, Opilia amentacea, Eulophia explanata, Naravelia zeylanica* and *Elatostema cuneatum.*
Jharkhand		
PALAMAU	Moist tropical deciduous forest : The prominent associates in the first storey of these forests are, *Haldina cordifolia, Anogeissus latifolia, Bauhinia purpurea, B. tomentosa, B. variegata, Bombax ceiba, Butea monosperma, Buchanania lanzan, Croton oblongifolius, Dendrocalamus strictus, Diospyros melanoxylon, Phyllanthus emblica, Madhuca longifolia, Syzygium cumini,* etc. Dry tropical deciduous forest: a. Dry mixed deciduous forest trees are deciduous during the dry season. *Boswellia serrata, Cochlospermum religiosum* are the characteristic species of such forest. Bamboos are found scattered throughout this forest type. b. Dry sal forest.: Such forests are characterized by low quality and low height *Shorea robusta* (Sal) trees. The regeneration is slow and it is mixed with other species. All the trees are deciduous during the dry season. Bamboos are often present but not luxuriant. Climbers, epiphytes and	Of the 136 families of flowering plants represented in the reserve area, the most dominant families are: Poaceae, Fabaceae, Asteraceae, Euphorbiaceae, Cyperaceae, Rubiaceae, Acanthaceae, while *Crotolaria, Cyperus, Ficus, Cassia, Euphorbia, Acacia, Desmodium, Lindernia, Indigofera, Commelina, Sida* are amongst the dominant genera. *Begonia picta, Clematis gouriana, Dolichos trilobatus, Drosera burmannii, D. indica, Helinus lanceolatus, Lavendula bipinnata,*

TIGER RESERVE	FOREST TYPES	IMPORTANT ELEMENTS
	ferns are inconspicuous. The chief associates of dry deciduous sal forests in the first storey are *Haldina cordifolia, Boswellia serrata, Madhuca longifolia,* etc. Hydrophytic vegetation : some plants have no contact with soil. They float on the surface of water, e.g. *Lemna perpusilla, Trapa natans* and *Nymphoides hydrophylla.* Some plants are fixed to the bottom of the water body with the help of roots, which are buried in the soil and their leaves, flowers, etc. float on the water surface e.g., *Nelumbo nucifera, Nymphaea, pubescens,* etc. Some other hydrophytes are submerged but not anchored in stagnant water. Plants of this group are *Ceratophyllum demersum, Potamogeton crispus,* etc. The vegetation along the bank of the rivers, rivulets, streams and the sandy riverbeds is quite characteristics. *Aegle marmelos, Ficus semicordata, F. racemosa, Terminalia arjuna,* etc. are some of the common trees and shrubs along the stream and river courses. The shrubby vegetation is represented by *Calotropis gigantea, Ludwigia octovalvis, Ipomoea carnea, Ziziphus oenoplia,* etc.	*Nervilia prainiana, Phalaris minor, Pittosporum floribundum, Rubia wallichiana, Striga angustifolia, Utricularia bifida, Zanthoxylum armatum,* etc. are some of the rare elements of the flora of the reserve.
Karnataka		
BANDIPUR	Forest types include dry deciduous scrub, Dry teak bearing forest, and Moist teak bearing forest. The higher reaches of the park also contain semi-evergreen forests. Scrub jungle consists of *Bauhinia racemosa, Capparis grandiflora, Dichrostachys cinerea, Dodonaea viscosa, Flacourtia indica, Gmelina asiatica, Grewia obtusa, Pterolobium hexapetalum,* etc. The mixed deciduous type of forest is characterised by the trees like *Anogeissus latifolia, Cassia fistula, Dolichandrone arcuata, Emblica officinalis, Hymenodictyon excelsum, Mitragyna parvifolia, Terminalia bellerica* and *Vitex altissima.* In the semi-evergreen type of forests trees like *Ficus glomerata, Glochidion ellipticum, Ligustrum walkeri, Olea dioica, Syzygium cumini* and *S. malabaricum* are common. *Artemisia nilagirica, Pogostemon pubescens, Xenacanthus pulneyensis* and *Rauvolfia difusifiora* are some of the common shrubs, and intermixed with these, thick patches of *Bambusa bambos* and *Dendrocalamus strictus* are encountered.	Some interesting trees reported from the area are *Garuga pinnata, Givotia rottleriformis, Gmelina arborea, G. asiatica, Gordonia* spp., *Grewia tiliifolia, Hymenodictyon excelsum, Haldina cordifolia, Hardwickia binata, Holigarna* spp., *Holoptelea integrifolia, Hopea parvifolia, H. wightiana, Humboldtia brunonis, H.* spp., *Hydnocarpus laurifolia, Kingiodendron pinnatum, Kydia calycina, Lagerstroemia* spp.
BHADRA	The main forest types found in the area are Southern dry mixed deciduous forest , Southern moist mixed deciduous forest and Western sub-tropical hill forest.	Some of the important tree species of the area are *Acrocarpus fraxinifolius, Albizia odoratissima, A. procera, Alstonia scholaris, Anogeissus latifolia, Artocarpus hirsutus, Bauhinia malabarica.*
Kerlala		
PERIYAR	The top canopy in Tropical wet evergreen forests is formed of trees like *Antiaris toxicaria, Artocarpus hirsuta, Bhesa indica, Bischofia javanica, Calophyllum apetalum, C. polyanthum, Canarium strictum, Cullenia exariallata, Diospyros buxifolia, Dimocarpus longan, Dipterocarpus indicus, Dysoxylum malabaricum, Elaeocarpus tuberculatus, Garcinia xanthochymus, Holigarna arnottiana, Hopea parviflora, Kingiodendron pinnatum, Lophopetalum wightianum, Mangifera indica, Mesua ferrea, Myristica dactyloides, Palaquium ellipticum, Polyalthea coffeoides,* etc. The dominant trees in the top storey of Montane temperate forests are *Actinodaphne campanulata, Alseodaphne semicarpifolia, Bhesa indica, Callicarpa tomentosa, Casearia* sp., *Cinnamomum wightii, C. perotteti, Cryptocarya stocksii, Elaeocarpus tuberculatus, Eugenia discifera, Garcinia cowa, Glochidion neilgherrense, Gordonia obtusa, Litsea wightiana, Microtropis ramiflora, Neolitsea fischeri, Phoebe wightii, Rapanea capitellata, Rhododendron arboreum,* etc.	The tremendous diversity in the flora of this reserve has been reflected by the presence of 151 families 823 genera and 1965 species of flowering plants. Of the 28 species of *Impatiens* collected from the area, 26 are South Indian endemics. 18 out of the 23 species of *Strobilanthes* collected from this area are found to be endemic to South India. At family level Orchidaceae rank first with 55 endemic species followed by Rubiaceae (35), Acanthaceae (32), Poaceae, Fabaceae, Lauraceae, Balsaminaceae and Euphorbiaceae

TIGER RESERVE	FOREST TYPES	IMPORTANT ELEMENTS
	Southern montane wet grasslands: Most part of these grasslands have already been cleared for *Eucalyptus* plantations. The chief communities of grasses met with in this type are (a) *Sehima-Dicanthium* type dominated by *Heteropogon contortus, Sehima nervosum and Dicanthium* spp. (b) *Cymbopogon-Themeda cymbaria* type wherein *Cymbopogon flexuosus* and *Themeda cymbaria* are dominant and (c) *Saccharum-Imperata-Phragmites* type consisting of *Phragmites karka, Saccharum spontaneum and Imperata cylindrica*. Other temperate grasses found here are *Agrostis schimidii, A. zenkeri and Bromus diandrus* along with species of *Exacum, Bupleurum.*	(25 each), Lamiaceae (19), Melastomataceae (18) and Asteraceae (11).
Madhya Pradesh		
PENCH	Southern tropical dry deciduous teak forests : *Tectona grandis* is the most dominant species in this type of forests. Other associates are *Anogeissus latifolia, Diospyros melanoxylon, D. exsculpta, Terminalia alata, Lagerstroemia parviflora, Phyllanthus emblica, Dalbergia latifolia, Lannea coromandelica, Ougeinia oojeinensis, Pterocarpus marsupium, Mitragyna parvifolia, Haldina cordifolia.* Southern tropical mixed dry deciduous forests : The most characteristic tree species is *Anogeissus latifolia*, while other associates are *Terminalia alata, Mitragyna parvifolia, Buchanania lanzan, Boswellia serrata, Chloroxylon swietenia, Dichrostachys cinerea, Sterculia urens, Schrebera swietenioides, Cochlospermum religiosum, Syzygium cumini, Albizia odoratissima, A. procera, Madhuca longifolia* var. *latifolia, Aegle marmelos, Mallotus philippensis*. Plants growing along river and streams: *Terminalia arjuna, Polygonum barbatum, Nepeta hindostana, Rotula aquatica, Veronica anagallis-aquatica, Ficus racemosa, Limnophila indica, Ludwigia octovalvis, Cyperus alulatus, C. compressus., C. difformis, C. iria, C. pygmaeus, Fimbristylis bisumbellata, F. miliacea, Phragmites karka, Thysanolaena maxima, Vetiveria zizanioides,* etc. Plants growing in ponds and adjoining areas: *Nymphaea pubescens, Aeschynomene indica, Ammannia baccifera, Ludwigia octovalvis, L. perennis, Utricularia aurea, U. exoleta, U. stellaris, Hydrilla verticillata, Najas graminea, Aponogeton crispus, Potamogeton crispus, P. nodosus, Scirpus lateriflorus, S. articulatus, Vallisneria natans, Polygonum glabrum*, etc. Plants growing in marshy habitats: *Drosera burmanni, Ammannia baccifera, Glinus lotoides, Caesulia axillaris, Cyathocline purpurea, Lobelia alsinoides, Wahlenbergia marginata, Dopatrium junceum, Lindernia nummulariifolia, L. parviflora,* etc.	563 species under 353 genera belonging to 102 families occur in the reserve. Out of these, 122 species (21.7%) in 77 genera (21.8 %) and 24 families (23.5%) belong to monocotyledons while 441 species (78.3 %) in 276 genera (78.2 %) and 78 families (76.5 %) belong to dicotyledons.A number of plants of the reserve show less population, and it is interesting to record that many of them also show less population in Madhya Pradesh. Such species are *Capparis sepiaria, Polygala chinensis, Firmiana colorata, Aspidopterys cordata., Maytenus emarginata, Crotalaria retusa, Paracalyx scariosus, Drosera burmanni, Pimpinella wallichiana, Spermadictyon suaveolens, Flaveria trinervia, Goniocaulon indicum, Diospyros cordifolia, Carissa paucinervia, Ceropegia hirsuta, Strychnos potatorum, Cordia macleodii, Trichodesma sedgwickianum, Oroxylum indicum, Gantelbua urens, Trichuriella monsoniae, Litsea glutinosa, Breynia retusa, Trewia polycarpa, Ficus arnottiana, Habenaria roxburghii, Peristylus lawii, Dioscorea wallichii.*
KANHA	Sal forests : These forests are confined to low hills, lower slopes of higher hills and valleys. *Shorea robusta* (sal) is the dominant species in these forests. Top storey comprises *Shorea robusta , Syzygium cumini , Pterocarpus marsupium, Terminalia alata, T. arjuna, Haldina cordifolia* and *Anogeissus latifolia*. In understorey *Miliusa tomentosa, Semecarpus anacardium, Mallotus philippensis, Kydia calycina, Phyllanthus enblica Dillenia aurea, Bauhinia racemosa, Glochidion velutinum, Schleichera oleosa,* etc. are common. Southern tropical moist deciduous forests: These forests are found in sheltered valleys where soil depth is more and moisture content is high. Top storey is 30 to 35 m high and is constituted by *Bridelia retusa, Pterocarpus marsupium, Ficus arnottiana, Stereospermum chelonoides, Grewia tiliifolia, Gmelina arborea, Schleichera oleosa, Terminalia alata, T. chebula* and *Haldina cordifolia.*	The pteridophytes are represented by 9 families comprising of 11 genera and 17 species, whereas, the angiosperms comprise 705 species under 439 genera belonging to 110 families. Rare plants, especially for the state of Madhya Pradesh, present in the tiger reserve are *Acrocephalus verbenifolius* (Lamiacaeae), *Combretum nanum* (Combretaceae), *Cyperus melanospermus* (Cyperaceae), *Dipteracanthus beddomei* (Acanthaceae), *Drosera burmanni* (Droseraceae),*Eriosaema himalaicum* (Fabaceae), *Ficus beddomei*

TIGER RESERVE	FOREST TYPES	IMPORTANT ELEMENTS
	Southern tropical dry deciduous forests: Small (12 to 20 m high) deciduous trees such as *Lannea coromandelica, Boswellia serrata, Aegle marmelos, Sterculia urens, Radermachera xylocarpa, Diospyros melanoxylon, Butea monosperma, Phyllanthus emblica, Buchnania lanzan, Madhuca longifolia* var. *latifolia* and *Cassia fistula* are common in these forests. Grasslands. These are found in lower part of valleys, on alluvial soil of streams and on flat hill- tops. In lower part of valleys excellent growth of grasses is seen. The main species of these grasses are *Apluda mutica, Bothriochloa intermedia, B. kuntzeana, Capillipedium parvifolium, Chionachne koenigii, Coix lacryma-jobi, Cymbopogon martinii, Dichanthium caricosum, Eulaliopsis binata, Heteropogon contortus, Iseilema anthephoroides, I. laxum, Panicum notatum, Pennisetum hohenackeri, Pogonantherum paniceum, Sorghum nitidum, Themeda laxa, T. triandra* and *T. quadrivalvis.* In alluvial soil along the banks of streams tall grasses, viz., *Apluda mutica, Chionachne koenigii, Coix aquatica*, etc. are quite common.	(Moraceae), *Flemingia prostrata* (Fabaceae), *Grewia sapida* (Tiliaceae), *Indigofera hamiltonii* (Fabaceae), *Ochna pumila* (Ochnaceae), *Olax nana* (Olacacaeae).
BORI-SATPURA	South Indian moist deciduous forests: These forests are mainly deciduous in nature but lower storeys are largely evergreen. Top canopy is rarely dense and even. Climber and epiphytes are generally abundant. The common constituents of these forests are the tall trees of *Tectona grandis, Shorea robusta, Pterocarpus marsupium, Terminalia alata, T. bellerica, T. chebula, Lannea coromandelica , Dalbergia paniculata, Haldina cordifolia, Bombax ceiba, Garuga pinnata, Lagerstroemia parviflora* and *Anogeissus latifolia.* Tropical dry deciduous forests: These forests are met with in northeastern part of the tiger reserve. The common constituents here are tall trees of *Terminalia* spp., *Tectona grandis, Pterocarpus marsupium, Cochlospermum religiosum, Butea monosperma, Lagerstroemia parviflora, Anogeissus latifolia, A. pendula, Mitragyna parviflora, Phyllanthus emblica, Sterculia* spp., *Boswellia serrata, Albizia* spp., *Hardwickia binata, Bauhinia* spp., *Aegle marmelos* and *Acacia* spp. Central Indian subtropical hill forests: These are found on hilltop of Pachmarhi plateau. These forests are exposed and often with poor soil and comprise *Michelia champaca, Syzygium cumini, Manilkara hexandra, Mangifera indica, Salix tetrasperma, Dillenia* spp., *Mallotus philippensis* together with tree fern *Alsophila* as a common element. Aquatic plants: The undulating geography and deep gorges have resulted in the formation of several waterfalls, marshy places and perennial streams which are congenial places for the growth of aquatic plants. These can be classified into six categories. Free floating hydrophytes: *Azolla piñnata, Eichhornia crassipes* and *Trapa nutans* var. *bispinosa.* Suspended submerged hydrophytes: *Ceratophyllum demersum* and *Utricularia exoleta.* Anchored submerged hydrophytes: *Hydrilla verticillata, Najas* spp. and *Vallisneria natans.* Anchored hydrophytes with floating shoots: *Ipomoea aquatica* and *Ludwigia adscendens.* Anchored hydrophytes with floating leaves: *Aponogeton natans, Marsilea minuta , Monochoria vaginalis, Nelumbo nucifera , Nymphaea nouchali* and *Nymphoides indica.* Emergent amphibious hydrophytes: *Aeschynomene indica, Ammania baccifera , A. multiflora, Brachiaria reptans, Cyperus distans .*	A total of 1319 species under 676 genera belonging to 163 families occur in the Satpura tiger reserve. Out of these, 1221 species belong to angiosperms and 98 species to pteridophytes. Among the ten dominant genera, the genus *Cyperus* exhibits maximum species diversity and represented by 32 species. It is followed by *Euphorbia* (19 spp.), *Crotalaria* (19 spp.). Two species and a variety found to be endemic in Pachmarhi wildlife sanctuary of Satpura Tiger Reserve are *Berberis hainesii* var. *hainesii, B. hainesii* var. *brevifolipes* and *Ficus cupulata.* Some of the rare species found in the reserve are *Abrus pulchellus, Acacia donaldi, Begonia malabarica, Cajanus heynei, Ceropegia oculata, Corallocarpus epigaeus*, etc.

TIGER RESERVE	FOREST TYPES	IMPORTANT ELEMENTS
BANDHAVGARH	Sal forests: The vegetation found on the lower slopes and on the plains represent a good patch of *Shorea robusta*. The main associates of Sal viz., *Pterocarpus marsupium, Lagerstroemia parviflora, Terminalia bellerica, Phyllanthus emblica, Buchanania lanzan, Careya arborea* are frequent in the second storey. Mixed forest: This forest is represented by the deciduous element of plants but the vegetation seen in the lower storey comprises evergreen species. Among the tree species *Shorea robusta* mixed with *Tectona grandis, Terminalia alata, T. chebula, Lannea coromandelica, Sterculia urens, Boswellia serrata, Bombax ceiba, Garuga pinnata, Soymida febrifuga* and *Anogeissus latifolia* are common. On the exposed slopes of the rocky hills the density of sal is quiet low and other species are *Albizia odoratissima*, and *Bridelia retusa*. Among the medium sized trees are *Cochlospermum religiosum, Madhuca longifolia* var. *latifolia, Erythrina stricta, Mallotus philippensis, Cleistanthus collinus, Diospyros exsculpta, Aegle marmelos, Dillenia pentagyna, Bridelia squamosa, Helicteres isora, Gardenia gummifera, Citrus medica, Holarrhena pubescens, Acacia catechu, Ficus racemosa*, etc. Grasslands: The common grass species are *Aristida adscensionis, Dimeria ornithopoda, Apluda mutica, Arundinella setosa, Digitaria longiflora, Bothriochloa intermedia, Cymbopogon* sp., *Dichanthium annulatum, Heteropogon contortus, Imperata cylindrica, Phragmites karka, Saccharum spontaneum*, etc. The species growing on rocky slopes are *Thysanolaena maxima, Themeda quadrivalvis* and *Arundinella setosa*. Aquatics: Free floating, submerged and anchored species: *Ceratophyllum demersum, Hydrilla verticillata, Lemna perpusilla* are the free floating forms. *Eichhornia crassipes, Potamogeton indicus, Ipomoea aquatica, Monochoria vaginalis, Nymphaea pubescens, Hygrorhiza aristata* are the submerged anchored forms. Plants growing in marsh: Large numbers of species grow in marshy land along the lake. These are *Aeschynomene aspera, Ammania baccifera, Coix aquatica, Cyperus distans, Eleocharis palustris, Ludwigia octovalvis, Polygonum barbatum, P. glabrum, P. plebejum, Rotala indica, Centella asiatica* and *Bacopa monnieri*.	The flora of Bandhavgarh Tiger reserve comprises 529 species belonging to 380 genera under 119 families. Of these, monocots are represented by 125 species, 86 genera under 22 families, whereas dicots are represented by 394 species, 286 genera under 90 families. Pteridophytes are represented by 10 species and 8 genera under 7 families. Family Poaceae with 46 genera and 62 species dominates in the reserve followed by Fabaceae 29/56; Asteraceae 27/33; Cyperaceae 7/26; Euphorbiaceae 11/18; Acanthaceae 13/17; Rubiaceae 10/15; Malvaceae 9/12; Lamiaceae 10/12; Amaranthaceae 8/10 and Caesalpinaceae 3/10. Similarly, *Cyperus* with 11 species, is the largest genus in the Tiger reserve, followed by *Ficus* with 9 species.
PANNA	Dry Teak forests: These forests occur on trap, shells, granites, geneses and sandstones. The growth is good in Ken valley where the soil is sandy and water table is high. But shallow soil and low water table on the plateaus exhibit stunted and sparsely distributed tree species. These are represented by *Tectona grandis, Anogeissus latifolia, Terminalia tomentosa, Lagerstroemia parviflora* Roxb., *Phyllanthus emblica, Ougeinia oogeinsis, Pterocarpus marsupium, Lannea coromandelica, Boswellia serrata*, etc. The under story comprises *Buchanania lanzan, Miliusa tomentosa, Gardenia latifolia, Aegle marmelos, Cassia fistula, Acacia catechu, Ziziphus xylopyrus*, etc. Dry deciduous mixed forests: These forests occur mainly on sandstones, shales and laterites where soils are shallow to fairly deep, sandy, lateritic and red loam. They are more prone to fires and have been subjected to heavy cattle grazing in the past. The tree species here belong to *Terminalia alata, Anogeissus latifolia, Mitragyna parvifolia, Lannea coromandelica, Boswellia serrata, Terminalia arjuna, Schleichera oleosa, Holoptelea integrifolia, Hoppea dichotoma, Catunaregum nilotica, Combretum roxburghii* and patches of *Tectona grandis*. Dry scrub forests: These forests are found in the areas adjacent to villages and cultivated fields and do not show stratification. The main components of these forests are represented by *Vitex negundo, Annona squamosa, Carissa opaca, Capparis zeylanica, Calycopteris floribunda, Flacourtia indica, Grewia hirsuta, Helicteres isora, Holarrhena pubescens, Jatropha curcas, Woodfordia fruticosa, Ziziphus oenoplia, Lantana camara, Datura innoxia, Wrightia tinctoria, Diospyros melanoxylon, Haldina cordifolia, Ziziphus nummularia*, etc. Most of the tree species of these forests are stunted and sparsely distributed.	Floristic diversity of the reserve is represented by 441 species of Angiosperms, distributed under 302 genera and 86 families. 9 species of Pteridophytes distributed under 8 genera and 7 families are also recorded from the area. Rare species of the Madhya Pradesh located in the reserve are *Crotalaria umbellata, Curcuma aromatica, Cuscuta hyalina, Diplazium esculentum, Dipteracanthus patulus, Eragrostis coarctata, Eriagrostis viscosa, Eriocaulon parviflorum.*

TIGER RESERVE	FOREST TYPES	IMPORTANT ELEMENTS
	Boswellia forests: These forests occur on dry upper slopes of hills having dry shallow and stony soils. The main characteristic component of these forests is *Boswellia serrata* which occupies the higher plateaus and slopes in dry conditions. These forests sometimes become pure on ridges in some areas of Talgaon and Kawar beats. The other common species associated with these forests are *Mitragyna parvifolia, Lannea coromandelica, Terminalia tomentosa, Anogeissus latifolia, Diospyros melanoxylon, Ougeinia oogeinsis, Phyllanthus emblica, Soymida febrifuga, Ziziphus xylopyrus, Holarrhena pubescens, Gardenia latifolia, Cassia fistula, Buchanania lanzan,* while *Ziziphus oenoplia, Butea parviflora, B. superba* and *Ventilago denticulata* are some of the common climbers of these forests. Fodder grasses are represented by the species viz. *Apluda mutica, Bothriochloa pertusa, Eragrostis tenella, Heteropogon contortus, Phragmites karka, Themeda caudata, Themeda quadrivalvis, Thysanolaena maxima* etc. Dry bamboo breaks: Bamboos do not occur in pure patches and are usually found on the slopes of hills, in upper reaches of nalas and occasionally along the banks of streams. The areas which were over exploited in the past and are close to the habitations still have bamboo growth but with poorly developed and quickly drying culms. These forests are mainly represented by two species viz. *Dendrocalamus strictus* and *Bambusa bambos*, which are found in the understorey of *Tectona grandis* and mixed forests such as *Phyllanthus emblica, Acacia catechu, Cassia fistula, Jatropha curcas, Acacia leucophloea, Woodfordia fruticosa, Ziziphus mauritiana.*	
Maharashtra		
PENCH	The vegetation is mainly of dry deciduous type in the reserve. Some common tree species include *Annona squamosa, Kydia calycina, Thespesia lampas, Bombax ceiba, Helicteres isora, Grewia tiliifolia, Boswellia serrata, Garuga pinnata, Zizyphus mauritiana, Dalbargia paniculata, D. sissoo, Erythrina stricta, Pongamia pinnata, Bauhinia racemosa, Tamarindus indica, Acacia chundra, A. leucophloea, A. nilotica, Anogeissus latifolia, Terminalia cuneata, Haldina cordifolia, Mitragyna parvifolia, Diospyros melanoxylon, Madhuca longifolia* var. *latifolia, Carissa congesta, Holarrhena pubescens, Wrightia tinctoria.* The aquatic vegetation includes common plants like *Nelumbo nucifera, Nymphaea nouchali, N. pubescens, Nymphoides hydrophylla, N. indica, Vallisneria spirallis.*	Angiosperms and pteridophytes, comprise 106 families, 385 genera and 635 species in the reserve. The ten dominant families in the area are: Poaceae, Fabaceae, Asteraceae, Euphorbiaceae, Acanthaceae, Caesalpiniaceae, Lamiaceae, Cyperaceae, Rubiaceae and Convolvulaceae. Poaceae represented by 94 species and 55 genera is the most dominant family in the area.
MELGHAT	These forests belong to, 'southern tropical dry deciduous forests'. *Tectona grandis* is the most dominant species. Its most common associates in almost all localities are *Legerstroemia parviflora, Lannea coromandelica, phyllanthuso emblica, Terminalia tomentosa, Anogeissus latifolia* and *Ougenia oojeinensis.* Depending up on the habitat, grasses like *Heteropogon ritchie, Spodiopogon rhizophorus, Themeda quadrivalvis, Sorghum controversum* show almost pure patches of growth (above 90%) in local areas of the reserve. The aquatics are limited in the reserve and represented by species like *Ceratophyllum demersum, Hydrilla verticillata, Vallisneria spiralis, Crinum defixum.*	The reserve shelters 648 species of vascular plants belonging to 398 genera and 97 families. Parasitic plants like *Dendrophthoe falcata* is common and occurs on a wide range of hosts, whereas *Viscum articulatum, Cuscuta reflexa* are rare and *Cuscuta chinensis* is frequent.
TAROBA-ANDHARI	The vegetation of the area is of mixed deciduous type. The prominent tree species occurring frequently are *Albizia lebbeck, Anogeissus latifolia, Bauhinia racemosa, Dalbergia latifolia, Diospyros melanoxylon, Haldina cordifolia, Mitragyna parvifolia, Sterculia urens, Tectona grandis, Terminalia bellirica, T. chebula, T. crenulata.* The plants on the top of the hillocks are represented by trees like *Bridelia retusa, Lannea coromandelica, Soymida febrifuga,* etc. Ponds and ditches, at places stagnant waters are rich in aquatic vegetation. The aquatic plant species frequently noticed are *Blyxa octandra, Ludwigia hyssopifolia, Nymphaea nouchali, Ottelia alismoides, Pistia stratioites,* etc.	Angiosperms and Pteridophytes comprise a total of 667 species, 393 genera and 110 families. The five dominant families in the area in the order of their highest representation of species are Fabaceae, Poaceae, Cyperaceae. Euphorbiaceae, Asteraceae.

TIGER RESERVE	FOREST TYPES	IMPORTANT ELEMENTS
Mizoram		
DAMPA	The vegetation is of tropical wet semi-evergreen to deciduous type , mixed bamboo forest and pure bamboo stands. Top canopy consisting of of *Aphanamixis wallichii, Bischofia javanica, Dipterocarpus retusa, Duabanga grandiflora, Firmiana colorata, Haldina cordifolia, Mesua ferrea, Syzygium cumini, Schima wallichii, Sapium baccatum, Lindera pulcherrima, Persea villosa, Castanopsis indica, Elaeocarpus aristatus, E. floribundus.* Some canopy species such as *Dipterocarpus indicus, Toona ciliata, Michelia doltsopa* and *Tetrameles nudiflora* reach up to 35 m in height. Common bamboo species forming pure strands are *Melocanna baccifera, Bambusa tulda, Dendrocalamus hamiltonii* and *Schizostachyum polymorphum.*	Pure bamboo strands of *Melocanna baccifera* have shown gregarious flowering in Mizoram after about 40 years interval and resulted in denudation of land as bamboo dies after completing its life cycle.
Orissa		
SIMILIPAL	Tropical moist deciduous forests: *Shorea robusta* (Sal) is the dominant species in this forest. The other important constituents of the top storey are *Xylia xylocarpa, Haldinia cordifolia, Mirtagyna parvifolia, Terminalia bellirica, T. alata, T. tomentosa, T. chebula, Madhuca indica, Bombax ceiba, Gmelina arborea, Firmiana colorata, Pterocarpus marsupium, Dalbergia latifolia, Schleichera oleosa, Bridelia retusa, Dillenia pentagyna,* Tropical semi-evergreen forests: The important constituents of these forests are *Artocarpus lacoocha, Toona ciliata, Mangifera indica, Bridelia retusa, Mesua ferrea, Xylia xylocarpa, Polyalthia cerasoides, Strychnos nux-vomica, Michelia champaca, Biscofia javanica, Cipadessa baccifera, Macaranga peltata, Litsea nitida, Anthocephalus chinensis, Syzygium cumini, Dalbergia latifolia, Mallotus philippensis, Celtis tetrandra, Terminalia alata, Ardisia solanacea, Woodfordia fruticosa, Phoebe lanceolata.* Tropical dry deciduous forests: The important constituents of these forests are *Shorea robusta, Anogeissus latifolia, Terminalia alata, T. chebula, Diospyros melanoxylon, Haldinia cordifolia, Cassia fistula, Mallotus philippensis, Lagerstoemia parviflora, Semicarpus anacardium, Buchanania lanzan, Lannea coromandelica, Protium serratum, Sterculia urens, S. villosa, Cochlospermum religiosum,* etc. Grasslands: *Imperata cylindrica, Saccharum* sp., *Themeda* spp., *Cymbopogon flexuosus, Andropogon alsinodis, Apluda mutica, Heteropogon contortus, Capillipedium assimile, Chrysopogon aciculatus, Arundinella setosa, Bothriochloa* spp., *Eragrostis* spp., *Sporobolus indicus, Digitaria* spp., *Cynodon dactylon* and a number of herbaceous species. Aquatic and wetland vegetation: The important aquatic plants of the reserve are *Hydrilla verticillata, Ottelia alismoides, Valisneria spiralis, Nymphoides hydrophilla, Utricularia* spp., *Aponogeton natans* and some algae. The significant plants in the swampy and marshy habitats include *Ammania baccifera, Arundo donax, Ludwigia octavalvis, Ipomoea aquatica, Polygonum barbatum, Homonoia riparia, Floscopa scandens, Monochoria vaginalis, Commelina benghalensis, Scirpus articulatus, Leersia hexandra, Paspalum* spp., *Sacciolepis indica, Paspalidium flavidum, Hygrorhiza aristata, Fimbristylis* spp., *Carex* spp., *Eriocaulon melaleucum.*	Simlipal shelters 180 families, 720 genera, 1276 species, 12 subspecies and 39 varieties of vascular plants including 73 cultivated or naturalised taxa.Of the 29 endemic taxa in Orissa, only 3 taxa, viz. *Aspidopterys tomentosa* var. *hutchinsonii* (Malpighiaceae), *Bulbophyllum panigrahianum* (Orchidaceae) and *Eria meghasaniensis* (Orchidaceae) occur in Similipal. While *B. panigrahianum* is confined only to Similipal *E. meghasaniensis* has an extension of its range to Rebana forest of the adjoining Keonjhar district.Present analysis reveals ca 75 taxa belonging to 59 genera and 29 families of vascular plants and thriving in the reserve are possibly rare or endangered.
Rajasthan		
RANTHAMBHORE	*Anogeissus pendula* forest: *Anogeissus pendula* is the dominant tree species of the reserve. It is often found in pure stands in the slopes of the hills. The usual trees species associated with it are: *Boswellia serrata, Sterculia urens, Lannea coromandelica, Diospyros montana, Bauhinia racemosa.*	From this reserve, a total number of 548 indigenous and naturalized plant species belonging to 324 genera under 97 families have been

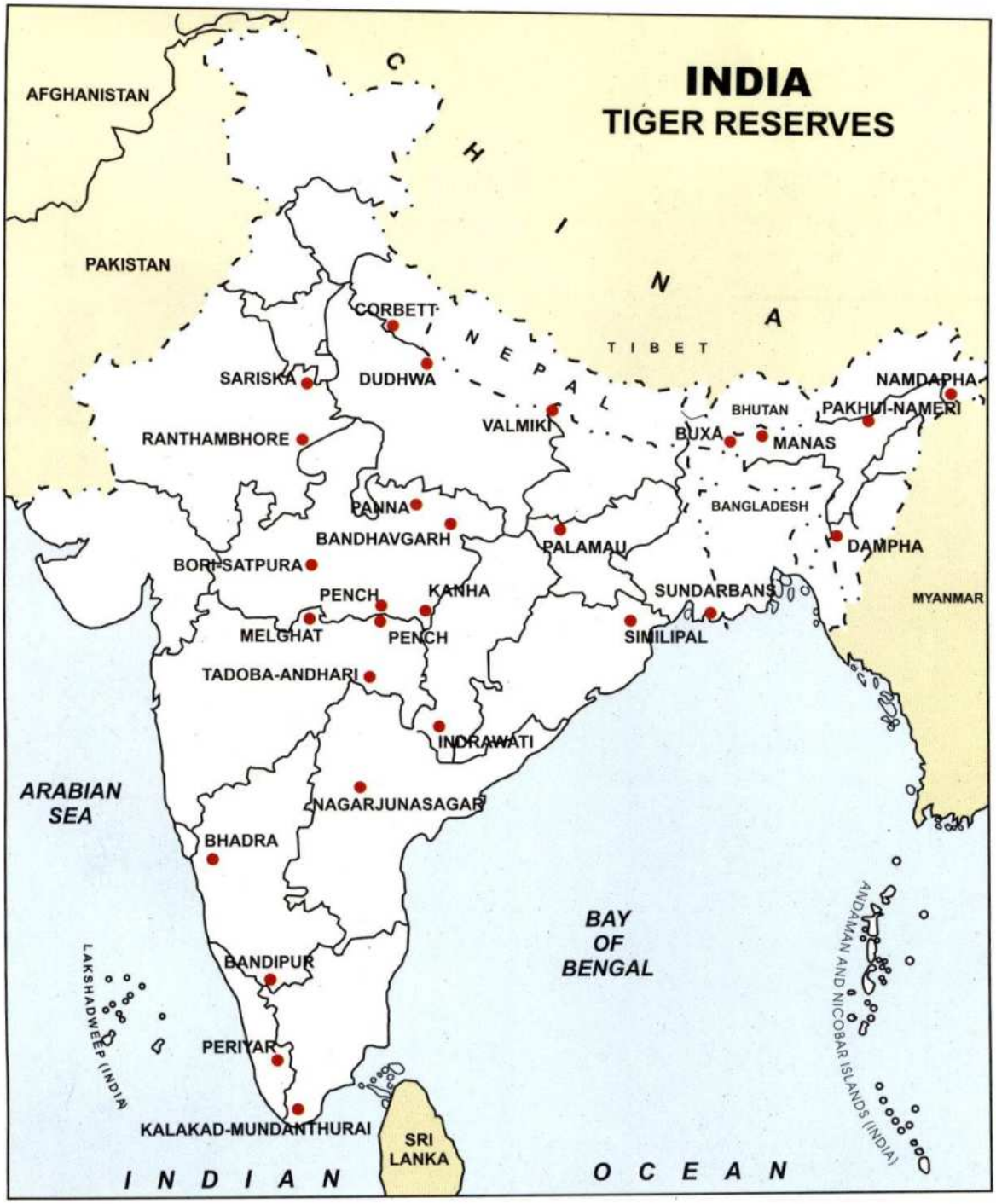
TIGER RESERVE	FOREST TYPES	IMPORTANT ELEMENTS
	Anogeissus pendula scrub forest: wherever above forests have been degraded, inferior species like *Euphorbia nerifolia, Dichrostachys cinerea* var. *indica, Acacia catechu, Grewia flavescens* etc. have invaded these forests. *Butea monosperma* forest: On lower hill slopes and flat ground (e.g. near Berda, Anatpura), almost pure associations of *Butea monosperma* are found. The other associates of it are: *Acacia leucophloea, Anogeissus pendula, Bombax ceiba, Capparis separia, Cassia fistula, Diospyros melanoxylon,* occasionally *Capparis decidua,* etc. Dry mixed deciduous forest: The main constituent of this forest is *Anogeissus pendula,* the other associates are: *Boswellia serrata, Bridelia retusa, Diospyros melanoxylon, Flacourtia indica, Lannea coromandelica, Mallotus philippensis, Mitragyna parvifolia, Sterculia urens* and *Terminalia bellerica,* etc. Ziziphus scrub forest: The vegetation in this type of forest is generally thorny and woody. The growing stock is irregular and densely erratic which consists of *Ziziphuz nummularia* as dominant species with associates like *Acacia catechu, Acacia leucophloea, Butea monosperma, Capparis deciduas, Dichrostachys cineria* var. *indica, Prosopis juliflora,* etc. The species which form typical aquatic vegetation of permanent nature are: *Ceratophyllum demersum, Hydrilla verticillata, Ipomoea aquatica, Lagarosiphon alternifolia, Limnophilla indica, Ludwigia adscendens, Monocharia vaginalis, Najas graminea, Nymphaea nauchali, N. pubescens, Nelumbo nucifera, Nymphoides hydrophylla, N. indica, Ottelia graminea, Potamogeton crispus, Spirodella polyrrhiza, Trapa natans* var. *bispinosa, Utricularia stellaris, Zannichellia palustris,* etc.	collected.Except for the Poaceae (78 species) and Cyperaceae (32 species), the monocotyledons are poorly represented. Among dicotyledons, Fabaceae is the largest family with 48 species and Asteraceae occupy second place with 29 species. Out of 77 families of dicotyledons, 59 families are represented by less than five species and among monocotyledons out of 15 families, 10 families are represented by a single species.
SARISKA	*Anogeissus pendula* forest: The usual trees are shrubs associated with it are: *Acacia catechu, Capparis sepiaria, Cassia fistula, Commiphora wightii, Cordia dichotoma, Dichrostachys cinerea, Diospyros melanoxylon, Ehretia aspera, Flacourtia indica, Grewia tenax, G. flavescens, Holoptelea integrifolia, Lannea coromandelica, Limonia acidissima, Sterculia urens, Wrightia tinctoria and Ziziphus mauritiana.* *Boswellia serrata* forest: *Boswellia serrata* is another dominant tree species found at the summit of the hills. *Anogeissus pendula* is the common tree species mixed with it up to the middle of slopes. The other common tree species found here are: *Acacia catechu, Anogeissus latifolia, Diospyros melanoxylon, Flacourtia indica, Grewia tiliifolia, Lannea coromandelica, Soymida febrifuga, Sterculia urens* etc. as in Kaligathi, Gamaka area of Sariska range and at Kankwari forest block. *Acacia catechu* forest*: Acacia catechu* is scattered on hill slopes, mixed with *Anogeissus pendula* and *Boswellia serrata.* The other common species are *Bauhinia racemosa, Crateva adansonii* subsp. *odora, Capparis sepiaria, Grewia flavescens* and *Wrightia tinctoria.* Aquatic/Marshy vegetation: There is no permanent or big lake inside the reserve, the aquatic vegetation is poor. In temporary ponds or nalahas where rainwater stagnates for a few months' aquatic species like *Hydrilla verticillata, Potomogeton crispus, P. pectinatus, P. perfoliatus, Vallisneria spirallis* var. *denseserrulata, Zanichellia palustris* are common. Occasionally, *Nymphoides cristatum, Trapa bispinosa* and *Nelumbo nucifera* are also met with.	From this reserve a total number of 414 indigenous and naturalized plant species belonging to 273 genera under 86 families are collected. This includes 4 species of Pteridophytes belonging to 3 genera and 3 families, and a species of Gymnosperm. Except for Poaceae (56 species) and Cyperaceae (17 species) the Monocotyledons are poorly represented.
Tamil Nadu		
KALKAD-MUNDANTHURAI	Southern tropical thorn forest : This type of forest occurs in the foothills up to an altitude of about 200 m. In these scrub jungles, the most common shrubs and trees are *Acacia chundra , A. horrida, A. planifrons, Alangium salvifolium, Albizia amara, A. lebbeck, Atalantia racemosa, Bauhinia tomentosa, Bridelia retusa, B. scandens, Euphorbia antiquorum, Zizypus oenoplia* and *Z. xylopyrus.*	This region comprises about 1200 species and is botanically one of the richest tiger habitats of the country. The unique feature of this area is the occurrence of more than 100 localised endemic plant species and

TIGER RESERVE	FOREST TYPES	IMPORTANT ELEMENTS
	Southern tropical dry deciduous forest : These forests occur at an altitude of about 350 m. The dominant tree species are *Adina cordifolia*, *Albizia amara*, *A. lebbeck*, *Anogeissus latifolia*, *Commiphora caudata*, *Dillenia pentagyna*, *Pterocarpus marsupium*, *Semecarpus anacardium* and *Terminalia chebula*. Southern tropical moist deciduous forest : This type of vegetation occurs at an altitude of about 500 m. The forests are thick and the topography is much undulating, with varied composition of flora. The forest is densely populated with *Calamus* spp. The major trees are *Acronychia pedunculata*, *Bombax ceiba*, *Dalbergia coromandeliana*, *D. latifolia*, *D. malabarica*, *Gyrocarpus asiaticus*, *Pterocarpus marsupium*, *Scleropyrum wallichianum*, *Terminalia chebula*, *T. paniculata* and *Vateria indica*. Tropical semievergreen forest : The dominant species are *Antidesma menasu*, *Filicium decipiens* and *Gordonia obtusa*, *Careya arborea* and *Terminalia chebula* are common deciduous elements. Southern tropical wet evergreen (rain) forest : This climax type of rain forest occurs between 800 m to 1500 m. The top canopy, or the first layer is extremely dense, represented by gigantic trees like *Artocarpus hirsutus*, *Canarium strictum*, *Cullenia exarillata*, *Diospyros ebenum*, *Elaeocarpus serratus*, *E. tuberculatus*, *Gluta travancorica*, *Holigarna arnottiana*, *Hopea parviflora*, *Hopea utilis*, *Mesua ferrea* , *Palaquium ellipticum* , *P. bourdillonii*, *Agasthiyamalaia pauciflorum (Poeciloneuron pauciflorum)* and *Vepris bilocularis*. Subtropical montane forest : This type occurs as a continuous expanse of evergreen forest, generally above 1500 m, In these exposed areas due to the high wind velocity the trees are of a stunted nature, hardly reaching up to 4 m height, and are clothed with lichens, mosses, ferns and orchids. Some of the common species are *Aglaia elaeagnoidea* var. *bourdillonii*, *Brysophyllum tetrandrum*, *Canthium neilgherrens*, *Eugenia mabaeoides*, *Euphorbia santapau*, *Glochidion arboreum*, *Hedyotis purpurascens*, *Impatiens leschenaultii*, *I. travancorica*, *I. uncinata*, *I. verticillata*, *Lasianthus blumeanus*, *L. cinereus*, *Ligustrum decaisnei*, *Moonia heterophylla*, *Polyscias acuminata* and *Vernonia travancorica*. Populations of *Bentinckia condapanna* an endemic palm are seen on inaccessibly steep slopes. Grasslands: Some of the common grasses met with are *Apocopis courtallumensis*, *Arundinella purpurea* var. *lax*, *Chrysopogon orientalis*, *C. aciculatus*, *Eulalia phaeothrix*, *Isachne walkeri* and *Themeda tremula*.	directly acting as site for their *in situ* conservation. In recent years about 50 new plant taxa have been discovered from the area and some of them are *Aenhenrya agastyamalayana* *Dendrobium diodon* subsp. *kodayarensis*, *D. panduratum* subsp. *villosum*, *Euphorbia santapaui*, *Exacum klackenbergi*, *Homalium jainii*, *Indotristicha tirunelveliana*, *Isachne jayachandranii*, *Marsdenia tirunelvelica*, *Memecylon subramanii*, *Reidia singampattiana*, *Rhynchosia jacobii*, *Sonerila kanniyakumariana* *Symplocos pulchera* subsp. *coriacea* *Tylophora subramanii*, etc.
Uttar Pradesh		
DUDHWA	The vegetation of Dudhwa Tiger Reserve is of tropical moist deciduous type. It has some of the best natural Sal forests, forming a climatic climax. Grasslands are also seen within the reserve area along with riparian fringe forest, Sal forest, mixed Sal and teak, and semievergreen forests. The various types of forests throughout the reserve are interrupted by wide streches of grasslands locally called as 'phantas'. The common perennial grasses are *Themeda arundinacea*, *Saccharum spontaneum*, *S. benghalense*, *Narenga porphyrocoma*, *Vetiveria zizanioides*, *Cymbopogon flexuosus*, *Desmostachya bipinnata*, *Apluda mutica*, *Dichanthium annulatum*, *D. glabrum*, *Pseudosorghum fasciculare*, etc. *Hygroryza aristata* is the common aquatic grass, whereas on the margins of ditches *Panicum paludosum* Roxb. and *Echinochloa* spp. are frequent There are a number of rivulets, temporary water pools and permanent tals in the Dudhwa Tiger Reserve which support a variety of aquatic plants. The common free-floating hydrophytes are *Trapa natans* var. *bispinosa*,	An analysis of the floristic diversity of Dudhwa Tiger Reserve revealed the presence of about 821 species of angiosperms falling under 489 genera representing 120 families.There are only two threatened species as per IUCN red list (1997) in the Tiger reserve area which included *Cymbopogon flexuosus* var. *microtachys* and *Cymbopogon osmastonii*. The later is also an endemic species reported from the reserve.

TIGER RESERVE	FOREST TYPES	IMPORTANT ELEMENTS
	Utricularia flexuosa, Hygroryza aristata, Lemna perpusilla, Spirodela polyrhiza, etc. *Aponogeton crispum, Hydrilla verticillata, Potamogeton pectinatus, Ottelia alismoides, Nelumbo nucifera, Nymphaea nouchali, Nymphoides cristata, Monochoria vaginalis, Echinochloa vaginalis, Sagittaria guayanensis* are most common species among anchored submerged hydrophytes.	
Uttrakhand		
CORBETT	In general, the vegetation in the major biome of Corbett Tiger Reserve consists of mixed deciduous, tropical and subtropical forests which can be further grouped into the following sub-types : *Shorea robusta* (Sal) is the most dominant tree species gregariously growing in the area. Elegant patches of "Sal" could be seen in Dhikala, Khinawauli, Bijrani and Kanda environs. Some striking evergreen associates of "Sal" are *Mallotus philippensis, Syzygium cumini, Phoebe lanceolata, Drypetes roxburghii* and *Boehmeria rugulosa. Lannea coromandelica, Haldina cordifolia, Terminalia alata, Terminalia bellirica, Lagerstroemia parviflora, Ehretia laevis, Sapium insigne, Stereopermum chelonoides* and *Semecarpus anacardium*, could be seen throughout.	Corbett Tiger Reserve harbours about 912 species under 556 genera and 168 families of which 741 species belong to angiosperms, 2 to gymnosperms, 36 to pteridophytes, 25 to bryophytes and 108 to lichens. There is only one threatened species viz. *Cymbopogon flexuous* var. *microstachys* reported so far as per IUCN (1997) red list categorisation. However, Corbett Tiger Reserve is a repository of a number of important medicinal and economically important plant species.
West Bengal		
BUXA	The forest of the Buxa Tiger Reserve can broadly be classified as moist tropical forests of Champion and Seth's classification. As the extension of this forest ranges from plains up to 1750 m in the hills, variation in the floristic composition is clearly visible depending on altitude. The most common species found within the forest and most important from ecological and economic point of view are Sal (*Shorea robusta*). The lofty sal trees occur with its usual associates, viz., *Michelia champaca, Schima wallichi, Chukrasia tabularis, Terminalia belerica, Lagerstroemia parviflora, Toona ciliata, Amoora wallichii, Amoora rohituka, Duabanga sonneratioides, Bombax ceiba*, etc. In riverine areas *Albizzia* spp., *Dalbergia sisoo* and *Acacia catechu* are the most common. Also, *Castanopsis indica, Acrocarpus fraxinifolius, Talauma hodgsonii, Walsura tabulata* associated with *Morus laevigata, Terminalia myriocarpa, Ailanthus grandis*, etc. can be found in different areas. Common hydrophytes available in the reserve are *Acorus calamus, Aeschynomene indica, Ammania baccifera, Bacopa monnieri, Cyperus haspan, C. iria, Limnophila heterophylla, Ludwigia parviflora, Myriophyllum indicum, Nymphaea pubescens, N. nouchali, N. rubra, Nymphoides cristanum, N. hydrophylla, N. indica, Trapa bispinosa, Rotala densiflora.*	Ten Dominant families with number of species collected from Buxa Tiger Reserve are Orchidaceae (144), Leguminosae(111),Euphorbiaceae (58), Rubiaceae (52),Poaceae (43), Cyperaceae(29), Lauraceae(27) Moraceae(27),Asteraceae(25), Meliaceae(24). Two new species have been described from Buxa Tiger Reserve i.e., *Dalbergia duarensis* and *Ophiorrhiza seshagiriana.*
SUNDERBAN	Forests types found in the estuarine plain of West Bengal, which also includes the area of the Sundarban Tiger Reserve are: Littoral forests on sandy beaches and dunes facing the sea; Mangrove scrubs or salt water forests; Mangrove forests; Salt water mixed forests of *Heritiera;* Brackish water forests; Palm swamp forests. The typical woody elements represented in the mangrove forests are *Aegiceras, Avicennia, Amoora, Bruguiera, Ceriops, Sonneratia* and	Sunderban is the only Tiger habitat supporting major area under mangrove vegetation. True mangrove elements are represented by 5 families, 8 genera, and 17 species in Sunderban.Some plants found in this Tiger Reserve are recorded as rare and

TIGER RESERVE	FOREST TYPES	IMPORTANT ELEMENTS
	Xylocarpus. The mixed forests of *Heritiera* are quite dense and spread fairly well in saline water. *Heritiera fomes, Excoecaria agallocha, Ceriops decandra, Xylocarpus granatum* and others occupy the top canopy in these forests. Some of the typical mangroves of moderate height are *Avicennia alba, Ceriops tagal, Xylocarpus moluccensis, Excoecaria agallocha.* Some of the bushy shrubs like *Acanthus ilicifolius, Dalbergia spinosa, Derris scandens, Desmodium umbellatum, Clerodendrum inerme* are found to form dense patches along the muddy flat lands.	endangered. These are *Ceriops decandra, C. tagal, Heritiera fomes, Nypa fruticans, Rhizophora apiculata, R. mucronata, Sarcolobus carinatus, Cerbera manghas, Sonneratia griffithii, Flagellaria indica, Intsia bijuga, Kandelia candal. Ceriops, Exocoecaria, Lumnitzera, Acanthus* are some threatened genera found in the Tiger reserve. Besides, some examples of threatened orchid species found in the reserves are *Acampe rigida, Dendrobium anceps, Oberonia gammiei* and *Trias oblonga.*

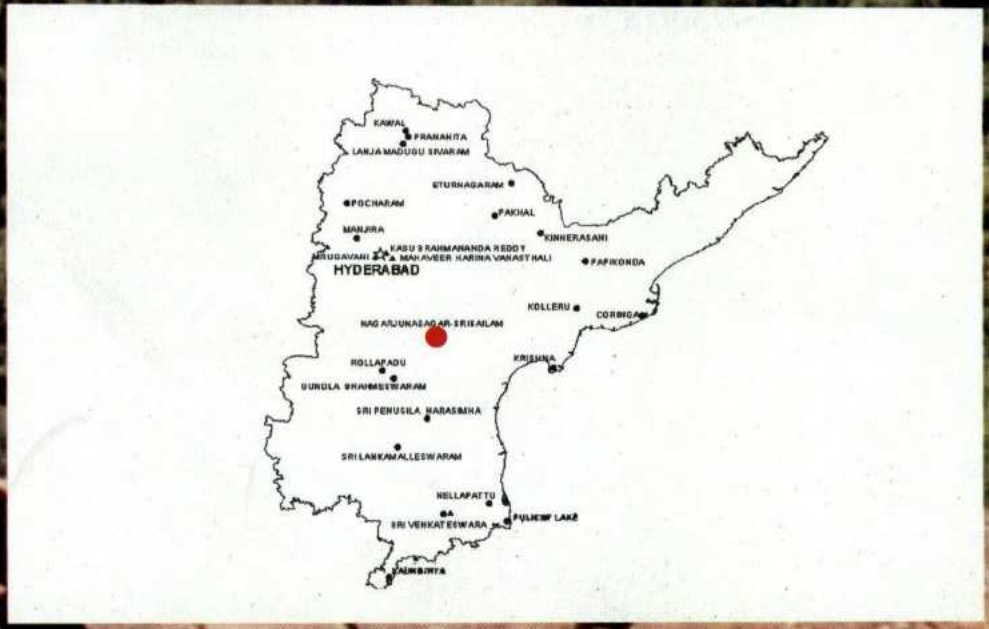
In spite of making best possible effort in understanding the floristic diversity of these Tiger Reserves, there exist taxonomic information gaps in some Tiger reserves. These are mainly related to traditional sampling techniques without taking help of GPS support system during field survey work, incomplete inventorisation, scarcity of subject specialists particularly in lower taxonomic groups, time constraint, and restrictions in carrying out field work in the protected areas.


INDIA
TIGER RESERVES
AFGHANISTAN
PAKISTAN
CHINA
NEPAL
TIBET
BHUTAN
BANGLADESH
MYANMAR
CORBETT
SARISKA
DUDHWA
RANTHAMBHORE
VALMIKI
NAMDAPHA
PAKHUI-NAMERI
BUXA
MANAS
PANNA
BANDHAVGARH
PALAMAU
DAMPHA
BORI-SATPURA
PENCH
KANHA
SUNDARBANS
MELGHAT
PENCH
SIMILIPAL
TADOBA-ANDHARI
INDRAWATI
NAGARJUNASAGAR
BHADRA
BANDIPUR
PERIYAR
KALAKAD-MUNDANTHURAI
ARABIAN SEA
BAY OF BENGAL
INDIAN OCEAN
SRI LANKA
LAKSHADWEEP (INDIA)
ANDAMAN AND NICOBAR ISLANDS (INDIA)

A view of Umamaheswaram Reserve Forests

ANDHRA PRADESH

Nagarjunasagar - Srisailam Tiger Reserve



Nagarjunasagar - Srisailam Tiger Reserve

GVS Murthy & JHF Benjamin
Botanical Survey of India - Southern Cirde, TNAU Campus, Coimbatore - 641003

The Nagarjuna Sagar - Srisailam Tiger Reserve located in Krishna river basin, 130 km south of Hyderabad, Andhra Pradesh was notified as a sanctuary in 1978 and declared as a tiger reserve in 1983. It is in IUCN management category IV (managed nature reserve). The tiger reserve is situated between lat. 15° 51' -16° 43' N and long. 78° 29' - 79°'29' E and surrounded by Nallamalai hills of Eastern Ghats. The altitude ranges from 100 to 915 m. The Nagarjunasagar-Srisailam is the largest tiger reserve in India encompassing an area of approximately 3,568 sq km in Nalgonda, Mahboobnagar, Kumool, Prakasam and Guntur districts of Andhra Pradesh. The Core zone is about 1200 sq km and the non-core/buffer area is 2368 sq km.

The topography is generally of undulating hilly terrain. The river Krishna that passes through the tiger reserve dissects the area into deep winding gorges. The ridges of the Nallamallai hills run in general north-south direction with many plateaus and valleys. The Nallamallais proper consist of a continuous range of unbroken, rugged and fairly steep hills with an average elevation of about 600m. The plateaus of Amrabad, Pecheru and Guttalachenu rise to an average altitude of 700 - 800 m. The highest elevation being the Durgamkonda, which has altitude 915 m, while the lowest being the Nagarjuna Sagar dam at 100 m altitude. The total geographical area of the Nallamalai Catchment is 10416.76 sq km covering the districts Kurnool, Prakasam and Cuddapah (part areas of adjoining hills) and Amrabad plateau of Mahaboobnagar district.

The moist upper plateaus, dry tracts of eastern parts towards Dindi valley, river Krishna with lofty hill slopes on either side, numerous hill streams, valleys and deep gorges, woodlands and bamboo forests contribute to the existence of a variety of wildlife species to support an ecosystem with the Tiger as super predator.

FAUNA : The fauna includes Langur *(Presbytis entellus),* Bonnet macaque, *(Macaca radiata),* Tiger *(Panthera tigris),* Leopard *(P. pardas),* Jungle Cat *(Felis chous),* Wild Dog *(Cuon alpinus),* Wolf *(Canis lupus),* Jackal *(C. aureus),* Bengal Fox *(Vulpes benghalensis),* Sloth Bear *(Melursus ursinus),* Smooth Coated Otter *(Lutra perspicillata),* Palm Civet *(Paredoxus* sp.), Stripped Hyena *(Hyaena hyaena),* Wild Boar *(Sus scurfy),* Indian Spotted Chevrotian *(Tragulus meminna),* Indian Muntjac *(Muntiacus muntjak),* sambar *(Cervus unicolor),* Spotted Deer *(C. axis),* Nilgai *(Boselaphus tragocamelus),* Four Horned Antelope *(Tetracerus quadricurvis),* Black Buck *(Antilope cervicapra),* Chinkara *(Gazelle dorcas),* Indian Pangolin *(Maris crassicaudata),* Giant Flying Squarrel *(Petaurista* sp.), Indian Porcupine *(Hysterix indica)* and Indian tree Shrew, etc. The avifauna is represented by nearly 150 species including the Grey Hornbill *(Tuckus birostris)* and of course the Peafowl (*Taro crestatus).* Reptiles include Indian soft-shelled Turtle, Monitor Lizard, (*Varanus* sp.), Indian Python, (*Python molurus*) and Marsh Crocodile (*Crocodylus palustris*).

VEGETATION AND FLORA

The sanctuary lies in an area of tropical dry deciduous forest. The vegetation can be broadly classified into four main types.

(1) The plain vegetation comprises herbs and some shrubs such as *Cassia auriculata, Tephrosia hirta, Lepidagathis cristata, Securingea leucopyrus, Capparis stylosa, Helicteres isora, Ziziphus mauritiana, Vitex negundo, Waltheria indica, Melhania hamiltoniana* and *Solanum pubescens.* There are few trees including *Wrightia tinctoria, Salvadora persica* and *Borassus flabellifer.* Marshes with sedges and herbs occur near the river.

(2) Scrub jungle occurs in the foothills with *Acacia horrida, A. chundra* and *Dichrostachys cinerea* as the dominant thorny xerophytic plants. Other common associates are *Grewia rotundifolia, Premna latifolia, Euphorbia antiquorum, E. rivulia.* Undershrubs include *Waltheria indica, Pavonia zeylanica* and *Indigofera hirsuta.* These shrubby plants are covered in climbers.

(3) Thorn forests on the well-drained hill slopes is dominated by *Grewia rotundifolia.* Associates include *Euphorbia antiquorum, Premna latifolia, Ziziphus oenophila* and climbers. Less common shrubs are *Grewia orientalis, Helicteres isora* and *Capparis sepiaria, Pavonia zeylanica* and *P. odorata* are undershrubs and ubiquitous.

(4) Dry deciduous forests on the hilltops comprises *Bauhinia racemosa, Albizzia amara, Cassia fistula* and *Commiphora roxburghii, Mundulea sericea*, a shrubby tree, occurs in huge populations. Shrubs include *Barleria acuminata, Carissa spinarum* and *Jasminum auriculatum, Maeruva apetala, Ziziphus xylopyrus, Cissus vitiginea* and *Pterolobium indicum* are some of the rare plants in the area. The grassland formation is a noteworthy feature.

Three forest types occur in Nallamalais, viz., Scrub, Dry deciduous and Moist deciduous with a few isolated types like Boswellia-type, Acacia-type, Hardwickia-type, Calamus rotang-type and some patches of evergreen type along perennial water sources. *(Suregada angustifolia* and *Memecylon umbellatum* are evergreen elements).

Savanna type vegetation

The dry deciduous types are further subdivisible into Teak type *(Tectona grandis),* Nallamalai type *(Terminalia tomentosa)* and *Anogeissus latifolia* type.

DECIDUOUS TYPE

This is principally confined to the hill portions of Amrabad, the foot of hills. This is represented by a good number of deciduous species such as Teak, *Pterocarpus marsupium, Chloroxylon* sp., *Butea monosperma, Diospyro* sp., *Dalbergia latifolia.* Scattered hardwickia trees are also met with in the plains of Acharmpet and parts of Amarabad plateau.

HARDWICKIA BINATA TYPE

It is confined principally to Krishna valley in

Amarabad and hilly slope of Acharmpet. The principal associates are *Anogeissu* sp., *Chloroxylon* sp., *Albizzia amara,* etc.

BAMBOO TYPE

Both *Bambusa bambos* and *Dendrocalamus strictus* occur in Amrabad and Achampet ranges. On lower elevation and plains, the distribution is confined to the margins of the streams. It occurs in pure dense marshes and sometimes mixed with deciduous tree species.

TEAK FORESTS

This contains 70% teak or more in mixture and occur in patches in Amrabad and on slopes and valleys in Achampet ranges.

THORNY FORESTS

Thorny-scrub type of vegetation is represented by degraded forests which are fairly common. The common trees in the area are *Acacia lecophloea* Willd., *Diospyros melanoxylon* Roxb., *D. chloroxylon* Roxb., *Strychnos nux-vomica* L., *S. potatorum* L.f., *Cassia fistula* L., *Zizyphus mauritiana* Wight & Arn., *Z. xylopyrus* Willd., *Manilkara hexandra* (Roxb.) Dubard, *Erythroxylon monogynum* Roxb. Shrubs like *Bridelia montana* Willd., *Hugonia mystax* L., *Carissa spinarum* L., *Randia malabarica* Lam., *Euphorbia neerifolia* L., *Gymnosporia montana* Benth., *Dodonaea viscosa* Lindl.

Climbers like *Abrus precatorius* L., *Toddalia asiatica* Lam., *Gymnema sylvestre* R. Br., *Pterolobium indicum* A. Rich., *Aristolochia indica* L., *Cissampelos pariera* L., *Cocculus hirsutus* Diels., *Asparagus racemosus* Willd. Herbs like *Andrographis paniculata* Nees, *Vernonia cinerea* Less., *Pavonia zeylanica*(L.) Cav., species of *Indigofera* and *Crotalaria* grow predominantly on hard gravelly soils.

REGIONAL TYPES

(i) Sub montane forests: These occur along the foot of the hills and in terai portions. The soil consists of sandy loam, sometimes mixed with small boulders or pebbles. The forests consists of an open thorny scrub or inferior deciduous type, while superior forest towards the foot hills. These are overgrazed by village cattle and have been used for small timber, fuel and fodder. *Soymida febrifuga* (Roxb.) A. Juss. is the dominant element.

(ii) The plateau forests: These include Sivapuram and Srisailam superior timber forests with dense bamboos of both the varieties. The plateaux of Sivapuram and Srisailam support mostly an open scattered hardwickia forest with plenty of *Anogeissus* sp. and other associates. Hardwickia trees attain fairly large dimensions especially in some localities along the in pure stands Krishna valley.

(iii) The hill forests: These occur along the back bone of the Nallamalais and its spurs. Here the vegetation is more luxuriant due to heavier rainfall. *Dendrocalamus strictus* grows luxuriantly in dense strands. Sometimes mixed with timber species. Tall dense grass is plentiful, fires are common and destructive. Giant climbers like *Bauhinia vahlii* and *Milletia auriculata* grow here.

Chenchus settlement

FLORISTIC DIVERSITY

The flora of Nagarjunsagar Srisailam Tiger Reserve is rich in species composition and represented by 120 famlies 517 genera and along 962 species of Angiosperms. This member will surely go up as more thorough explorations are carried out.

Table : Floristic Analysis of Nagarjunsagar Srisailam Tiger Reserve.

Group	Families	Genera	Species
Dicotyledons	97	407	750
Monocotyledons	23	110	213
Total	120	517	962

As is evident from the table Monocotyledons are poorly represented as compared to Dicotyledons. Five dominent families of Angiosperms in respect of number of species are :

Family	No. of Species
Poaceae	118
Fabaceae	101
Euphorbiaceae	54
Acanthaceae	44
Cyperaceae	33

ENUMERATION

RANUNCULACEAE

Narvelia zeylanica (L.) DC.

DILLENIACEAE

Dillenia pentagyna Roxb.

ANNONACEAE

Annona squamosa L.
Miliusa tomentosa (Roxb.) Sinclair
M. velutina (Dunal) Hook.f. & Thomson
Polyalthia cerasoides (Roxb.) Bedd.

MENISPERMACEAE

Anamirta cocculus (L.) Wight & Arn.
Cissampelos pariera L. var. **hirsuta** (Buch.-Ham. ex DC.) Forman
Cocculus hirsutus(L) Diels.
Tiliacora acuminata (Lam.) Miers
Tinospora cordifolia (Willd.) Miers ex Hook. f. & Thomson

NYMPHAEACEAE

Nymphaea nouchali Burm. f.
N. pubescens Willd.

NELUMBONACEAE

Nelumbo nucifera Gaertn.

PAPAVERACEAE

Argemone mexicana L.

CAPPARACEAE

Cadaba fruticosa L.
C. brevispina DC.
C. divaricata Lam.
C. grandis L. f.
C. sepiaria L.
C. zeylanica L.
Crataeva magna (Lour.) DC.
Maerua apetala (Roth) Jacobs
M. oblongifolia (Forssk.) A. Rich.

CLEOMACEAE
Cleome aspera Koen.
C. chelidonii L. f.
C. felina L. f.
C. gynandra L.
C. monophylla L.
C. tenella L. f.
C. viscosa L.
VIOLACEAE

Hybanthus enneaspemus (L.) F. Muell

COCHLOSPERMACEAE

Cochlospermum religiosum (L.) Alston

FLACOURTIACEAE

Casearia elliptica Willd.
C. graveolens Dalzell

Flacourtia indica (Burm. f.) Nees

POLYGALACEAE

Polygala chinensis L.
P. elongata Klein ex Willd.
P. erioptera DC.

CARYOPHYLLACEAE

Polycarpaea corymbosa (L.) Lam.

PORTULACACEAE

Portulaca oleracea L. var. **oleracea**
P. oleracea L. var. **linearifolia** Sivar. & Manilal
P. pilosa L.
P. quadrifida L.
P. wightiana Wall. ex Wight & Arn.

CLUSIACEAE

Calophyllum inophyllum L.

MALVACEAE

Abelmoschus ficulnens (L.) Wight & Arn.
A. moschatus Medik.
Abutilon crispum (L.) G. Don
A. hirtum (Lam.) Sw.
A. indicum (L.) Sw. ssp. **indicum** Borss. - Walk.
A. pannosum (Forst. f.) Schlecht.
Gossypium herbaceum L.
Hibiscus furcatus Willd.
H. lobatus (Murr.) Kuntze
H. sabdariffa L.
H. lunariifolius Willd.
H. ovalifolius (Forssk.) Vahl
H. vitifolius L.
Kydia calycina Roxb.
Malvastrum coromandelianum (L.) Garcke
Pavonia otiorata Willd.
P. zeylanica (L.) Cav.
Sida acuta L.
S. cordata (Burm. f.) Borssum
S. cordifolia L.
S. glutinosa Commers. ex Cav.
S. rhombifolia L.
Thespesia lampas (Cav.) Dalzell ex Dalzell & Gibson
Urena lobata L. ssp. **sinuata** (L.) Borss. - Walk.

STERCULIACEAE

Byttneria herbacea Roxb.
Eriolana hookeriana Wight & Arn.
E. lushingtonii Dunn
Firmiania colorata (Roxb.) R. Br.
Guazuma ulmifolia Lam.
Helicteres isora L.
Melhania incana Heyne ex Wight & Arn.
Melochia corchorifolia L.
Pterospermum xylocarpum (Gaertn.) Santapau & Wagh
Sterculia urens Roxb.
S. vilosa Roxb. ex DC.
Waltheria indica L.

TILIACEAE

Corchorus aestuans L.
C. fascicularis Lam.
C. olitorius L.
C. trilocularis L.
Grewia bracteata Heyne ex Roth
G. damine Gaertn.
G. flavescens A. Juss.
G. hirsuta Vahl
G. orbiculata Rottler
G. orientalis L.
G. rothii DC.
G. tenax (Forssk.) Fiori
G. tiliifolia Vahl
G. villosa Willd.
Triumfetta pentandra A. Rich.
T. pilosa Roth
T. rhomboidea Jacquem.
T. rotundifolia Lam.

ERYTHROXYLACEAE

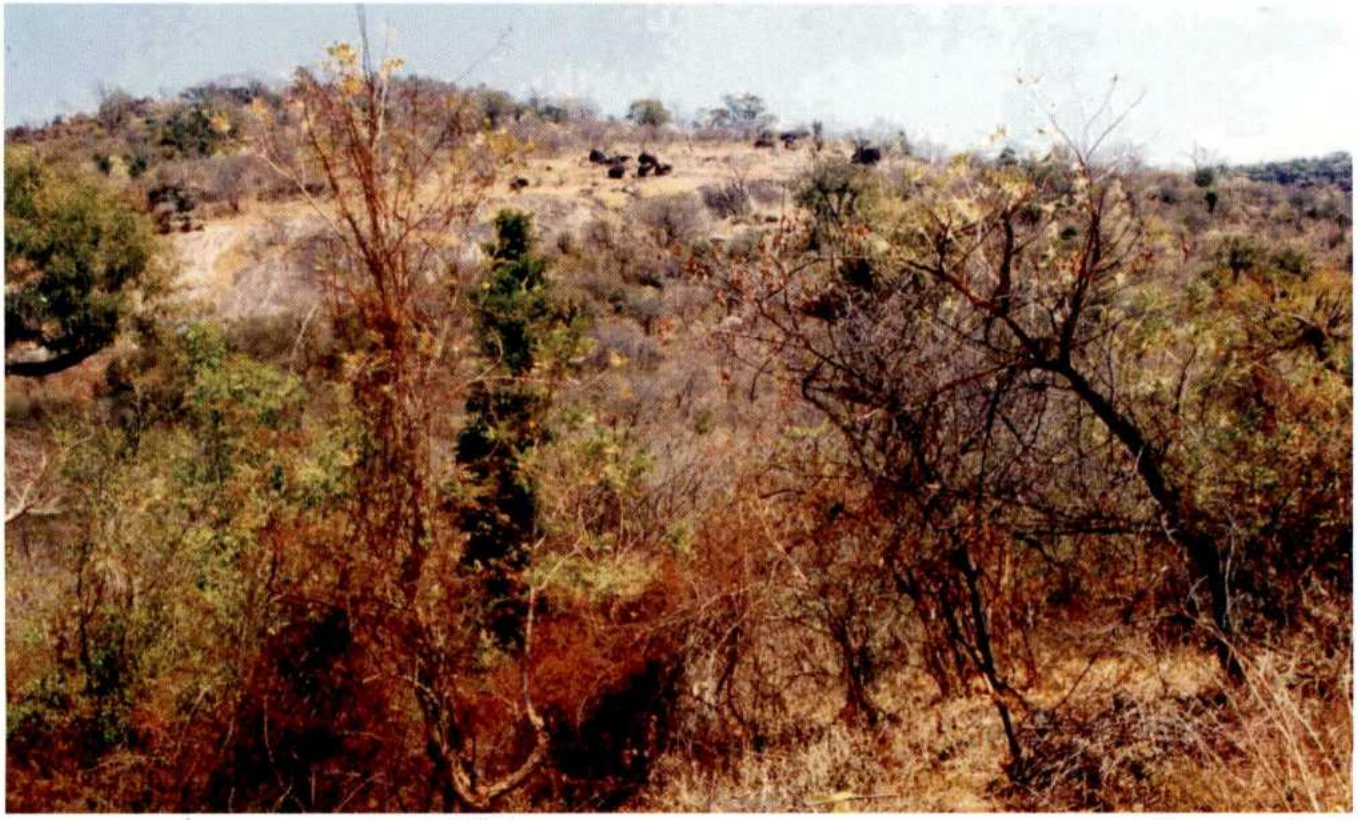
Erythroxylum monogynum Roxb.

MALPIGHIACEAE

Aspidopterys cordata (Heyne ex Wall.) A. Juss.
A. indica (Roxb.) Hochr.
Hiptage benghalensis (L.) Kurz

ZYGOPHYLLACEAE

Fagonia cretica L.
Tribulus terrestris L.



A View of scrub forests

OXALIDACEAE

Biophytum nervifolium Thwaites
B. reinwardtii (Zucc.) Klotzsch
Oxalis corniculata L.

BALSAMINACEAE

Impatiens balsamina L. var. **balsamina**

RUTACEAE

Aegle marmelos (L.) Correa
Atlantia monophylla (L.) Correa
Limonia acidissima L.
Micromelum minutum (Forst. f.) Wight & Arn.
Murraya koenigii (L.) Spreng.
Naringi alata (Wall. ex Wight & Arn.) J.L. Ellis
N. crenulata (Roxb.) Nicolson

SIMAROUBACEAE

Ailanthus excelsa Roxb.
Balanites aegyptiaca (L.) Delile

OCHNACEAE

Ochna gamblei King ex Brandis

BURSERACEAE

Boswellia serrata Roxb. ex Colebr.
Commiphora caudata (Wight & Arn.) Engl.
Garuga pinnata Roxb.
Protium serratum (Colebr.) Engl.

MELIACEAE

Azadirachta indica A. Juss.
Cipadessa baccifera (Roth) Miq.
Melia azedarach L.
M. dubia Cav.
Soymida febrifuga (Roxb.) A. Juss.

FLINDERSIACEAE

Chloroxylon swietenia DC.

A View of Nallamalai hills

OLACACEAE

Olax scandens Roxb.
Ximenia americana L.

OPILIACEAE

Opilia amentacea Roxb.

CELASTRACEAE

Cassine glauca (Rottb.) Kuntze
Celastrus paniculatus Willd.
Maytenus emarginata (Willd.) Ding Hou

HIPPOCRATEACEAE

Loesneriella obtusifolia Roxb.

RHAMNACEAE

Ventilago denticulata Willd.
V. madersapatana Gaertn.
Ziziphus glabrata Heyne ex Roth
Z. horrida Roth
Z. mauritiana Lam. var. **mauritiana**
Z. oenoplia (L.) Mill.
Z. rugosa Lam.
Z. xylopyrus (Retz.) Willd.

VITACEAE

Ampelocissus latifolia (Roxb.) Planch.
A. tomentosa (Heyne ex Roth) Planch.
Cayratia pedata (Lam.) Juss. ex Gagnep.
C. trifolia (L.) Domin.
Cissus pallida (Wight & Arn.) Planch.
C. quadrangularis L.
C. vitiginea L.
Cyphostemma setosum (Roxb.) Alston

LEEACEAE

Leea asiatica (L.) Risdale
L. indica (Burm.f.) Merr.
L. macrophylla Roxb. ex Hanem.

SAPINDACEAE

Allophyllus serratus (Roxb.) Kurz
Cardiospermum canescens Wall.
C. halicacabum L.
Dodonaea viscosa (L.) Jacq.
Lepisanthes tetraphylla (Vahl) Radlk.

Sapindus emarginatus Vahl
Schleichera oleosa (Lour.) Oken.

ANACARDIACEAE

Anacardium occidentale L.
Buchanania axillaris (Desr.) Ramam.
B. lanzan Spreng.
Lannea coromandelica (Houtt.) Merr.
Mangifera indica L.
Rhus mysorensis G. Don
Semecarpus anacardium L. f. var. **anacardium**

MORINGACEAE

Moringa concanensis Nimmo ex Dalzel & Gibson
M. oleifera Lam.

LEGUMINOSAE - PAPILIONOIDAE

Abrus precatorius L.
Aeschynomene aspera L.
A. indica L.
Alysicarpus bupleurifolius (L.) DC.
A. heterophyllus (Benth. ex Baker) Jafri & Ali
A. heyneanus Wight & Arn.
A. longifolius Wight & Arn.
A. scariosus (Rottl. ex Spreng.) Grah. ex Thw.
A. scariosus var. **pilifer** (Prain) Pramanik & Thoth.
A. vaginalis (L.) DC. var. **vaginalis**
Atylosia crassa Prain
A. scarabaeoides (L.) Benth.
Butea monosperma (Lam.) Taub.
Cajanus cajas (L.) Druce.
Canavalia gladiata (Jacq.) DC.
Clitoria tematea L.
Crotalaria calycina Schrenk.
C. hirsuta Willd.
C. madurensis Wight var. **kurnoolica** J.L. Ellis
C. medicaginea Lam.
C. montana Roth
C. mysorensis Roth
C. orixensis Rottler
C. paniculata Willd.
C. prostrata Rottler ex Willd.
C. pusilla DC.
C. ramosissima Roxb.
C. retusa L.
C. verrucosa L.
Cyamopsis tetragonoloba (L.) Taub.
Dalbergia lanceolaria L. f.
D. latifolia Roxb.
D. paniculata Roxb.
D. sissoo Roxb.
D. volubilis Roxb.
Derris scandens (Roxb.) Benth.
Desmodium dichotomum (Willd.) DC.
D. gangeticum (L.) DC.
D. heterocarpon (L.) DC. var. **heterocarpon**
D. laxiflorum DC.
D. motorium (Houtt.) Merr.
D. pulchellum (L.) Benth.
D. triflorum (L.) DC.
D. triquetrum (L.) DC.
D. velutinurn (Willd.) DC.
Dolichos trilobus L.
Erythrina stricta Roxb.
Flemingia macrophylla (Willd.) Kuntze ex Merr.
F. strobilifera (L.) R. Br. ex Ait.
Galactia longiflora Benth.
G. tenuiflora (Klein ex Willd.) Wight & Arn.
Glicirdia sepium (Jacq.) Kunth ex Walp.
Goniogyna hirta (Willd.) Ali
Indigofera barberi Gamble
I. caerulea Roxb. var. **caerulea**
I. cassioides Rottler ex DC.
I. cordifolia Heyne ex Roth
I. glabra L.
I. linifolia (L.f.) Retz.
I. linnaei Ali
I. mysorensis Rottler ex DC.
I. oblongifolia Forssk.
I. tinctoria L.
I. trifoliata L.
I. trita L. f.
Lablab purpurens L.
Macrotyloma uniflorum (Lam.) Verdc.
Milletia racemosa (Wight & Arn.) Benth.
Mucuna hirsuta Wight & Arn.
M. pruriens (L.) DC.
Mundulea sericea (Willd.) A. Cheval.

Paracalyx scariosus (Roxb.) Ali
Pongamia pinnata (L.) Pierre
Pseudarthria viscida (L.) Wight & Arn.
Psoralea corylifolia L.
Pterocarpus marsupium Roxb.
Pueraria tuberosa (Willd.) DC.
Pycnospora lutescens (Poir.) Schindl.
Rhynchosia cana DC.
R. capitata (Roth) DC.
R. minima (L.) DC.
R. rothii Benth. ex Aitch.
R. rufescens (Willd.) DC.
R. suaveolens (L. f.) DC.
R. viscosa (Roth) DC.
Sesbania bispinosa (Jacquem.) W. Wight
S. grandiflora (L.) Poir.
S. procumbens (Roxb.) Wight & Arn.
Stylosanthes fruticosa (Retz.) Alston
Tephrosia pumila (Lam.) Pers.
T. purpurea (L.) Pers.
T. strigosa (Dalz.) Sant. & Mahesh.
T. tinctoria Pers.
T. villosa (L.) Pers.
Teramnus labialis (L. f.) Spreng.
Uvaria picta Desv.
U. rufescens (DC.) Schindl.
Vigna aconitifolia (Jacquem.) Marech.
V. radiata (L.) Wikzek var. **sublobata** (Roxb.) Verdc.
V. trilobata (L.) Verdc.
Zornia gibbosa Span.

LEGUMINOSAE - CAESALPINIOIDEAE

Bauhinia malabarica Roxb.
B. racemosa Lam.
B. tomentosa L.
B. vahlii Wight & Arn.
B. variegata L.
Caesalpinia bonduc (L.) Roxb.
C. pulcherrima (L.) Sw.
Cassia absus L.
Parkinsonia aculeata L.
Peltophorum pterocarpum (DC.) Baker ex Heyne
Pterolobium hexapetalum (Roth) Sant. &Wagh
Tamarindus indica L.

LEGUMINOSAE-MIMOSOIDAE

Acacia caesia(L.) Willd.
A. catechu (L. f.) Willd.
A. chundra (Roxb. ex Rottler) Willd.
A. farnesiana(L.)Willd.
A. horrida (L.) Willd.
A. leucophloea (Roxb.) Willd.
A. nilotica (L.) Willd. ex Del. ssp. **indica** (Benth.) Brenan
A. pennata (L.) Willd.
Albizia amara (Roxb.) Boivin.
A. lebbeck (L.) Willd.
A. odoratissima (L. f.) Benth. var. **odoratissima**
A. procera (Roth) Benth.
Dichrostachys cinerea (L.) Wight & Arn. ssp. **cinerea** var. **cinerea**
Entada rheedii Spreng.
Leucaena latisiliqua (L.) Gillis
Mimosa lanata Willd.
M. intsia L.
M. polyancistra Benth.
M. pudica L.
Neptunia triquetra (Willd.) Benth.
Parkia biglandulosa Wight & Arn.
Samanea saman (Jacquem.) Merr.

COMBRETACEAE

Combretum latifolium Blume
Terminalia arjuna (Roxb. ex DC.) Wight & Arn.
T. bellirica (Gaertn.) Roxb.
T. chebula Retz.
T. coriacea (Roxb.) Wight & Arn.

MYRTACEAE

Psidium guajava L.
Syzygium alternifolium (Wight) Walp.
S. cumini (L.) Skeels

BARRINGTONIACEAE

Barringtonia acutangula (L.) Gaertn.
Careya arbrea Roxb.

MELASTOMATACEAE

Memecylon umbellatum Burm. f.
Osbeckia muralis Naud.
O. zeylanica L. f.
Sonerilla tenera Royle

A View of Rocky terrain

LYTHRACEAE

Ammania baccifera L.
A. multiflora Roxb.
Lagerstroemia parviflora Roxb.
Rotala mexicana Cham. & Schlect.
ssp. **pusilla** (Tul.) Koehne
Woodfordia fruticosa (L.) Kurz

ONAGRACEAE

Ludwigia octovalviis (Jacquem.) Raven ssp.
sessiliflora (Mich.) Raven
L. perennis L.
L. prostrata Roxb.

PASSIFLORACEAE

Adenia wightiana (Wall. ex Wight & Arn.) Engl.
Passiflora foetida L.

CARICACEAE

Carica papaya L.

CUCURBITACEAE

Citrullus colocynthis (L.) Schrad.
Ctenolepis garcinii (Burm. f.) C. B. Clarke
C. sativus L.
C. trigonus Roxb.
Diplocyclos palmatus (L.) Jeffrey
Luffa acutangula (L.) Roxb. var.
acutangula
L. cylindrical (L.) Roem.
L. tuberosa Roxb.
Momordica charantia L.
M. dioica Roxb.
Mukia maderaspatana (L.) Roem.
Solena amplexicaulis (Lam.) Gandhi
Trichosanthes tricuspidata Lour. var. **tricuspidata**

CACTACEAE

Opuntia stricta (Haw.) Haw. var.
dillenii (Ker- Gawl.) Brenan

AIZOACEAE

Trianthema decandra L.
T. portulacastrum L.

MOLLUGINACEAE

Glinus lotoides L.
G. oppositifolius (L.) A. DC.

Mollugo cerviana (L.) Ser.
M. nudicaulis Lam.
M. pentaphylla L.

APIACEAE

Centella asiatica (L.) Urban
Coriandrum sativum L.
Pimpinella heyneana (Wall. ex. DC.) Kurz
P. wallichiana (Hohen.) Gandhi

ARALIACEAE

Schefflera stellata (Gaertn.) Harms.

ALANGIACEAE

Alangium salvifolium (L. f.) Wang. ssp. **salvifolium**

RUBIACEAE

Borreria articularis (L. f.) F.N. Williams
B. pusilla (Wall.) DC.
Canthium dicoccum (Gaertn.) Teijsm. & Binn.
C. parviflorum Lam.
Catunarengam spinosa (Thunb.) Tirveng.
C. ulginosa (Retz.) Sivar.
Ceriscoides turgida (Roxb.) Tirveng.
Deccania pubescens (Roth) Tirveng.
var. **pubescens**
Gardenia gummifera L. f.
G. latifolia Ait.
G. resinifera Roth
Haldinia cordifolia (Roxb.) Ridsdale
Hymnodictyon orixense (Roxb.) Mabb.
Ixora pavetta Andrews
Knoxia sumatrensis (Retz.) DC.
Mitragyna parviflora (Roth) Korth.
Morinda tomentosa Heyne ex Roth
Oldenlandia affinis (Roem. & Schult.) DC.
O. corymbosa L.
O. nitida (Wight & Arn.) Gamble
O. ovatifolia (Cav.) DC.
O. umbellata L.
Pavetta indica L.
P. tomentosa Roxb. ex Smith
Spermadictyon suaveolens Roxb.
Tarenna asiatica (L.) Kuntze ex Schum.
Thecagonum biflorum (L.) Babu
Wendlandia tinctoria (Roxb.) DC.

ASTERACEAE

Adenostemma lavenia (L.) Kuntze
Ageratum conyzoides L.
Anaphalis subdecurrens (DC.) Gamble
Bidens bitemata (Lour.) Merr. & Sherff.
Blumea bifoliata (L.) DC.
B. eriantha DC.
B. fistulosa (Roxb.) Kurz
B. lacera (Burm. f.) DC.
B. membranacea Wall. ex DC.
B. virens Wall. ex DC.
Conyza bonariensis Crong.
Crassocephalum crepidioides (Benth.) Moore
Dicoma tomentosa Cass.
Emilia sonchifolia (L.) DC.
Gnaphalium polycaulon Pers.
Echinops echinatus Roxb.
Eclipta prostrata (L.) L.
Goniocaulon glabrum Cass.
Grangea maderaspatana (L.) Poir.
Lactuca runcinata DC.
Lagascea mollis Cav.
Laggera alata (D. Don) Sch.-Bip. ex Oliv.
L. aurita (Willd.) Sch.-Bip.
Oligochaeta ramosa (Roxb.) Wagenit.
Parthenium hysterophrus L.
Senecio tenuifolius Burm. f.
Sonchus oleraceus L.
Sphaeranthus indicus L.
Synedrella nodiflora (L.) Gaertn.
Tricholepis radicans (Roxb.) DC.
Tridax procumbens L.
Vernonia albicans DC.
V. anthelmintica (L.) Willd.
V. cinerea (L.) Less.
V. divergens (Roxb.) Edgew.
Vicoa indica (L.) DC.
Wedelia urticifolia DC.
Xanthium strumarium L.

LOBELIACEAE

Lobelia alsinoides Lam.
L. heyneana Roem. & Schult.

Wahlenbergia erecta (Roem. & Schult.) Moel. & Tuyn.

PLUMBAGINACEAE

Plumbago zeylanica L.

MYRSINACEAE

Embelia tsjeriam-cottam DC.
E. villosa Baker

SAPOTACEAE

Madhuca indica Gmel.
Manilkara hexandra (Roxb.) Dubard.
M. roxburghiana (Wight) Dubard.
M. zapota (L.) Royen
Mimusops elengi L.

EBENACEAE

Diospyros chloroxylon Roxb.
D. ebenum Koenig ex Retz.
D. melanoxylon Roxb.
D. ovalifolia Wight
Maba buxifolia (Roth) A.L. Juss.

OLEACEAE

Jasminum arborescens Roxb.
J. auriculatum Vahl
J. cuspidatum Rottler
J. malabaricum Wight
J. roxburghianum Wall. ex C.B. Clarke
J. sambac (L.) Aitch.

NYCTANTHACEAE

Nyctanthes arbor-tristis L.

SALVADORACEAE

Salvadora persica L.

APOCYNACEAE

Aganosma dichotoma (Roth) K. Schum.
Carissa hirsuta Roth
Catharanthus pusillus (Murr.) G. Don
C. roseus (L) G. Don
Holarrhena pubescens (Buch.-Ham.) Wall. ex G. Don
Ichnocarpus frutescens (L.) Ait. & Ait. f.
Valiaris solanacea (Roth) Kuntze
Wrightia arborea (Dennst.) Mabb.
W. tinctoria R. Br.

ASCLEPIADACEAE

Calotropis gigantea (L.)
C. procera (Ait.) R. Br.
Caralluma adscendens (Roxb.) Haw. var. **attenuata** (Wight) Grav. & Magur.
Cryptolepis buchanani Roem. & Schult.
Cryptostegia grandiflora R. Br.
Decalepsis hamiltonii Wight & Arn.
Gymnema sylvestre (Retz.) R. Br. ex Schult.
Hemidesmus indicus (L.) R. Br. ex Ait.
Holostemma ada-kodien Schult.
Leptadenia reticulata (Retz.) Wight & Arn.
Marsdenia tenacissima (Roxb.) Moon
Oianthus disciflorus Hook. f.
Pergularia daemia (Forssk.) Choiv.
Sarcostemma acidum (Roxb.) Voigt
Tylophora macrantha Hook. f.
Wattakaka volubilis (L. f) Stapf

LOGANIACEAE

Cynoctonum mitreola (L.) Britton

STRYCHNACEAE

Strychnos nux-vomica L.
S. potatorum L. f.

GENTIANACEAE

Canscora decurrens Dalzell
C. decussata Schult. & Schult.
C. diffusa (Vahl) R. Br.
C. pauciflora Dalzell
Enicostemma axillare (Lam.) Royal ssp. **axillare**
Exacum carinatum Roxb.
E. pedunculatum L.
Swertia angustifolia Buch.-Ham. var. **pulchella** Burkill

MENYANTHACEAE

Nymphoides hydrophylla (Lour.) Kuntze
N. indica (L.) Kuntze

A View of Foothills Forests

BORAGINACEAE

Coldenia procumbens L.
Cynoglossum zeylanicum (Vahl ex Hornem.) Thunb. ex Lehmann
Heliotropium curassavicum L.
H. indicum L.
H. ovalifolium Forssk.
H. supinum L.
Trichodesma indicum (L.)Lehmann
T. sedgwickianum Benerj.
T. zeylanicum (Burm. f.) R. Br.

CORDIACEAE

Carmona retusa (Vahl) Masam.
C. macleodii Hook. f. & Thomson
C. monoica Roxb.
C. obliqua Willd.
Ehretia canarensis (C.B. Clarke) Gamble
E. laevis Roxb.
E. pubescens Benth.

CONVOLVULACEAE

Argyreia cymosa (Roxb.) Sw.
A. kleiniana (Roem. & Schult.) Raizada
A. nervosa (Burm.f.) Boj.
A. setosa (Roxb.)Choisy
Convolvulus rottlerianus Choisy
Evolvulus alsinoides (L.) L.
Hewittia scandens (Milne) Mabb.
Ipomoea coptica (L.) Roem. & Schult.
I. diversifolia R. Br.
I. eriocarpa R. Br.
I. hederifolia L.
I. illustris (C.B. Clarke) Prain
I. muricata (L.) Jacqem.
I. nil (L.) Roth
I. obscura (L.) Ker. Gawl.
I. pes - capre (L.) R.Br.
I. sepiaria Koenig & Roxb.
I. staphylina Roem. & Schult.
Jacquemontia paniculata (Burm.f.) Hallier f.
Merremia aegyptica (L.) Urban

M. gangetica (L.) Cuf.
M. hederacea (Burm.f.) Hallier f.
M. tridentata (L.) Hallier f.
M. turpethum (R. Br.) Rendle
Operculina petaloidea (Choisy) Oostr.
Rivea hypocrateriformis Choisy
R. ornata Choisy

SOLANACEAE

Datura metel L.
Physalis minima L.
Solanum anguivi Lam.
S. incanum L.
S. nigrum L.
S. pubescens Willd.
S. seaforthianum Andrews
S. surattense Burm.f.

SCROPHULARIACEAE

Bacopa monnieri (L.) Wettst.
Buchnera hispida Buch. -Ham.
Limnophila indica (L.) Druce
L. rugosa (Roth) Merr.
Lindenbergia muraria (Roxb. ex D. Don) Brukl.
Lindernia ciliata (Colsm.) Pennell.
L. crustacea (L.) F. Muell.
L. parviflora (Roxb.) Haines
L. pusilla (Willd.) Bold.
Scoparia dulcis L.
Sopubia delphinifolia (L.) G.Don
Stemodia viscosa Roxb.
Striga angustifolia (D.Don) C. J. Saldanha
S. asiatica (L.) Kuntze
S. gesnerioides (Willd.) Vatke
Verbascum chinense (L.) Santapau

LENTIBULARIACEAE

Utricularia exoletea R.Br.
U. reticulata Sm. var. **parviflora** Santapau

BIGNONIACEAE

Dolichandrone arcuata (Wight) C.B. Clarke
D. atrovirens (Heyne ex Roth) Sprague
D. falcata (Wall. ex DC.) Seem.
Millingtonia hrotensis L. f.
Oroxylum indicum (L.) Vent.
Stereospermum personatum (Hassk.) Chatterjee
S. suaveolens (Roxb.)DC.

PEDALIACEAE

Martynia annua L.
Pedalium murex L.
Sesamum orientate L.

ACANTHACEAE

Andrographis nallamalayana J.L. Ellis
A. paniculata (Burm.f.) Wall. ex Nees
Asystasia gangetica (L.) T. Anderson
Barleria acuminata Nees
B. cristata L.
B. longiflora L.f.
B. prionitis L. ssp. **prionitis**
B. strigosa Willd.
B. tomentosa Roth
Blepharis maderaspatensis (L.) Heyne ex Roth
Dicliptera cuneata Nees
D. verticellata (Forssk.) C. Chr.
Dipteracanthus patulus (Jacquem.) Nees
D. prostratus (Poir.)Nees
Dyschoriste vagans (Wight) Kuntze
Elytraria acaulis (L.f.) Lindau
Eranthemum capense L.
E. purpurescens Nees
Gantelbua urens (Heyne ex Roth) Bremek.
Hemigraphis hirta T. Anderson
H. latebrosa (Heyne ex Roth) Nees
Hygrophila auriculata (Schum.) Heine
H. salicifolia (Vahl) Nees
Indoneesiella echioides (L.) Sreem.
Justicia betonica L.
J. glabra Koenig ex Roxb.
J. glauca Rottl.
Lepidagathis cristata Willd.
L. subarmata (C.B. Clarke) Gamble
Meyenia hawtayneana (Wall.) ex Nees
Nelsonia canescens (Lam.) Spreng.
Peristrophe paniculata (Forssk.) Brummitt
Phaulopsis dorsiflora (Retz.) Santapau
Phlebophyllum spicatum (Roth) Bremek.
Rhinacanthus nasutus (L.) Kurz
Rostellularia crinita (Nees) Nees

R. procumbens (L.) Nees
R. prostrata (Roxb. ex C.B. Clarke) Majumdar
R. vahlii (Roth) Nees var. **vahlii**
Ruellia tuberosa L.
Rungia repens (L.) Nees
Staurogyne glauca Nees
Thunbergia fragrans Roxb. var. **laevis** (Nees) C.B. Clarke

VERBENACEAE

Citharexylum subserratum Sw.
Clerodendrum phlomides L. f.
C. serratum (L.) Moon
Gmelina arborea Roxb.
G. asiatica L.
Phyla nodiflora (L.) Greene
Premna latifolia Roxb. var. **mollissima** C.B. Clarke
P. tomentosa Willd.
Stachytarpheta jamaicensis (L.) Vahl
Symphorema involucratum Roxb.
Tectona grandis L.f.
Vitex altissima L.f.
V. leucoxylon L.f.
V. negundo L.

LAMIACEAE

Acrocephalus indicus (Burm.) Kuntze
Anisochilus camosus (L.f.) Wall.
Anisomeles indica (L.) Kuntze
A. malabarica (L.) R. Br. ex Sims.
Basilicum polystachyon (L.) Moench.
Becium filamentosum (Forssk.) Chiov.
Colebrookea oppositifolia Smith
Endostemon viscosus (Roth) Ashby
Hyptis suaveolens (L.) Poir.
Lavandula bipinnata Kuntze
Leonotis nepetiifolia (L.) R. Br.
Leucas aspera (Willd.) Link
L. mollissima Wall. ex Benth. var. **scaberula** Hook.f.
L. stricta Benth.
L. urticifolia (Vahl) R. Br.
Orthosiphon pallidus Royle ex Benth.
O. rubicundus (D. Don) Benth.
O. thymiflorus (Roth) Sleesen
Platystoma africanum Beauv.
Scutelleria colebrookiana Benth.

NYCTAGINACEAE

Boerhaavia chinensis (L.) Asmer & Schweinf.
B. diffusa L.
B. erecta L.

AMARANTHACEAE

Achyranthes aspera L.
A. lanata (L.) Juss.
A. sanguinolenta (L.) Blume
Allmania longipedunculata (Trimen) Gamble
A. nodiflora (L.) R. Br. var. **angustifolia** Hook.f.
A. nodiflora (L.) R. Br. var. **dichotoma** (Roth) Hook.f.
Alternanthera pungens Kunth
A. sessilis (L.) R. Br. ex DC.
Amarathus roxburghianus Nevski
A. spinosus L.
Celosia argentea L.
C. polygonoides Retz.
Nothosaerva brachiata (L.) Wight
Pupalia lappacea (L.) Juss. var. **lappacea**
Trichurus monsoniae (L.f.) Towns.

POLYGONACEAE

Polygonum barbatum L. var. **gracilis** (Danser) Steward
P. glabrum Willd.
P. plebeijum R. Br.

ARISTOLOCHIACEAE

Aristolochia bracteolata Lam.
A. indica L.

PIPERACEAE

Piper attenuatum Buch.-Ham. ex Miq.
P. hymenophllum Miq.
Piper nigrum L.

LAURACEAE

Cassytha filiformis L.

HERNANDIACEAE

Gyrocarpus americanus Jacquem.

LORATHACEAE

Dendrophthoe falcata (L.f.) Ett. var. **falcata**
D. falcata (L.f.) Ett. var. **pubescens** (Hook.f.) V. Chandras.
Taxillus bracteatus (Wall.) van Tiegh.

VISCACEAE

Viscum nepalense Spreng.
V. orientate Willd.

SANTALACEAE

Osyris wightiana Grah.
Santalum album L.

EUPHORBIACEAE

Acalypha alnifolia Klein ex Willd.
A. ciliata Forssk.
A. indica L.
A. lanceolata Willd.
Antidesma acidum Retz.
A. ghaesmbilla Gaertn.
Baliospermum montanum (Willd.) Muell. Arg.
Breynia retusa (Densst.) Alston
Bridelia cinerascens Gehrm.
B. montana Willd.
B. retusa (L.) Spreng.
Cleistanthus collinus (Roxb.) Benth. ex Hook.f.
C. patulus (Roxb.) Muell. Arg.
Croton bonplandianus Baill.
C. scabiosus Bedd.
Drypetes sepiaria (Wight & Arn.) Pax. & Hoffman
Euphorbia agowensis Hochst. ex Boiss.
E. antiquorum L.
E. caducifolia Haines
E. corrigioloides Boiss.
E. elegans Spreng.
E. fusiformis Buch.-Ham.
E. geniculata Ortega
E. hirta L.
E. indica Lam.
E. linearifolia Roth var. **linearifolia** var. **nallamalayana** J.L. Ellis
E. prostrata Aitch.
E. senguptae N.P. Balakr. & Subr.
Givotia rottleriformis Griff.
Glochidion velutinum Wight
G. zeylanicum Juss.
Homonia riparia Lour.
Jatropha glandulifera Roxb.
J. gossypifolia L.
J. heynei N.P. Balakr.
Mallotus philippiensis (Lam.) Muell. Arg.
Phyllanthus amarus Schum. & Thonn.
P. debilis Klein ex Willd.
P. embilica L.
P. indofischeri Bennet
P. pinnatus (Wight) Webster
P. polyphyllus Willd.
P. reticulatus Poir.
P. maderaspatensis L.
P. rheedhii Wight
P. urinaria L.
P. virgatus Forst.f.
Sebastiana chamaelea (L.) Muell. Arg.
Securingea leucopyrus (Willd.) Muell. Arg.
S. virosa (Roxb. ex Willd.) Baill.
Suregada angustifolia (Muell. Arg.) Airy Shaw
Tragia involucrata L.
T. plukenetii R. Sm.

URTICACEAE

Pouzolzia auriculata Wight
P. zeylanica (L.) Benn.

ULMACEAE

Celtis philippiensis Blanco var. **wightii** (Planch.) Soep.
Holoptelea integrifolia (Roxb.) Planch.
Trema orientalis (L.) Blume

MORACEAE

Ficus ampilissima Sm.
Ficus hispida L.f.
F. microcarpa L.f.
F. mollis Vahl
F. racemosa L.
F. religiosa L.

F. virens Ait. var. **virens**
Plecospermum spinosum Trec.
Strebulus asper Lour.

HYDROCHARITACEAE

Blyxa echinosperma (C.B. Clarke) Hook.f.
Hydrilla verticillata (L.f.) Royle
Ottelia alismoides (L.) Pers.
Vallisneria nutans (Lour.) H. Hara

ORCHIDACEAE

Geodorum densiflorum (Lam.) Schlech.
Habenaria platanginea Lindl.
H. roxburghii (Pers.) R.Br.
Liparis prazari King. & Prantl.
Peristylis goodyeroides (D. Don) Lindl.
Vanda tessellata (Roxb.) Hook. ex G. Don

ZINGIBERACEAE

Globba bulbifera Roxb.

COSTACEAE

Costus speciosus (Koenig) Sm.

AMARYLLIDACEAE

Crinum defixum Ker -Gawl.

HYPOXIDACEAE

Curculigo orchioides Gaertn.

AGAVACEAE

Agave americana L.
Sansevieria roxburghiana Schult. & Schult.

TACCACEAE

Tacca leontopetaloides (L.) Kuntze

DIOSCOREACEAE

Dioscorea bulbifera L.
D. hispida Dennst.
D. oppositifolia L.
D. pentaphylla L.
D. pentaphylla L. var. **communis** Prain & Burkill
D. tomentosa Koenig ex Spreng.
D. wallichii Hook.f.

LILIACEAE

Aloe vera (L.) Burm.f.
Asparagus racemosus Willd.
Chlorophytum arundiaceum Baker
C. tuberosum (Roxb.) Baker
Gloriosa superba L.
Iphigenia indica (L.) A. Gray
Sacilla zeylanica L.
Smilax zeylanica L.

PONTEDERIACEAE

Monochoria vaginalis (Burm.f.) Presl

COMMELINACEAE

Amischophacelus axillaris (L.) R.S. Rao & Kammathy
A. cucullata (Roth) R.S. Rao & Kammathy
Commelina attenuate Koenig ex Vahl
C. benghalensis L.
C. clavata C. B. Clarke
C. diffusa Burm.f.
C. ensifolia R. Br.
C. erecta L.
C. paludosa Blume
Cyanotis cristata (L.) D. Don
C. fasciculata (Heyne ex Roth) Schult.f.
C. tuberosa (Roxb.) Schult. & Schult.
C. tuberosa Schult. var. **adscendens** C.B. Clarke
Murdannia juncoides (Wight) R.S. Rao & Kammathy
M. nudiflora (L.) Brenan
M. scapiflorum (Roxb.) Royle

ARECACEAE

Borassus flabellifer L.
Calamus rotang L.
Caryota urens L.
Phoenix louerii Kunth
P. sylvestris (L.) Roxb.

PANDANACEAE

Pandanus odoratissimus L.f.

TYPHACEAE

Typha angustata Bory & Chaub.

ARACEAE

Amorphophallus sylvaticus (Roxb.) Kunth

Pistia stratioites L
Theriophonum minutum (Willd.) Bail.

ALISMATACEAE

Limnophyton obtusifolium (L.) Miq.

NAJADACEAE

Najas graminea Dalzell
N.marina L.

APONOGETONACEAE

Aponogeton natans (L.) Engl. & Krause

POTAMOGETONACEAE

Potamogeton pectinatus L.

ERIOCAULACEAE

Eriocaulon quinquangulare L.

CYPERACEAE

Bulbostylis barbata (Rottb.) C.B. Clarke
Cyperus articularis L.
C. compressus L.
C. difformis L.
C. distans L.f. var. **distans**
C. distans L. f. var. **pseudonutans** Kueken.
C. haspan L.
C. niveus Retz.
C. nutans Vahl ssp. **eleusinoides** (Kunth) T. Koyama
C. pilosus Vahl
C. rotundus L.
C. rubicundus Vahl
C. tenuispica Steud.
Elaeocharis atropurpurea (Retz.) K. B. Presl
Fimbristylis bisumbellata (Forssk.) Bub.
F. complanata (Retz.) Link
F. cymosa R. Br.
F. dichotoma (L) Vahl
F. ferruginea (L.) Vahl
F. miliacea (L) Vahl
F. ovata (Burm.f.) Kern.
F. tetragona R. Br.
Kyllinga brevifolia Rottb.
K.triceps Rottb.
Mariscus clarkei (Cooke) T. Koyama
M. compactus (Retz.) Bold.
M. cyperinus (Retz.) Vahl
M. dubius (Rottb.) Kuekenth. ex Fischer
Pycreus flavidus (Retz.) T. Koyama
P. polystachyos (Rottb.) Beauv.
Pycreus pumilus (L.) Nees ex C.B. Clarke
Rikliella squarrosa (L.) Raynal
Scleria lithospema (L.) Sw.

POACEAE

Acrachne racemosa (Heyne ex Roem. & Schult.) Ohwi
Alloteropsis cimcina (L.) Stapf.
Andropogon pumilus Roxb.
Apluda mutica L.
Aristida adscensionis L. var. **adscensionis**
A. funiculata Trin. & Rupr.
A. hystrix L.f.
A. mutabilis Trin. & Rupr.
A. redacta Stapf
A. setacea Retz.
Arthraxon echinatus (Nees) Hochst.
A.lancifolius (Trin.) Hochst.
Arundinella nepalensis Trin.
A. setosa Trin. var. **setosa**
Bambusa bambos (L.) Voss.
Brachiaria cruciformis (Sm.) Griseb.
B. ramosa (L.) Stapf
B. reptans (L.) Gardn. & Hubb.
Cenchrus biflorus Roxb.
C. ciliaris L.
Centotheca lappacea (L.) Desv.
Chionachne koenigii (Spreng.) Thwaites
Chloris barbata Sw.
C. bournei Rang. et Tad.
C. dolichostachya Lagasca
C. quinquesetica Bhide
C. virgata Sw.
Chrysopogon aciculatus (Retz.) Trin.
C. fulvus (Spreng.) Chiov.
Coelachyropsis logopoides Bor
Cymbopogon caesius (Hook. & Arn.) Stapf
C. coloratus (Nees) Stapf
C. martini (Roxb.) Watson
Cynodon dactylon (L.) Pers.
Dactyolactenium aegypticum (L.) P. Beauv.

D. aristatum Link
Dendrocalamus strictus (Roxb.) Nees
Dicanthium annulatum (Forssk.) Stapf
D. caricosum (L.) A. Camus
D. glabrum (Roxb.) S.K. Jain & Deshp.
var. **glabrum**
D. huegelli (Hack.) S.K. Jain & Deshp.
D. pertusum (L.) Clayton
D. pseudoischaemum (Nees ex Steud.) S.K. Jain
Digitaria albudens (Roem. & Schult.) Veldk.
D. bicomis (Lam.) Roem. & Schult.
D. ciliaris (Retz.) Koel.
D. longiflora (Retz.) Pers.
D. stricta Roth ex Roem. & Schult.
D. tomentosa (Willd.) Henrad.
Dinebra retroflexa (Vahl) Pahz.
Echinochloa colonum (L.) Link
E. crusgalli (L.) P. Beauv.
Eleusine corcana (L.) Gaertn.
E. indica (L.) Gaertn.
Enneapogon schimperianus (A. Rich.) Renvoize
Eragrostiella bifaria (Vahl) Bor
E. brachyphylla (Stapf) Bor
Eragrostis atrovirens (Desf.) Trin. ex Steud.
E. coarctata Stapf
E. diarrhena (Schult.) Steud.
E. gangetica (Roxb.) Steud.
E. japonica (Thunb.) Trin.
E. pilosa (L.) P. Beauv.
E. tenella (L.) P. Beauv. ex Roem. & Schult.
E. tremula Hochst.
E. uniloides (Retz.) Nees ex Steud.
E. viscosa (Retz.) Trin.
Eremopogon foveolatus (Del.) Stapf
Eriochloa procera (Retz.) C. E. Hubb.
Eulalia phaeothrix (Hack.) Kuntze
E. trispicata (Schult.) Henrad.
Garnotia stricta Brongn.
Hackelochloa granularis (L.) Kuntze
Heteropogon contortus (L.) P. Beauv. ex Roem. & Schult.
Imperata cylindrica (L.) Raeusch.
Ischaemum indicum (Houtt.) Merr.
I. pilosum (Klein ex Willd.) Wight
I. rugosum Salisb.
Iseilema anthephoroides Hack.
I. laxum Hack.
I. prostratum (L.) Anders.
Leptochloa chinensis (L.) Nees
Lophopogon tridentatus (Roxb.) Hack.
Melanocenchris jacquemontii Jaub. & Spach.
M. monoica (Rottl.) Fischer
Ophiuros exaltatus (L.) Kuntze
Oplismenus burmanii (Retz.) P. Beauv.
O. compositus (L.) P. Beauv.
Oryza granulata Nees & Arn.
O. malampuzhaensis Krishnsw.
Panicum notatum Retz.
P. paludosum Roxb.
P. repens L.
P. trypheron Schult.
Paspalidum flavidum (Retz.) A. Camus
P. geminatum (Forssk.) Stapf
Paspalum distichum L.
P. scorbiculatum L.
Perotis indica (L.) Kuntze
Pogonatherum paniceum (Lam.) Hack.
Pseudosorghum fasciculate (Roxb.) A. Camus
Rhynchelytrum repens (Willd.) C. E. Hubb.
Rottboellia exaltata L.f.
Sehima nervosum (Rottl. ex Willd.) Stapf
Setaria intermedia (Roth) Roem. & Schult.
S. pumilla (Poir.) Roem. & Schult.
S. verticillata (L.) P. Beauv.
Sporobolus coromandelianus (Retz.) Kunth
S. diander (Retz.) P. Beauv.
S. spicatus (Wall.) Kunth
S. tenuissimus (Schrank.) Kuntze
Tetrapogon tenellus (Roxb.) Chiov.
Thelepogon elegans Roth
Themeda triandra Forssk.
Trachys muricata (L.) Pers. ex Trin.
Tragus roxburghii Panigrahi
Urochloa panicoides P. Beauv. var.
pubescens (Kunth) Bor
Vetiveria zizanoides (L.) Nash

HUMAN SETTLEMENTS & BIOTIC FACTORS

Bifurcated through a length of 130 km by the river Krishna- this tiger reserve envelops about 120 villages

of which 24 Chenchu settlements with 557 families live in 'Core zone', while the rest consisting mixed tribes and sects in non-core zone. There are about 200 villages within the 2 km radius of the reserve comprising about 1,69,000 human population and 93,000 cattle (Thulsi Rao & Sudhakar, 1998).

The Chenchus and Yanadis identify a large number of edible plant species. They collect fruits, roots, tubers and green leaves for food. The main diet of chenchus consists of edible roots and tubers. Some are found throughout the year and others can be collected only in certain seasons or in certain localities. The most important tuber for Chenchus is Nallgadda; the other roots and tubers collected by them are Eravelagadda, Nulagadda, Chenchugadda, Bondagadda, Samakurragadda and Gitagadda etc.

The fruits collected by them seasonally are *Bauhinia vahlii, Tamarindus indicus, Buchanania latifolia* (February-March), *Ficus infectoria, F. glomerata, Diospyros melanoxylon* (March-April). The chenchus very much love the flowers of *Madhuca indica* (Mahuva tree). The flowers are eaten raw or boiled. They also extract liquor from the sun dried flowers. During the month of May, they collect wild mangoes and fruits of *Ficus benghalensis.* Most frequently consumed leafy vegetables are Dogal kura, Pontikura, Banka kura, Bodumala kura and Sher kura. Chenchus are expert in honey collection, which is an important food for them. They like only *Boswellia serrate* and *Albizzia procera* honeys.

Grazing: Prakasam, Mahboobnagar, Guntur and Nalgonda districts receive less rain due to the rain shadow aspect of the Nallamalai hill ranges. Consequently people living in this region send their cattle for grazing in to the reserve and keep their cattle for six months from mid June to end of December. These animals compete for fodder and water with wild animals. Locals to protect their cattle sometimes poison the carcasses to kill the wild predators.

Non-timber Forest Produce: About 34 species of NTFP have been identified as economically beneficial to the tribals of this region. Tendu leaf, Adda leaf, Amla, Mushrooms, Mahuva, Chironji are major NTFP of this area. Collection of these products has major bearing on the relationship of the people with the forest administration. Collectors set fire in the PA for early collection of Mahuva flowers and to get fresh shoots of Tuniki leaves, resulting in forest fires. The unscientific tapping of gum from *Sterculia urens* (Gum Karaya tree) pushed this species into endangered list. *Hardwickia binata* trees are lopped for fodder. People depend on this reserve for leaf plate making, bamboo basket weaving, gum, honey, broom, tamarind, soapnut, and other medicinal roots.

Following localities in the reserve are subjected to heavy illicit fellings; *Hardwickia* forests along Krishna valley, Guvvalakuntla, Indireswaram, Peddacheruvu plateaus, Guttalachernu plateau and Amrabad plateau.These habitats and species are now further threatened by the increasing human population, cattle grazing, pilgrimage and the resultant change in the land use pattern. Realizing the need to conserve its biodiversity, the Government of Andhra Pradesh has drawn an action plan through people's participation for conserving the biodiversity.

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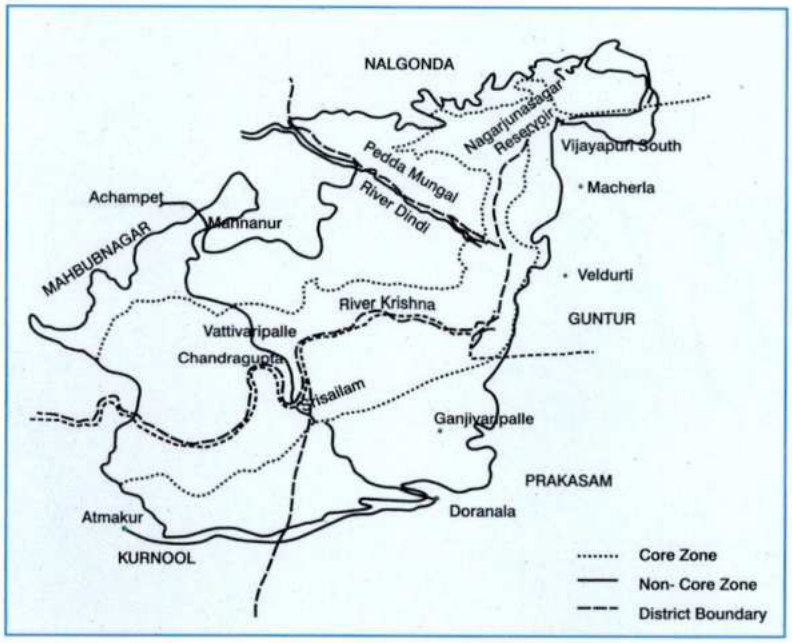
Dry deciduous forests Mannanur



Map of Nagarjunasagar - Srisailam Tiger Reserve

SALIENT FEATURES

Area

Core	:	1200 sq km
Buffer	:	2368.09 sq km
Total	:	3568.09 sq km
Longitude	:	78°29' to 79°29' East
Latitude	:	15°51' to 16°43' North
Altitude	:	100 m to 917 m above msl
Rainfall	:	Average 1000 mm

Temperature

Minimum	:	16°C
Maximum	:	43°C

Seasons

Monsoon	:	Mid-June to mid-November
Winter	:	Mid-November to February
Summer	:	Mid-March to mid-June

PLACES NEARBY

Mannanur is a pre-existing tribal hamlet with a comfortably furnished camp bungalow. Next to the bungalow are a crocodile pond and an environment education center. From Mannanur, one can explore the western corner of the tiger reserve. The forest area here is thickly set with miscellaneous timber species with local names like Nallamadi *(Terminalia tomentosa)*, Chirumanu *(Anogeissus latifolia)*, etc., as well as stretches of teak forest. One can also spot spotted deers, sambars, and nilgais here. Nagarjunsagar is the place where excavations have unearthed many historical monuments belonging to 1st and 2nd century AD. The place is also home to a large dam built on the river Krishna.

REACHING THERE

By Air

The nearest airport is at Hyderabad, 316 km away from Srisailam. Hyderabad is connected to many important cities in India including Delhi and Mumbai, the major international gateways.

By Rail

Srisailam is connected through Hyderabad as well as via Markapur (85 km away) on the South Central Railway.

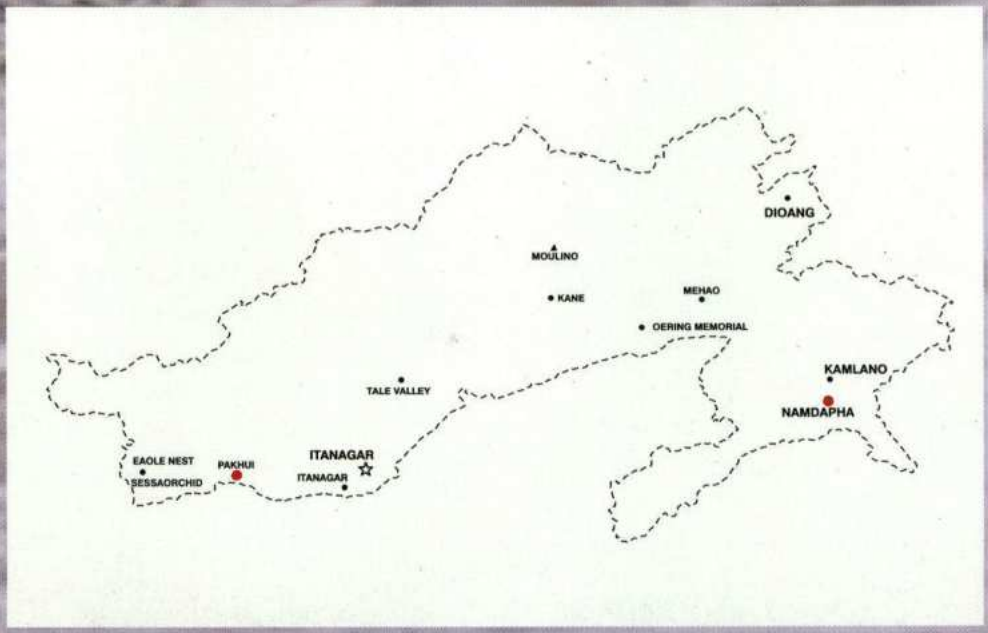
By Road

Srisailam is 190 km from Kurnool, 220 km from Guntur, 470 km from Chennai, and 85 km from Mannanur.

Seasonal flood in approach to Pakke Tiger Reserve

ARUNACHAL PRADESH

- **Namdapha Tiger Reserve**
- **Pakke Tiger Reserve**



Namdapha Tiger Reserve

BK Sinha & S Phukan
Botanical Survey of India, Eastern Circle, Shillong-793001

Namdapha Tiger Reserve was established in 1982-83 with an area of ca 1985 sq km (1808 sq km core area and 177 sq km buffer area). The reserve is bounded between lat. 27°17'-27°40'N and long. 96°16'-96 °59'E in the Changlang . district of Arunachal Pradesh. The reserve is surrounded in the north by the Mishmee hills, on the east by Homakharan Bum; on the west by Dibrugarh district of Assam and its southern limit extend to Patkoi hills. The area is endowed with a conglomeration of different climatological regimes and this has adequately manifested in remarkable diversity both in plants and animals. The area is covered with virgin lush evergreen dense tropical forests from the altitudes of 200 m to 4571 m. Due to its inaccessibility and remoteness, the vegetation is still pristine and virgin. The tropical humid climate coupled with heavy rainfall facilitates dense floristic growth and every thing in these forests grow with vigour.

The flora of the Reserve have been discussed in detail by J. Joseph (1984), Joseph & Chauhan (1993), Hajra (1996) and Chauhan (1997). To evaluate the habitat requirements of tigers and other associated animals in the reserve areas various vegetation types of the Reserve are discussed and species collected from the area have been enumerated.

The Namdapha Tiger Reserve is a highly rugged area with deep valleys and hill ranges running in different directions. The great Himalayan Mountains lie towards the east. The Eastern Himalaya trails off towards the south in a narrow ridge, which is slightly forward to the east meeting the eastern end of the Patkoi Mountains at Chaukam pass. The eastern sides of the mountains are drained in the Irrawady basin while the western slopes are drained in the Brahmaputra basin. Parallel to but north of Patkoi there is a higher ridges, stretching from east to west called the Dapha Bum ridges which has many high peaks of over 4500 m. This ridges separates the Noa-Dihing drainage basin from the northern Lohit river basin.

The sub-tropical vegetation zone having sub-tropical climate have short cold winter from November to February in the lower reaches. Cold season is for longer period at higher altitudes as in other Himalayan regions.

As a part of North East India the Reserve receives more than 250 cm of rain annually. The rainfall increases upto 400 cm towards east of the Reserve. The number of rainy days with more than 2.5 mm of rain averages between 125 and 150 annually. During summer relative humidity is 60 to 70 %.

VEGETATION

The luxuriant vegetation of the Namdapha Tiger Reserve may be broadly classified into tropical, temperate and alpine. The tropical and sub-tropical evergreen forest predominates mostly in lower reaches and alpine vegetation is met within upper reaches. It supports a luxuriant tropical, temperate and alpine vegetation in pristine and virgin form. Its unique geographical position, varied topography, high rainfall, tropical humid climate and minimum biotic interference due to inaccessibility and remoteness makes the area one of the richest

botanical treasure house of the country. The low land tropical evergreen forests are perhaps the largest remaining *Dipterocarpus* forests in the whole of India. The floral diversity is such that no single species can be said as the dominant species of the reserve. The forests are further remarkable in the lack of clear cut storey formation of vegetation, perhaps due to vigorous natural regeneration continuously throughout the year owing to conducive climatic and edaphic factors. The best of *Dipterocarpus retusus* Blume (Hollong) sometimes reach a height of over 50 m, with large buttresses and are covered with epiphytic growth of Lichens, Mosses, Ferns, Piperomias, Aroids and Orchids. There are about 150 timber yielding species growing in the area.

The dominant tall trees are *Albizia julibrissin* Durazz var. *mollis* (Wall.) Benth., *A. procera* (Roxb.) Benth., *Alnus nepalensis* D. Don, *Anthocephalus chinensis* (Lam.) A. Rich. ex Walp., *Artocarpus chama* Buch.-Ham., *A. heterophyllus* Lam., *Canarium strictum* Roxb., *Castaopsis echinocarpa* Miq., *C. kurzii* (Hance) S. N. Biswas, *C. tribuloides* (Sm.) DC., *Celtis tetranda* Roxb., *Dipterocarpus retusus* Blume, *Duabanga grandiflora* (Roxb. ex DC.) Walp., *Elaeocarpus aristatus* Roxb., *E. sphaericus* (Gaertn.) K. Schum., *Exbucklandia populnea* (R. Br. ex Griff.) R. Br., *Ficus altissima* Blume, *F. elastica* Roxb. ex Homem, *F. drupacea* Thunb., *F. nervosa* Heyne ex Roth, *F. rigida* Jack., *Mangifera sylvatica* Roxb., *Nauclea griffithii* Hav., *Quercus lamellosa* Sm., *Q. semiserrata* Roxb., *Shorea assamica* Dyer, *Terminalia myriocarpa* Heurck. & Muell. Arg. and *Toona ciliata* Roem. The other trees forming middle storey, which is almost obscure comprises *Altingia excelsa* Noronha, *Brunsmia polysperma* (C. B. Clarke) Steenis, *Castanopsis indica* (Roxb.) A. DC., *Dalbergia assamica* Benth., *Dillenia indica* L., *D. pentagyna* Roxb., *Docynia indica* (Wall.) Decne., *Dysoxylum binectariferum* (Roxb.) Hook. f. & Bedd., *D. gobara* (Buch.- Ham.) Merr., *Elaeocarpus tectaricus* (Lour.) Poir., *Syzygium kurzii* (Duthie) Balakr., *Evodia trichotoma* (Lour.) Planch., *Kydia calycina* Roxb. var. *glabrescens* (Mast.) Deb, *Magnolia griffithii* Hook. f., *Schima wallichii* (DC.) Korth., *Terminalia chebula* Retz., *T. citrina* (Roxb.)Flem., and *Turpinia pomifera* DC., etc. *Actephila excelsa* (Dalz.) Muell., *Actinodaphne obovata* (Nees) Blume, *Alangium chinense* (Lour.) Harms., *Beilschmiedia roxburghiana* Nees, *Cinnamomum bejolghata* (Buch.-Ham.) Sweet, *C. tamala* (Spr.)Nees & Eberm., *Drypetes assamica* (Hook. f.) Pax. ex Hoffin., *Ficus semicordata* J. E. Sm., *Garcinia cowa* Roxb. ex DC., *Griffithianthus fuscus* Merr., *Gynocardia odorata* R. Br., *Litsia cubeba* (Lour.) Pers., *L. monopetala* (Roxb.) Pers., *L. salicifolia* (Roxb. ex Nees) Hook. f., *Macropanax undulates* (Wall. ex G. Don) Seem., *Magnolia hodgsonii* (Hook. f. & Thomson) King and *Styrax serrulatum* Roxb. form a third storey of the canopy.

Osbeckia nutans- (Courtesy : M.K. Pathak)

Some of the common large shrubs or small trees are *Aralia armata* (G. Don) Seem., *Ardisia virens* Kurz, *Brassaiopsis glomerulata* (Blume) Regel., *Pseudobrassiopsis hispida* (Seem.) R.N. Ban., *Camellia caudata* Wall., *Coffea khasiana* Hook. f., *Debregeasia*

longifolia (Burm.f.) Wedd., *Maesa indica* (Roxb.) Wall., *Micromelum integerrimum* (Roxb.) Wight & Arn. ex Roem., *Morinda angustifolia* Roxb., *Murraya paniculata* (L.) Jack., *Myrsine semiserrata* Wall., *Saurauia armata* Kurz, *S. macrotricha* Kurz, *S. nepaulensis* DC., *S. punduana* Wall., *S. roxburghii* Wall., *Vernonia volkameriaefolia* DC. and *Oreocnide rubescens* (Blume) Miq. etc.

The tropical and subtropical evergreen forests have also entangling web of thick lianas, wiry climbers, creepers and weak stemed stragglers viz. *Adenia trilobata* (Roxb.) Engl., *Argyreia argentea* (Roxb.) Choisy, *A. nervosa* (Burm. f.) Bojer, *Cayratia japonica* (Thunb.) Gegnep., *Cissus assamica* (Laws.) Craib, *Combretum flagrocarpum* C. B. Clarke, *C. punctatum* (Marq.) Blume, *Crawfurdia campanulacea* Wall. ex C.B. Clarke et Griff., *Dioscorea alata* L., *D. pentaphylla* L., *Entada rheedii* Spreng. ssp. *sinohimalensis* Grierson & Long, *Erythropalum scandens* Blume, *E. vagum* (Griff.) Mast., *Mastersia assamica* Benth., *Paederia scandens* (Lour.) Merr., *Tetrastigma bracteatum* (Wall.) Planch., *T. leucostaphylum* (Dennst.) Alston., *T. obovatum* (M. A. Lawson) Gagnep., *T. rumicispermum* (M. A. Lawson) Planch., *Poikilospermum suaveolens* (Blume) Merr., *Thadiantha hookeri* C.B. Clarke, etc. The ground in these forests are dark and moist due to lofty trees with thick canopy and has a thick layer of undisturbed humus, supporting many fleshy fungi and saprophytic flowering plants. The common herbs are *Andrographis paniculata* (Burm. f.) Nees, *Blumea fistulosa* (Roxb.) Kurz, *Begonia aborensis* Dunn, *B. barbata* Wall. ex DC., *B. palmata* D. Don, *B. roxburghii* (Miq.) DC., *Cardaminea hirsuta* L., *Chirita macrophylla* Wall., *Euphorbia hirta* L., *Hedyotis verticiilata* (L.) Lam., *Hygrophila salicifolia* (Vahl) Nees, *Impatiens porrecta* Wall. ex Hook. f. & Thomson, *Knoxia mollis* R. Br., *Limnophila chinensis* (Osbeck) Merr., *Lobelia angulata* Forst., *L. monotana* Reinw. & Blume, *Mosla dianthera* (Buch.-Ham. ex Roxb.) Maxim., *Oenanthe thomsonii* C. B. Clarke, *Oxalis corymbosa* DC., *Plantago erosa* Wall., *Phyllanthus urinaria* L., *Polygonum posumbu* D. Don, *P. strigosum* R. Br., *P. tenellum* Blume, *Ranunculus cantoniensis* DC., *Spilanthes acmela* (L.) Merr., *Torenia diffitsa* D. Don and *Viola diffiisa* Ging. Some of the common grasses and sedges along the way side are *Arundinella decampedalis* (Kuntze) Jan., *A. nepalensis* Trin., *Arundo donax* L., *Carex caricina* (D. Don) Ghildyal & Bhattacharya var. *caricina* , *Coix lacryma-jobi* L., *Cyperus brevifolius* (Roxb.) Hassk., *Fimbristylis dichotoma* (L.) Vahl, *Garnotia acutigluma* (Steud.) Ohwi, *Imperata cylindrica* (L.) Raeusch., *Isachne albens* Trin., *Oplismenus compositus* (L.) P. Beauv., *Phragmites karka* (Retz.) Trin. ex Steud. var. *karka, Saccharum griffithii* Munro ex Aitchis., *Themeda villosa* (Poir.) A. Camus, *Pogonantherum crinitum* (Thunb.) Kunth and *Setaria palmifoila* (Koen.) Stapf.

Epiphytes and other climbers are very common on the trunks in the forests and the common ones are *Aeschynanthus acuminata* Wall., *A. hookeri* C. B. Clarke, *A. superba* C. B. Clarke, *Agapetes variegata* D. Don, *Piper clarkii* DC., *P. hymenophyllum* Miq., *P. mannii* DC., *P. sylvaticum* Roxb., *P. thomsonii* (DC.) Hook. f., *P., scandens* L., *Procris laevigata* Blume, *Raphidophora grandis* Schott. *R. hookeri* Schott. and *Schefflera venulosa* (Wight & Arn.) Harms. Beside, these more than 120 species of Orchids, which include some highly ornamental species, also grow in the reserve area. Some new species such as *Coelogyne hajrae* Phukan etc. discovered from the Reserve.

FLORISTIC DIVERSITY

The flora of Namdapha Tiger Reserve is rich and dense as well as diverse in species composition . It supports several endemics that have evolved locally or have survived only due to protective natural barriers.

As far as the phytogeographical relationship and affinities of the flora of Namdapha are concerned, these show greater affinity with Indo-Malayan flora. The reserve contains ca 73 species of Lichens, 59 species of Hipaticaceae, 112 species of

Pteridophytes, 5 species of Gymnosperms and 830 species of Angiosperms (see table 1). However, undoubtedly, this number will go up as more and more areas are surveyed. Some of the taxa viz. *Cinnamomum glaucescens, Dipterocarpus retusus, Shorea assamica* and *Terminalia myriocarpa,* which grow profusely at lower elevations from Miao to 65th mile forests are totally absent near Gandhinagar towards Myanmar border. Other interesting taxa such as *Rhopalocnemis phalloides, Sapria himalayana* are found near 40th mile forest area, while *Balanophora diocia* shows its maximum population density towards Kumon Bum at 1800 m altitude. *Betula, Quercus, Peliosanthes, Primula* and *Rhododendron* spp. are found at higher elevations.

It may be mentioned that many taxa viz. *Aeschynanthes superba, Angiopteris evecta. Cheirostylis pusila, Christensenia aesculifolia, Cyathea gigantea, Diplomeris pulchella, Glycosmis cymosa, Impatiens porrecta, Lodes hookeriana, Phlegmariurus phlegmaria, Magnolia griffithii, M. pterocarpa, Pentaschme wallichii, Psilotum nudum* and *Tetrastigma obovatum* etc. hitherto reported rare and endemic to Assam, Manipur, Meghalaya and Nagaland grow profusely in this reserve. Besides, many primitive flowering plants viz. *Exbucklandia, Houtuynia, Kadsura, Magnolia, Talauma* and many species of Annonaceae, Lauraceae, Myrsinaceae, Piperaceae etc. are found in this reserve. Apart from these many nearby Bhutan, Myanmar and Sino-Himalayan genera like *Acanthopanax, Actinida, Anthocephalus, Bruinsmia. Bulbophyllum, Camellia, Cymbidium, Epigenium* and *Kadsura.* etc., Malayan elements viz., *Balanophora, Engelhardtia, Exbucklandia, Miliusa, Rubus, Talauma* and *Vaccinium* etc., and to a lesser extent the elements of peninsular India e.g. *Apodites, Butea, Cissampelos, Elastostema,Entada, Garcinia, Dillenia, Eurya, Mahonia* and *Ternstroemia* etc., are found in this Tiger Reserve.

It is rather interesting to note that in spite of its terrestrial contiguity with its surrounding areas, it shows considerable endemicity e.g. *Aconitum lethale, Begonia arborensis, B. iridescens, Ceratostylis subulata, Chirtias mishmiensis, Cymbidium eburneum* var. *parishii, Euonymus glaber, Phaius rubra, Piper clarkii, Rubus burkillii, Symplocos pealii* and *Wallichia triandra,* etc. Besides, a number of crop plants, wild relatives of cultivated plants, ethnobotanically important and medicinal plants and plants of great horticultural values etc. are found here. However, it has been observed that invasion of several obnoxious weeds like *Bidens, Chromoleana, Eupatorium, Mikania* and *Tridax* etc. into cleared tropical rain forest may seriously affect succession and regeneration of the same type of forest is impossible and eradication of such exotics has become one of the most serious problems now.

Table-1: The Floristic Analysis of Namdapha Tiger Reserve

Group	Families	Genus	Species
Angiosperms			
Dicot	119	403	634
Monocot	19	111	196
Pteridophytes	36	54	112
Gymnosperms	3	4	5
Hepaticae	21	33	59
Lichens	17	34	73

An analysis of major 10 families of angiosperms with their respective genera and species is given in descending order in the Table-2 to show the richness and diversity of Namdapha Tiger Reserve. Families like Orchidaceae, Rubiaceae, Leguminaceae and Poaceae are almost equally represented.

Table-2: The Ten Dominant Angiosperm Families in Namdapha Tiger Reserve

Families	Genera	Species
Orchidaceae	35	81
Rubiaceae	31	59
Fabaceae	22	39
Urticaceae	13	39
Poaceae	27	33
Euphorbiaceae	22	32
Asteraceae	19	24
Cyperaceae	7	20
Acanthaceae	11	18
Gesneriaceae	8	15

The floristic analysis of Lichens, Hepaticeae (Bryophytes) Pteridophytes and Gymnosprms are discussed in Chauhan (1997). Out of 17 families of Lichens there are 34 genera having total number of 73 species. Of these, the family Parmeliaceae is the largest having 13 species under 6 genera. There are 11 families of Bryophytes (Hipaticeae) represented by 59 species belonging to 33 genera. Of these, the family Lejeuniaceae is the largest having 10 species under 7 genera.

It is relevant to mention here that a number of rare, endangered and threatened taxa; two new genera; four new species were described from here, thus placing the region as one of the most important and biologically rich areas.

So far as the richness and genetic diversity of the Flora of Namdapha Tiger reserve is concerned, it may be mentioned that many taxa hitherto reported rare and endemic to Assam , Manipur, Meghalaya and Nagaland could also be collected from Namdapha and few of them are growing profusely. They include *Aeschynanthus superba* C. B. Clarke, *Angiopeteris evecta* Hoffm. , *Bruinsmia polysperma* (C.B. Clarke) Steenis, *Cheirostylis pusilla* Lindl., *Christensenia aesculifolia* (Blume) Maxon, *Cythea gigantea* (Wall. ex Hook.) Holt., *Arundina graminifolia* (D. Don) Hochr., *Diplomeris pulchella* D. Don, *Gnetum ula* Brongn., *Glycosmis cymosa* (Kurz) Narayanswamy, *Impatiens porrecta* Wall. ex Hook. f. & Thomson, *Lodes hookeriana* Baill., *Phlegmariurus phlegmaria* (L.) Sen & Sen, *Magnolia griffithii* Hook. f. & Thomson, *M. pterocarpa* Roxb., *Oxyspora cernua* Beauv., *Pteracanthus nobilis* (C.B. Clarke) Brem., *Pseudobrassaiopsis hispida* (Seem.) R. N. Banerjee, and *Tetrastigma obovatum* (M.A. Lawson) Gagnep., etc. It also hosts several rare and endangered taxa which are being depleted or on the verge of extinction due to many developmental projects and' Jhum' cultivation in other parts of north-eastern region.

Many primitive flowering plants viz. *Exbucklandia, Houttuynia, Kadsura, Magnolia* and *Talauma* and many species of the Annonaceae, Lauraceae, Myrsinaceae and Piperaceae are found here. Apart from these many taxa of nearby Sino-Himalayan, Bhutanese, Burmese, Malaysian and to a lessor extent with peninsular Indian affinity could be seen in this area. The Chinese, Bhutanese and Himalayan genera found in the Namdapha Tiger Reserve are : *Actinidia, Anthocephalus, Bruinsmia, Bulbophyllum, Camellia, Cymbidium, Epigeneium* and *Kadsura.* Of the Malayan elements occurring in Namdapha Tiger Reserve are genera like: *Balanophora, Engelhardtia, Exbucklandia, Miliusa, Talauma* and *Vaccinium* , etc.

The flora exhibits affinities with peninsular India with common elements like *Butea parviflora* Roxb.,

Ctssampelos pareira L., *Dillenia indica* L., *D. pentagyna* Roxb., *Eurya japonica* DC., *Elatostema plafyphylla* Wedd., *Entada pursaetha* DC., *Garcinia cawa* Roxb. ex DC., *Mesua ferrea* L., *Meliosma simplicifolia* (Roxb.) Walp., *Pavetta indica* L. and *Trichosanthes tricuspidata* Lour.

ETHNOBOTANICALLY IMPORTANT PLANTS

Food plants :

The Namdapha Tiger Reserve is diverse and rich ethnobotanically. The tribals of various enthnic groups inhabiting this area practice " Jhum " cultivation. Land holdings are small and subsistence agriculture prevails. The natives still gather many wild food plants from sites. Tubers, rhizomes, shoots, beries, etc. of wild plants are eaten raw or boiled or even cooked and pickled and also used as vegetables. 'Lisus' are mainly dependant on the plants for their survival. A list of species used by local people are as follows:

	Name of the plants	Family
1.	*Abroma augusta* L. f.	Sterculiaceae
2.	*Aconitum lethale* Griff.	Ranunculaceae
3.	*Actephila excelsa* (Dalz.) Muell. Arg.	Euphorbiaceae
4.	*Aesculus assamica* Griff.	Hippocastanaceae
5.	*Agapetes variegata* D. Don	Ericaceae
6.	*Albizia julibrissin* Durazz.	Mimosaceae
7.	*Alpinia malaccensis* (Burm.f.) Rose.	Zingiberaceae
8.	*Amomum dealbatum* Roxb.	Zingiberaceae
9.	*Aquilaria malaccensis* Lam.	Thymelaceae
10.	*Arundo donax* L.	Poaceae
11.	*Begonia barbata* Wall.	Begoniaceae
12.	*Beilschmedia roxburghiana* Nees	Lauraceae
13.	*Calamus floribundus* Griff.	Arecaceae
14.	*Callicarpa arborea* Roxb.	Verbenaceae
15.	*Castonopsis indica* (Roxb.) A. DC.	Fagaceae
16.	*Chloranthus elatior* R. Br.	Chloranthaceae
17.	*Clerodendrum colebrookianum* Walp.	Verbenaceae
18.	*Coffeat khasiana* Hook.f.	Rubiaceae
19.	*Cyperus haspan* L.	Cyperaceae
20.	*Dioscorea glabra* Roxb.	Dioscoreaceae
21.	*Garcinia cowa* Roxb.	Clusiaceae

	Name of the plants	Family
22.	*Hedychium coronarium* Koen.	Zingiberaceae
23.	*Hodgsonia macrocarpa* (Blume) Congdon	Cucurbitaceae
24.	*Houttuynia cordata* Thunb.	Saurauiaceae
25.	*Jasminum sambac* (L.) Ait.	Oleaceae
26.	*Macrosolen cochinchinensis* (Lour.) V. Tiegh	Loranthaceae
27.	*Piper sylvaticum* Roxb.	Piperaceae
28.	*Setaria pumila* (Poir.) Roem. & Schult.	Poaceae
29.	*Solanum spirale* Roxb.	Solanaceae
30.	*Zanthoxylum alatum* Roxb.	Rutaceae

MEDICINAL PLANTS

Namdapha Tiger Reserve harbours numbers of medicinal plants, which are being used by the tribals of Chaglang district of Arunachal Pradesh. Some of the medicinal plants are listed below with their uses:-

Name of plant & Family	Habit	Uses
Achyranthes aspera L. (Amaranthaceae)	Herb	Roots used in urinary disorder; stems and leaves boils, piles & skin disease & seeds in hydro rophobia
Alpinia allughas (Retz.) Rose. (Zingiberaceae)	Tall herb	Rhizome used in fever and rheumatism
Anthocephalus chinensis (Lam.) A. Rich. ex Walp. (Rubiaceae)	Tree	Leaves used in case of ophthalmia
Barleria cristata L. (Acanthaceae)	Shrub	Roots and leaves used in cough and cold and in swellings
Buddleja asiatica Lour. (Buddlejaceae)	Shrub	Plants are used as abortifacient and skin diseases
Cannabis sativa L. (Cannabinaceae)	Shrub	Plants used in stomach disorders as appetite Stimulants
Chirita vestitum A. DC. (Gesneriaceae)	Herb	Leaves used in itching
Cissampelos pareira L. (Menispermaceae)	Twing	Tubers acts as diuretic, stems juice generally taken after delivery; leaves for itching.
C. divaricatum Jack. (Verbenaceae)	Shrub	Roots and leaves are taken in dysentery and fever
Costus speciosus (Koenig.) Sm. (Zingiberaceae)	Tall herb	Rhizomes used in respiratory troubles

Name of plant & Family	Habit	Uses
Croton caudatus Geiseler (Euphorbiaceae)	Shrub	Fruits used in vomiting
Cyathea gigantea (Wall. ex Hook.f.) Holttum (Cyatheaceae)	Woody Shrubs or herb	Leaves used for curing swelling
Dillenia indica. L. (Dilleniaceae)	Tree	Fruits used in cough, fever and weakness
Elaeocarpus sphaericus (Gaert.) Schumann (Elaeocarpaceae)	Tree	Flowers and fruits used in cardiac disorders
Equisetum diffusum D.Don (Equisetaceae)	Herb	Plants used in joining broken bones of cattle
Garcinia acuminata Planch. & Triana (Clusiaceae)	Tree	Fruits used in gastrointestinal problems
Houttuynia cordata Thunb. (Saurauiaceae)	Herb	Rhizome taken in cough and leaves in cholera
Mastersia assamica Benth. (Fabaceae)	Woody Climber	Leaves used in wounds
Musa velutina Wendl. & Drude. (Musaceae)	Tall Perennial herb or shrub	Pseudostem used in dysentery, check the bleeding
Persicaria hydropiper (L.) Spach (Polygonaceae)	Herb	Stems and leaves used in urinary disorders
Piper thomsoni (DC.) Hook. f. (Piperaceae)	Climber	Roots promote the discharge of urine
Pothos scandens L. (Araceae)	Climbers herb	Leaves used to cure small pox
Spilanthes paniculata DC. (Asteraceae)	Herb	Flowers used in dysentery
Tacca integrifolia Ker-Gawl. (Taccaceae)	Herb	Leaves used in dysentery
Toddalia asiatica (L.) Lam. (Rutaceae)	Shrub	Roots used in diarrhoea and fever
Trema orientalis (Blume) Blume (Ulmaceae)	Tree	Plants used in diseases of nervous system
Xanthium strumarium L. (Asteraceae)	Shrub	Plants used in inflammation of the thyroid glands and ulcers
Zanthoxylum armatum DC. (Rutaceae)	Tree	Leaves used in indigestion, twigs in toothache

WILD RELATIVES OF CULTIVATED PLANTS

The forests explored so far are rich in wild species of cultivated plants. Some of the important plants are given below:

Artocarpus chama Buch.-Ham.ex Roxb. (Wild Jackfruit). A tall tree with edible fruits.

Citrus medica L. - A wild citrus allied to cultivated common lime, distributed at lower altitudes in the Tiger Reserve.

Camellia caudata Wall. (Wild Tea)-A small tree which grows under the dense canopy of tall trees.

Coffea benghalensis Heyne ex Roem. & Schult. (Wild Coffee) - A shrub with white flowers.

C. khasiana Hook.f. (Wild Coffee)-A common shrub with orange red flowers .

Coix gigantea Roxb. - Plants are grown in the kitchen garden for seeds.

C. lacryma-jobi L. - Plants are cultivated in the kitchen gardens for its seeds.

Ensete glaucum (Roxb.) Cheesman -Wild banana found growing on the road side before Deban.

Mangifera sylvaticum Roxb.-Wild mango plant collected near 36th mile and 40th mile with long pendulous bunches of beaked fruits. Mature fruits are pinkish -red with leathery thick edible skin and very thin non-fibrous covering over the nut.

Musa glauca Roxb. - A tall wild banana, common in moist and open places on forest edges.

Musa rosacea Jacq. - A common wild banana on road sides and forest edges. *Musa velutina* Wendl. & Drude - A common gregarious dwarf banana with attractive erect, bright -red spadix.

It is interesting to note that in spite of terrestrial contiguity with surrounding area, this area shows considerable endemicity e.g. *Aconitum lethale* Grif, *Begonia arborensis* Dunn, *B. iridescens* Dunn, *Ceratostylis subulata* Blume, *Chirita mishminensis* Debb., *Cymbidium ebumeum* Lindl. var. *parishii* (Reichb. f.) Hook. f. , *Euonymus glaber* Roxb., *Phaius rubra* Lindl., *Piper clarkii* C. DC., *Rubus burkillii* Rolf, *Symplocos pealii* King & Das and *Wallichia triandra* (Joseph) S.K. Basu. The reserve rich in gene pool of several rare and endangered taxa viz., *Aeschynanthus superba* C. B. Clarke, *Angiopteris evecta* Hoffm., *Aquilaria malaccensis* Lam., *A. khasiana* Wall., *Esmeralda cathcartii* Reichb.f., *E. clarkei* Reichb.f., *Balanophora dioica* R. Br., *Bruinsmia polysperma* (C.B. Clarke) Steenis, *Cheirostylis pusilla* Lindl., *Christensenia aesculifolia* (Blume) Maxon, *Cyathea gigantea* (Wall. ex Hook.) Holtt, *Cymbidium eburneum* Lindl. var. *parishii* (Reichb. f.) Hook. f. *Diplomeria pulchella* D.Don, *Galeola altissima* (Blume) Reichb. f, *Glycosmis cymosa* (Kurz) V. Naray, *Gnetum gnemon* L., *G. ulva* Brongn, *Impatiens porrecta* Wall. ex Hook. f., & Thomson, *Iodes hookeriana* Baill., *Liparis distas* C.B. Clarke, *Livistonia jenkinsiana* Griff., *Magnolia griffithii* Hook. f., & Thomson, *M. pterocarpa* Roxb., *Oxyspora cernua* (Roxb.) Triana and *Psilotum nudum* etc. Some of these plants are getting rare in N.E. Region due to several biotic influence. The genetic diversity met with in crop plants and plants of horticultural value is also remarkable.

The selective felling of the *Aquilaria malaccensis* Lam., for Agar extraction, *Canarium strictum* Roxb. 'Dhup' and *Cinnamomum glanduliferum* (Nees) Meissn. may pose serious threat to their population. "*Attar*" trees are often wounded for its resin. These trees may also face threat in due course.

Besides, the natural factors such as flood, earth quakes, land slides, natural competition between species and forest fires affected a change in the native flora of the reserve. Population pressure, coupled with increased demand on natural forests areas for cultivation, grazing and fuel has brought about the destruction of natural forests at greater pace year after year. The Jhum fallows abandoned by jhumias gradually transformed into barren rocky places or grassland. This has also facilitated the invasion by

alien species, particularly exotic weeds like *Chromolaena, Eupatorium, Lantana* & *Mikania* etc.

CONSERVATION ASPECTS

Ecologically, it may be emphasized that the area is having balanced ecosystem. Interestingly, the human interference in this reserve is almost negligible, as such the limiting factors are not apparently visible due to rich vegetative covers, optimum temperature and humidity coupled by well distributed rainfall. As a result, the area has become autotrophic component which leads to richness of heterotrophic organisms and facilitate the inhabitation of rich and diverse fauna. More than 120 species of mammals, 560 species of birds and 90 species of reptiles and amphibians have been recorded from this region. The selective felling of *Aquilaria agallocha* for 'Agar' extraction and *Canarium strictum* for 'Dhoop' is also being often wounded for its resin. These trees may face threat in due course. The most vital threat to this tiger reserve is biotic factor, for example, the Chakma refugee settlement on the western side of Deban river in close vicinity to the core area will create more problem to the management as and when their population will increase. Therefore, it is suggested, if possible these refugees be shifted to some other areas. Almost similar problem is also prevailing in the Gandhigram area on the southeastern flanks of the reserve and there is already a lot of resentment among Lisu's to encroach more core area for Jhum cultivation which requires a special attention.

ENUMERATION

LICHENS

ARTHONIACEAE

Cryptothecia candida (Kremph.) Sant.

OPEGRAPHACEAE

M. melanophthalma (Muell. Arg.) Sant.
M. phyllosema (Nyl.) Zehlbr.
Opegrapha filicina Mont.

STRIGULACEAE

Phylloblastia dolichospora Vein.
Strigula elegans (Fee) Muell. Arg.
S. nemathora Mont.
S. subelegans Vein.
Trichothelium epiphyllum Muell. Arg.

CLATHROPORINACEAE

Porina cupreola (Muell. Arg.) Schilling
P. epiphylla (Fee) Fee
P. fulvella Muell. Arg.
P. monocarpa (Kremph.) Schilling
P. nitidula Muell. Arg.
P. phyllogena Muell. Arg.

PELTIGERACEAE

Peltigera dolichorrhiza (Nyl.) Nyl.
P. rufescens (Weis.) Humb.

COLLEMATACEAE

Collema pulcellum Ach. var. **subnigrescens** (Muell. Arg.) Degelius
Leptogium austro-americanum (Malme) Dodge
L. cyanescens (Rabenh.) Korb.
L. denticulatum Nyl.
L. ulvaceum (Pers.) Vain.

COCCOCARPIACEAE

Coccocarpia erythroxyli (Spreng.) Swinsc.
C. palmicola (Spreng.) Arvidson & Galloway

BACIDIACEAE

Bacidia apiahica (Muell. Arg.) Zahlbr.
B. glabinea (Kremph.) Zahlbr.
B. palmularis (Muell. Arg.) Zahlbr.

ECTOLECHIACEAE

Calopadia nymanii (Sant.) Vezda
C. puiggarii (Muell. Arg.) Vezda
C. subcoerulescens (Zahlbr.) Vezda
Sporopodium xantholeucum (Muell. Arg.) Zahlbr.
Tapellaria bilimbioides Sant.

GOMPHILLACEAE

Gyalectidium filicinum Muell. Arg.
Tricharia albostrigosa Sant.
T. vainioia Sant.

ASTEROTHYRIACEAE

Echinoplaca pellicula (Muell. Arg.) Sant.
E. epiphylla Fee

PILOCARPACEAE

Byssolecania fuscolivida Vain.
Byssoloma leucoblepharum (Nyl.) Vain.
B. rotuliforme (Muell. Arg.) Sant.
B. tricholomum (Mont) Zahlbr.
Fellhanera fuscatula (Muell. Arg.) Vezda
F. semicarpi (Vein.) Vezda

PARMELIACEAE

Bulbothrix isidiza (Nyl.) Hale
B. setschwanensis (Zahlbr.) Hale
Everniastrum cirrhatum (Fr.) Hale
E. nepalense (Tayl.) Hale
Hypotrachyna degelii (Hale) Hale
H. infirma (Kurok.) Hale
Parmelaria thomsonii (Stirt.) Awasthi
P. aurulenta (Tuck.) Hale
P. wallichiana (Tayl.) Hale
P. cristiferum (Tayl.) Hale
P. reticulatum (Tayl.) Choisy
P. sancti-angelii (Lynge) Hale
P. tinctorum (Despr. ex Nyl.) Hale

USNEACEAE

Usnea baileyi (Stirt.) Zahlbr.
U. bismolliuscula Zahlbr.
U. rubicunda Stirt.

RAMALINACEAE

Ramalina subcomplanata (Nyl.) Kashiwadani

CLADONIACEAE

Cladonia bacillaris (Ach.) Nyl.
C. cartilaginea Muell. Arg.
C. coniocraea (Florke) Spreng.
C. pityrea (Florke) Fries
C. scabriuscula (Del.) Nyl.

PHYSCIACEAE

Dirinaria confluens (Fr.) Awasthi
D. consimilis (Stirton) Awasthi
D. picta (Sw.) Clem. & Shear.
Phaeophyscia endococcinodes (Poelt) Essl.
Physcia tribacoides Nyl.
P. congnata Stirt.
P. philippina Vain.
P. sorediata (Ach.) Mont.

HEPATICAE (BRYOPHYTA)

LEPIDOZIACEAE

Bazzania ovostipula (St.) Abeyw.
B. pearsonii (St.) Pears.
B. praerupta (Reinw., Blume et Nees) Trev.
B. tricrenata (Wahl.) Trev.
B. tridens (Reinw., Blume et Nees) Trev.

CALYPOGEIACEAE

Calypogeia fissa (L.) Raddi.
C. trichomanis (L.) Corda.

CEPHALOZIACEAE

Cephalozia gollani St.

JACKIELLACEAE

Jackiella javanica Schiffn. var. **cavifolia** Schiffn.
J. javanica Schiffn. var. **cordifolia** Schiffn.

JUNGERMANNIACEAE

Chandonanthus hirtellus (Web.) Mitt.
Junggermannia rubripunctata (Hatt.) Amak,
J. sikkimensis St.
J. tetragona Lindenb.
Notoscyphus darjeelingensis Udar et Kumar
N. pandei Udar et Kumar

GEOCALYCACEAE

Lophocolea bidentata (L.) Dum.
Chiloscyphus polyanthus (L.) Corda

RADULACEAE

Radula acuminate St.
R. assamica St.

PORELLACEAE

Porella campylophylla (Lhm. & Lindenb.) Trev.
P. densiflora (St.) Hatt.
P. densiflora (St.) Hatt. ssp. **appendiculata** (St.) Hatt.
P. plumose (Mitt.) Inoue

JUBLACEAE

Frullania musicola St.
F. physantha Mitt.
F. sqarrosa Nees

LEJEUNEACEAE

Cololejeunea farmosana Mizut.
C. pseudoplagiophyla Wu et Lou
C. spinosa (Horik.) Hatt.
Colura calyptrifolia (Hook.) Dum.
Leptolejeunea foliicola St.
L. subacuta St.
Mastigolejeunea replete (Tayl.) St.
Ptychanthus striatus (Lehm. & Lindenb.) Nees
Rhaphidolejeunea yunnanensis Chen
Spruceanthus emirepandus (Nees) Verd.

FOSSOBRONIACEAE

Fossombronia cristula Aust.
F. wondraczekii (Corda) Dum.

PELLIACEAE

Pellia epiphylla (L.) Corda

PALLAVICINIACEAE

Pallavicinia lyellii (Hook.) Gray

ANEURACEAE

Aneura pellioides (Horik.) Inoue
Riccardia multifida (L.) Gray
R. sikkimensis (St.) Pande & Srivastava
R. tenuicostata Schiffn.
R. villosa (St.) Pande & Srivastava

TARGIONIACEAE

Targionia hypophylla L.

CONOCEPHALACEAE

Conocephalum conicum (L.) Dum.

REBOULIACEAE

Plagiochasma appendiculatum Lehm. et Lindenb.
Reboulia hemisphaerica (L.) Readdi

MARCHANTIACEAE

Dumortiera hirsuta (Sw.) Reinw.
Marchantia nepalensis Lehm. & Lindenb.
M. palmata Nees

RICCIACEAE

Ricciocarpus natans (L.) Corda

ANTHOCEROTACEAE

Folioceros appendiculatus (St.) Udar & D.K.Singh
Phaeoceros laevis (L.) Prosk.
P. laevis (L.) Prosk. ssp. **laevis** Pork
P. laevis (L.) Prosk. ssp. **carolinianus** (Mich.) Prosk.

PTERIDOPHYTES

HUPERZIACEAE

Huperzia squarrosa (Forst.) Trev.
H. subulifolia (Wall. ex Hook. & Grev.) Trev.
Phlegmariurus phlegmaria (L.) Sen & Sen

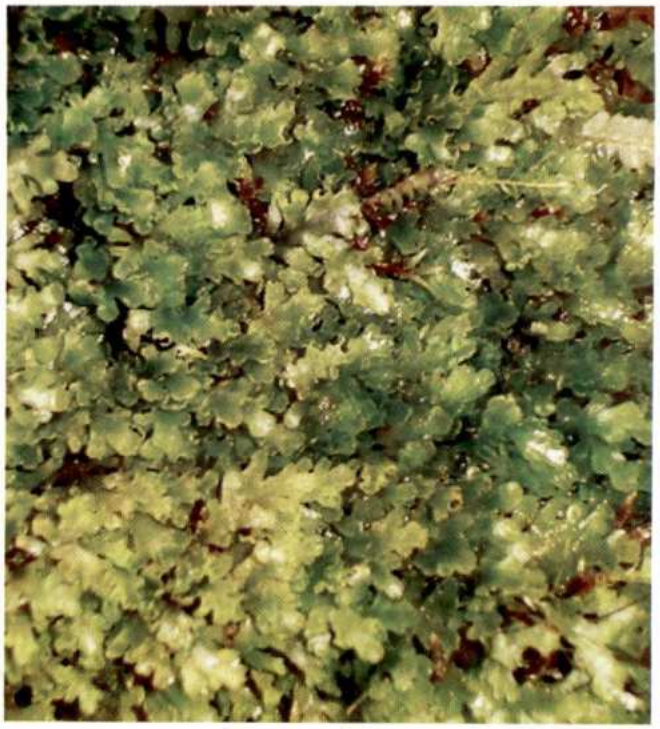
LYCOPODIACEAE

Palhinhaea cernua (L.) Franco & Vasc.

SELAGINELLACEAE

Selaginella decipiens Warb.
S. helferi Warb.
S. hookeri Baker
S. semicordata (Wall. ex Hook. & Grev.) Spring
S. wallichii (Wall. ex Hook. & Grev.) Spring

Frullania physantha (Courtesy : D.K. Singh)



Riccardia sikkimensis (Courtesy : D.K. Singh)

EQUISETACEAE

Equisetum diffusum D.Don
E. ramosisimum Desf.

PSILOTACEAE

Psilotum nudum (L.) P. Beauv.

ANGIOPTERIDACEAE

Angiopteris evecta (Forst.) Hoffm.

POLYPODIACEAE

Arthromeris wallichiana (Spreng.) Ching
Belvisia mucronata (Fee) Copel.
Colysis hemionitidea (Wall. ex Mett.) Presl
Drymoglossum heterophyllum (L.) Trimen
Goniophlebium amoenum (Wall. ex Mett.) J. Smith
Kaulinia hancockii (Baker) B.K. Nayar
K. pteropus (Blume) Nayer
Lemmaphyllum carnosum (Wall.) Presl
Lepidogrammitis rostrata (Hook.) Ching
Lepisorus thunbergianus (Kaulf.) Ching
Leptochilus axillaries (Cav.) Kaulf.
Microsorium cuspidatum (D.Don) Tagawa
M. puntatum (L.) Copel.
M. superficiale (Blume) Ching
M. zippelii (Blume) Ching
Neocheiropteris normalis (D.Don) Tagawa
Pyrrosia adnascens (Sw.) Ching
P. beddomeana (Gies.) Ching
P. flocculosa (D.Don) Ching
P. heteracta (Mett. ex Kuhn) Ching
P. lanceolata (L.) Farw.
P. lingua (Thunb.) Farw.
P. mannii (Gies.) Ching
P. nummularifolia (Sw.) Ching
P. stenophylla (Beddome) Ching
P. subfurfuracea (Hook.) Ching

DIPTERIDACEAE

Dipteris propinqua (Wall. ex Mett.) J. Smith

LYGODIACEAE

Lygodium flexuosum (L.) Sw.

L. japonicum (Thunb.) Sw.

CHEILANTHACEAE

Cheilanthus farinose (Forssk.) Kaulf.

CRYPTOGRAMMACEAE

Onchium siliculosum (Desv.) C. Chr.

PTERIDACEAE

Pteris biaurita L.
P. ensiformis Burm.f.
P. grevilleana Wall. ex Agardh
P. longipes D. Don
P. longipinnula Wall. ex Agardh
P. pellucida Presl
P. quadriaurita Retz.
P. semipinnata L.
P. vittata L.
P. wallichiana Agardh

ADIANTACEAE

Adiantum capilluveneris L.
A. caudatum L.
A. philippens L.

HEMIONITIDACEAE

Conigramme fraxinea (D.Don) Fee
Pityrogramma calomelanos (L.) Link

ANTROPHYACEAE

Antrophyum henryi Hiern
A. obovatum Baker
A. plantagineum (Cav.) Kaulf.

VITTARIACEAE

Vittaria doniana Hieron var. **doniana**
V. elongate Sw.
V. sikkimensis Kuhn
V. zosterifolia Willd.

PARKERIACEAE

Ceratopteris thalictroides (L.) A. Brongn.

HYMENOPHYLLACEAE

Mecodium exsertum (Wall. ex Hook.) Copel.
M. polyanthus (Sw.) Copel.
Vandenboschia auriculata (Blume) Copel.

DICKSONIACEAE

Cibotium barometz (L.) J. Sm.

CYATHEACEAE

Alsophila brunoniana Wall. ex Hook.
A. gigantea Wall. ex Hook.
A. spinulosa (Hook.) Tryon

DENNSTAEDTIACEAE

Microlepia speluncae (L.) Moore
M. strigosa (Thunb.) Presl

PTERIDIACEAE

Pteridium aquilinum (L.) Kuhn

LINDSAEACEAE

Lindsaea cultrate (Willd.) Sw.
L. ensifolia Sw.

ASPLENIACEAE

Asplenium bullatum Wall. ex Mett.
A. cheilosorum Kuntze
A. finlasonianum Wall. ex Hook.
A. laciniatum D. Don
A. nidus L.
A. nitidum Sw.
A. prolongatum Hook.
A. sorelii Hook.
A. unilaterale Lam.

ATHYRIACEAE

Athyrium drepanopterum (Kuntze) A. Br. ex Milde
Diplazium asperum Blume
D. bentamense Blume
D. esculentum (Retz.) Sw.
D. maximum (D. Don) C. Chr.

ASPIDIACEAE

Tectaria polymorpha (Wall. ex Hook.) Copel.

DRYOPTERIDACEAE

Dryopteris sparsa (D. Don) Kuntze
Polystichum aculeatum (L.) Roth
P. biaristatum (Blume) Moore
P. lentum (D. Don) Moore
P. semifertile (C. B. Clarke) Ching

LOMARIOPSIDACEAE

Egenolfia appendiculata (Willd.) J. Sm.

BULBITIDACEAE

Bolbitis costata (Wall. ex Hook.) Ching

NEPHROLEPIDACEAE

Nephrolepis cordifolia (L.) Presl

OLEANDRACEAE

Oleandra wallichii (Hook.) Presl

DOVALLIACEAE

Humata griffithiana (Hook.) C. Chr.
H. repens (L. f.) Diels

BLECHNACEAE

Blecnum orientale L.
Woodwardia unigemmata (Makino) Nakai

SALVINIACEAE

Salvinia natans (L.) All.

GYMNOSPERMS

PINACEAE

Pinus merkusii Jungh & De Vries
Abies delavayi Franch.

CEPHALOTAXACEAE
Cephalotaxus griffithii Hook. f.

GNETACEAE

Gnetum gnemone L.
G. ula Brongn.

ANGIOSPERMS
DICOTYLEDONS

RANUNCULACEAE

Aconitum lethale Griff.
Clematis acuminata DC.
Ranunculus cantoniensis DC.

DILLENIACEAE

Dillenia indica L.
D. pentagyna Roxb.

MAGNOLIACEAE

Magnolia griffithii Hook. f. & Thomson
M. hodgsonii (Hook. f. & Thomson) King
M. pterocarpa Roxb.
Michelia baillonii (Pierre) Finet

SCHISANDRACEAE

Kadsuria heteroclita (Roxb.) Craib

ANNONACEAE
Desmos dumosus (Roxb.) Safford
Fissistigma polyanthum (Hook. f. & Thomson) Merr.
F. wallichii (Hook. f. & Thomson) Merr.
Goniothalamus sesquipedalis (Wall.) Hook. f. & Thomson
Griffithianthus fuscus Merr.
Milliusa globosa (DC.) Panigrahi & S.C. Mishra
Polyalthia jenkinsii (Hook. f. & Thomson) Hook. f. & Thomson.
Trivalvaria argentia (Hook. f. & Thomson) Sinclair

MENISPERMACEAE
Cissampelos pareira L. var. **hirsuta** (Buch.-Ham. ex DC.) Forman
Cyclea bicristata (Griff.) Diels
Haematocarpus validus (Miers) Bakh. f. ex Forman
Parabaena sagittata Miers
Pericampylus glaucus (Lam.) Merr.
Stephania japonica (Thunb.) Miers var. **discolor** (Blume) Forman

LARDIZABALACEAE

Holboellia latifolia Wall.

Paravatia elliptica (Hemsl.) M.P. Nayar & T.K. Paul

BRASSICACEAE

Brassica rapa L. ssp. **campestris** (L.) Claphan
Cardamine hirsuta L.

CAPPARACEAE

Capparis acutifolia Sw. ssp. **sabiaefolia** (Hook. f. & Thomson) Jacobs
C. multiflora Hook. f. & Thomson
Stixis suaveolens (Roxb.) Pierre

VIOLACEAE

Viola diffusa Ging. ex DC.
V. pilosa Blume
V. sikkimensis W. Becker

FLACOURTIACEAE

Gynocardia odorata R. Br.
Hydnocarpus kurzii (King) Warb.

POLYGALACEAE

Polygala arillata Buch. - Ham. ex D. Don
P. tricholopha Chod.
Salomonia cantoniensis Lour.

CARYOPHYLLACEAE

Drymaria villosa Cham. & Schlecht.
Stellaria media (L.) Vill.
S. vestita Kurz

HYPERICACEAE

Hypericum japonicum Thunb. ex Murray

CLUSIACEAE

Garcinia acuminata Planchon & Triana
G. cowa Roxb. ex DC.
G. tinctoria (DC.) W.F. Wight
Maesua ferrea L.

THEACEAE

Camellia caudata Wall.
Eurya acuminata DC.
E. nitida Korth.
Schima wallichii (DC.) Korth.

SAURAUIACEAE

Saurauia cerea Griff. ex Dyer
S. macrotricha Kurz ex Dyer
S. napaulensis DC.
S. punduana Wall.
S. roxburghii Wall.

DIPTEROCARPACEAE

Dipterocarpus retusus Blume
Shorea assamica Dyer

MALVACEAE

Abelmoschus manihot (L.) Medik. ssp. **tetraphyllus** (Roxb. ex Hornem.) Borss.
Hibiscus fragrans Roxb.
Kydia calycina Roxb.
K. calycina Roxb. var. **glabrescens** (Mast.) Deb
Sida acuta Burm. f.
Urena lobata L.

STERCULIACEAE

Abroma angusta (L.) L. f.
Sterculia hamiltonii (Kurz) Adelb.

BYTTNERIACEAE

Byttneria grandifolia DC.

TILIACEAE

Columbia floribunda Wall.
Grewia denticulata Wall. ex Viogt
G. desperma Rottb.
G. elastica Royle
Triumfetta annua L.

ELAEOCARPACEAE

Elaeocarpus aristatus Roxb.
E. lancifolius Roxb.
E. sphaericus (Gaertn.) K. Schum.
E. tectorius (Lour.) Poir.
Sloanea dasycarpa (Benth.) Hemsl.
S. tomentosa (Benth.) Rehder & Wilson

MALPIGHIACEAE

Aspidopterys indica (Willd.) Hochr.

OXALIDACEAE

Oxalis corniculata L.
O. debilis Kunth var. **corymbosa** (DC.) Lour.

BALSAMINACEAE

Impatiens bracteolata Hook. f.
I. laevigata Wall. ex Hook. f. & Thomson
I. latifolia Wall. ex Hook. f. & Thomson
I. porrecta Wall. ex Hook. f. & Thomson
I. racemulosa Wall. ex Hook. f. & Thomson
I. tripetala Roxb. ex DC.

RUTACEAE

Citrus medica L.
Evodia lunu-ankenda (Gaertn.) Merr.
E. trichotoma (Lour.) Planch.
Glycosmis arborea (Roxb.) DC.
G. cyanocarpa (Blume) Spreng.
G. cymosa (Kurz) N. Narayan.
Micromelum munutum (Forst. f.) Wight & Arn.
M. integerrimum (Roxb.) Wight & Arn.
Murraya paniculata (L.) Jack.
Toddalia asiatica (L.) Lam.
Zanthoxylum acanthopodium DC.

SIMAROUBACEAE

Brucea mollis Wall. ex Kurz
Picrasma javanica Blume

BURSERACEAE

Canarium strictum Roxb.

MELIACEAE

Aglaia edulis A. Gray
Aphanamixis chiitagonga (Miq.) Harid. & R.R. Rao
A. polystachya (Wall.) Parker
Chisocheton cumingianus (C. DC.) Harms ssp.
C. balansae (C. DC.) Mabberley
Dysoxylum binecteriferum Hook. f. & Beddome
D. gobara (Buch.- Ham.) Merr.
D. pallens Hiern
D. reticulatum King
Melia superba Roxb.
Toona ciliata Roem.

OLACACEAE

Erythopalum scandens Blume
E. vagum (Griff.) Mast.
Olax acuminate Benth.
Schopfia fragrans Wall.

OPILIACEAE

Lepionurus sylvestris Blume

ICACINACEAE

Iodes hookeriana Baill.
I. ovalis Blume
Natsiatum herpeticum Buch.- Ham. ex Arn.

CELASTRACEAE

Euonymus glaber Roxb.
E. theifolius Wall. ex Lawson
Microtropis discolor (Wall.) Arn.

HIPPOCASTANACEAE

Aesculus assamica Griff.

RHAMNACEAE

Gouania tiliaefolia Lam.
Rhamnus napalensis (Wall.) Lawson
Ziziphus mauritiana Lam.

VITACEAE

Cayratia japonica (Thunb.) Gagnep.
C. pedata (Lour.) Juss. ex Gagnep.
C. trifolia (L.) Domin
Cissus assamica (Lawson) Craib
C. repens Lam.
Tetrastigma bracteolatum (Wall.) Planch.
T. leucostaphylum (Dennst.) Alston
T. obovatum (Lawson) Gagnep.
T. rumicispermum (Lawson) Planch.
T. serrulatum (Roxb.) Planch.
Vitis planicaulis Hook. f.

LEEACEAE

Leea compactiflora Kurz
L. crispa L.
L. edgeworthii Santapau

L. indica (Burm. f.) Merr.
L. macrophylla Roxb.

SAPINDACEAE

Allophylus distachys (DC.) Radlk.
Lepisanthes erecta (Thwaites) Leenh.
L. senegalensis (Juss. ex Poir.) Leenh.
Nephelium mutabile Blume

ACERACEAE

Acer laevigatum Wall.
A. oblongum Wall. ex DC. var. **microcarpum** Hiern.
A. sikkimense Miq var. **serrulatum** Pax

STAPHYLACEAE

Turpinia nepalensis Wight & Arn.
T. pomifera (Roxb.) DC.

SABIACEAE

Meliosma pinnata (Roxb.) Walp.
M. simplicifolia (Roxb.) Walp.
M. wallichii Planchon ex Hook. f.
Sabia lanceolata Colebr.

ANACARDIACEAE

Drimycarpus racemosus (Roxb.) Hook. f.
Mangifera sylvatica Roxb.
Pegia nitida Colebr.
Rhus chinensis Mill.
R. semialata Murray
R. succedanea L.
Spondias pinnata (L. f.) Kurz

LEGUMINOSAE-PAPILIONOIDEAE

Cajanus crassus (Prain & King) van der Maesen
Crotalaria albida Heyne ex Roth
C. mysorensis Roth
Dalbergia assamica Benth.
D. pinnata (Lour.) Prain
D. sissoo Roxb.
Derris elegans Benth. var. **vestita** (Baker) Prain
Desmodium caudatum (Thunb.) DC.
D. gyroides (Link) DC.
D. sequax Wall.
D. triangulare (Retz.) Merr.
D. triquetrum (L.) DC.
Flemingia macrophylla (Willd.) Kuntze ex Merr.
Indigofera nigrescens King & Prain
Mastersia assamica Benth.
Millettia cinerea Benth.
M. pachycarpa Benth.
M. piscida Wight
Mucuna monosperma DC. ex Wight
Pueraria peduncularis (Benth.) Grab. ex Benth.
Shuteria vestita Wight & Arn.
Spatholobus parviflorus (Roxb. ex DC.) Kuntze
Tephrosia candida DC.
Uraria crinita (L.) Desv.

LEGUMINOSAE-CAESOLPINIOIDEAE

Bauhinia khasiana Baker
Caesalpinia cucullata Roxb.
C. tortuosa Roxb.
Cassia alata L.
C. floribunda Cav.
C. hirsute L.
C. occidetalis L.

EGUMINOSE-MIMOSOIDEAE

Acacia caesia (L.) Willd. var. **caesia** var. **subnuda** (Craib) Nielson
Albizia julibrissin Durazz. var. **mollis** (Wall.)Benth.
A. lebbek (L.) Benth.
A. odoratissima (L. f.) Benth.
A. procera (Roxb.)Benth.
Entada rheedini Spreng. ssp. **sinohimalensis** Grierson & Long
Pithecellobium heterophyllum (Roxb.) Macbr.

ROSACEAE

Docynia indica (Wall.) Decne.
Duchesnea indica (T. Anderson) Focke
Eriobotrya bengalensis (Roxb.) Hook.f.
Neillia thrysiflora D.Don
Photinia integrifolia Lindley
Rubus alceifolius Poir.
R. burkillii Rolfe
R. hamiltonii Hook.f.
R. insignis Hook.f.

R. lineatus Reinw. ex Blume
Rubus lucens Focke
R. niveus Thunb. var. **rosaefoliaus** (Hook.f.) Hara
R. paniculatus Smith
R. rugosus Smith

HYDRANGEACEAE

Hydrangea robusta Hook.f. & Thomson

ITEACEAE

Itea macrophylla Wall.

CRASSULACEAE

Sinocrassula indica (Decne.) Berger

HAMAMELIDACEAE

Altingia excelsa Noronha
Exbucklandia populnea (R.Br. ex Griff.) R.W. Br.

COMBRETACEAE

Combretum dasystachyum Kurz
C. flagrocarpum C.B. Clarke
C. punctatum Blume
Terminalia chebula Retz.
T. citrina (Gaertn.) Flem.
T. myriocarpa Heurck & Muell. Arg.

MYRTACEAE

Syzygium cumini (L.) Skeels
S. cuneatum (Duthie) N.P. Balakr.
S. kurzii (Duthie) N.P. Balakr.

MELASTOMATACEAE

Blastus cochinchinensis Lour.
Modinella erythrophyllum Lindley
Melastoma malabathricum L.
Osbeckia chinensis L.
O. nepalensis Hook.
O. nutans Triana
Oxyspora cernua (Roxb.) Triana
O. paniculata DC.
Sarcopyramis nepalensis Wall.

LYTHRACEAE

Cuphea balsamiana Ch. & Schl.
Rotala macrandra Koehne

SONNERATIACEAE

Duabanga grandiflora (Roxb. ex DC.) Walp.

ONAGRACEAE

Ludwigia octovalvis (Jacq.) Raven

PASSIFLORACEAE

Adenia trilobata (Roxb.) Engl.

CUCURBITACEAE

Diplocyclos palmatus (L.) Jeffrey
Gynostemma pedata Blume
Hodgsonia macrocarpa (Blume) Cogn.
Melothria leucocarpa (Blume) Cogn.
Momordica dioica Roxb.ex Willd.
Neoalsomitra clavigera (Wall.) Hutch.
Thlandiantha cordifolia (Blume) Cogn.
T. hookeri C. B. Clarke
Trichosanthes himalensis C. B. Clarke
T. tricuspidata Lour.

BIGONIACEAE

Begonia aborensis Dunn
B. barbata Wall. ex DC.
B. cathcartii Hook. f. & Thomson
B. hatacoa Buch. -Ham. ex D. Don
B. iridescens Dunn
B. obversa C. B. Clarke
B. palmata D. Don
B. roxburghii (Miq.) A. DC.
B. silhetensis C. B. Clarke

APIACEAE

Centella asiatica (L.) Urban
Hydrocotyle javanica Thunb.
Oenanthe thomsonii C. B. Clarke
Sanicula elata Ham. ex D.Don

ARALIACEAE

Aralia armata (G. Don) Seem.
A. thomsonii Seem.
Brassaiopsis glomerulata (Blume) Regl.
B. hainla (Buch. - Ham. ex D. Don) Seem.

Macropanax undulates (Wall. ex G. Don) Seem.
Pseudobrassaiopsis hispida (Seem.) R. N. Banerjee
Schefflera venulosa (Wight & Arn.) Harms
S. wallichiana (Wight & Arn.) Harms
Trevesia palmata (Roxb.) Devis.

ALANGIACEAE

Alangium chinense (Lour.) Harms

CAPRIFOLIACEAE

Lonicera macrantha (D. Don) Spreng.
Viburnum colebrookianum Wall. ex DC.
V. corylifolium Hook. f. & Thomson
V. cylindricum Buch.-Ham. ex D. Don
V. foetidum Wall.

SAMBUCACEAE

Sambucus javanica Blume

RUBIACEAE

Anthocephalus chinensis (Lam.) A. Rich. ex Wall.
Borreria articularis (L. f.) F. N. Williams
Canthium dicoccum (Gaertn.) Teysm. & Binn.
Coffea benghalensis Heyne ex Roem. & Schult.
C. khasiana Hook. f.
Damnacanthus indicus Gaertn.
Galium asperifolium Wall. ex Roxb.
Hedyotis scandens Roxb.
H. verticillata (L.) Lam.
Hyptienthera stricta (Willd.) Wight & Arn.
Ixora nigricans R. Br. ex Wight & Arn.
I. subsessilis G. Don
Knoxia mollis R. Br.
Lasianthus biermannii King
L. hookerii C. B. Clarke
L. lucidus Blume
L. sikkimensis Hook. f.
L. tubiflorus Hook. f.
Luculia pinceana Hook.
Meyna spinosa Roxb. ex Link
Morinda angustifolia Roxb.
Mussanda glabra Vahl
M. incana Wall.
M. macrophylla Wall.
M. roxburghii Hook. f.
Mycetia longifolia (Wall.) Kuntze
Myrioneuron nutans Kurz
Nauclea griffithii Hav.
Ophiorrhiza argentea (Hook. f.) N.P. Balakr.
O. calcarata Hook. f.
O. hispida Hook. f.
O. succirubra King ex Hook. f.
O. treutleri Hook. f.
Paederia foetida L.
P. scandens (Lour.) Merr.
Pavetta indica L.
P. indica ssp. **tomentosa** (Roxb. ex J. E. Sm.) Bennet
Polyura geminata Hook. f.
Psychotria adenophylla Wall.
P. calocarpa Kurz
P. denticulata Wall.
P. erratica Hook. f.
P. montana Blume
P. monticola Kurz
P. silhetensis Hook. f.
Randia cochinchinensis (Lour.) Merr.
R. fasciculata (Roxb.) DC.
Rubia manjith Roxb. ex Fleming
R. sikkimensis Kurz
Saprosma ternatum Hook. f.
Silvisanthus bracteatus Hook. f.
Spiradiclis bifida Wall. ex Kurz
S. cylindrica Hook. f.
Tarenna disperma (Hook. f.) Pitard
Uncaria macrophylla Wall.
U. sessilifructus Roxb.
Wendlandia grandis (Hook. f.) Cowan
W. tinctoria (Roxb.) DC.

CARLEMANNIACEAE

Carlemannia griffithii Benth.

VALERIANACEAE

Valeriana jatamansii Jones

ASTERACEAE

Ageratum conyzoides L.
Ainsliaea latifolia (G. Don) Sch.-Bip.

Artemisia nilagirica (C.B. Clarke) Pampan.
Bidens biternata (Lour.) Merr. & Scherff.
B. pilosa L.
Blumea lanceolaria (Roxb.) Druce
B. procera DC.
Chromolaena odorata (L.) King & Robinson
Erigeron bonariensis L.
Gnaphalium pensylvanicum Willd.
Gynura cusimbua (D. Don) S. Moore
Mikania micrantha Kunth
Myriactis nepalensis Less.
Prenanthes scandend Hook.f. & Thomson
Senecio cappa Buch.- Ham. ex D. Don
S. wightii (DC.) Benth. ex C.B. Clarke
Spilanthes paniculata Wall. ex DC.
Synotis triligulata (Buch.- Ham. ex D.Don) C. Jeffery
Tithonia diversifolia (Hemsl.) A. Gray
Vernonia saligna DC.
V. volkmerifolia DC.
Xanthium indicum Koen.

CAMPANULACEAE

Codonopsis parviflora Wall. ex DC.

LOBELIACEAE

Lobelia montana Reinw. ex Blume

ERICACEAE

Agapetes saligna (Hook.f.) Hook.f.
A. variegata (Roxb.) G. Don
Lyonia ovalifolia (Wall.) Drude var. **ovalifolia**
Vaccinum vacciniaceum (Roxb.) Sleumer

MYRSINACEAE

Amblyanthus glandulosus (Roxb.) DC.
Ardisia crispa (Thunb.) DC.
A. depressa C.B.Clarke
A. solanacea Roxb.
A. thyrsiflora D. Don
A. virens Kurz
Embelia floribunda Wall.
E. ribes Burm. f.
E. subcoracea (C.B. Clarke) Mez
Hymenandra wallichii A. DC.
Maesa indica (Roxb.) A. DC.
M. indica (Roxb.) A. DC. var. **angustifolia** Hook. f.
M. montana DC.
Myrsine semiserrata Wall.

SAPOTACEAE

Sarcosperma arboretum Benth. & Hook. f.

STYRACEAE

Bruinsmia polysperma (C.B.Clarke) Steenis
Styrax serrulatum Roxb.

SYMPLOCACEAE

Symplocos pealii King ex Das

OLEACEAE

Jasminum amplexicaule Buch.- Ham. ex G. Don
J. azoricum L.
J. coarctatum Roxb.
J. lanceolaria Roxb.
J. multiflorum (Burm.f.) Andr.
J. nepalense Spreng.
J. nervosum Lour.
J. sambac (L.) Ait.
J. subtriplinerve Blume
Myxopyrum smilacifolium (Wall.) Blume
Olea dioica Roxb.

APOCYNACEAE

Allamanda cathartica L.
Chonemorpha fragrans (Moon) Alston
Holarrhena pubescens (Buch.-Ham.) Wall. ex G. Don
Melodinus khasianus Hook.f.
Parabarium micranthum (DC.) Pierr. ex Spire
Pottsia laxiflora (Blume) Kuntze
Tabernaemontana divaricata (L.) Roem. & Schult.

ASCLEPIADACEAE

Cryptolepis buchanani Roem. & Schult.
Gonogronema nepalense (Wall.) Decne.
Hoya glabulosa Hook.f.
H. lobbii Hook.f.
Marsdenia roylei Wight

Pentasachme caudatum Wall. ex Wight
P. wallichii Wight

LOGANIACEAE
Gardneria ovata Wall.

BUDDLEJACEAE
Buddleja asiatica Lour.

GENTIANACEAE
Canscora andographioides C.B. Clarke
Crawfurdia camparinlacea Wall. & Griff. ex C.B. Clarke
Exacum tetragonum Roxb.
Gentiana campanulacea (Wall. & Griff.) Marq.
G. speciosa (Wall.) Marq.

STRYCHNACEAE

Strychnos quintuplineruis A. W. Hill
S. wallichiana Benth.

HYDROPHYLLACEAE
Hydrolea zeylanica (L.) Vahl

BORAGINACEAE

Cordia dichotoma G. Forst.
Cynoglossum glochidiatum Wall. ex Benth.
C. furcatum Wall.
C. zeylanicum (Vahl ex Hornem.) Thunb. ex Lehm.
Tournefortia viridiflora Wall.
Trichodesma khasianum C.B. Clarke

CONVOLVULACEAE
Argyreia argentea (Roxb.) Choisy
A. nervosa (Burm. f.) Bojer
A. roxburghii Choisy
A. sikkimensis (C.B. Clarke) Oost.
Ipomoea kingii Prain
Merremia mammosa (Lour.) Hallier
M. umbellata (L.) Hall. f.

SOLANACEAE

Lycianthes laevis (Dunal) Bitter ssp. **crasipetala** (Wall.) Deb
Physalis peruviana L.
Solanum anguivi Lam.
S. ciliatum Lam.
S. erianthum D.Don
S. kurzii Brace ex Prain
S. laevis (Dunal) Bitter ssp. **subtruncate** (Wall. ex Dunal) Deb
S. lysimachioides Roxb.
S. myriacanthum Dunal
S. spirale Roxb.
S. torvum Sw.

SCROPHULARIACEAE

Limnophila chinensis (Osbeck) Merr.
L. indica (L.) Druce
Lindernia cordifolia (Colsm.) Merr.
L. montana (Blume) Koord.
L. ruelloides (Colsm.) Pennell
Mazus pumilus (Burm. f.) Steenis
Torenia asiatica L.
T. diffusa D. Don

GESNERIACEAE

Aeschynanthus acuminate Wall. ex DC.
A. bracteatus Wall. ex DC.
A. gracilis Parish. ex C. B. Clarke
A. ramosissima Wall.
A. superba C. B. Clarke
Boeica filiformis C. B. Clarke
B. fulva C. B. Clarke
Chirita mishmiensis Debb. & Biswas
C. oblongiflora (Roxb.) Sinclair
Loxostigma griffithii (Wight) C. B. Clarke
Lysionotus atropurpurea Hara
Rhynchoglossum obliquum Blume
R. ellipticum (Wall. ex Dietr.) A. DC.
R. vestitum C. B. Clarke
Teraphyllum bengalense C. B. Clarke

BIGNONIACEAE

Oroxylum indicum (L.) Venten.
Radermachera glandulosa (Blume) Miq.
Stereospermum colais (Dillwyn) Mabb.

ACANTHACEAE

Acanthus leucostachys Nees
Diflugossa colorata (Nees) Bremek.

Goldfussia discolor Nees
G. glabrata (Nees) N.P. Balakr.
Hygrophila erecta (Burm. f.) Hochr.
H. salicifolia (Vahl) Nees
Hypoestis triflora (Forssk.) Roem. & Schult. var. **triflora**
Lepidagathis incurva Buch.-Ham. ex D. Don
Phlogacanthus asperulus Nees
P. curviflorus Nees
P. guttatus Nees
P. parviflorus T. Anderson
P. tubiflorus Nees
Pseuderanthemum indicum (Nees) A. M. & J. M. Cowan
P. palatiferum (Nees) Radlk.
Pteracanthus nobilis (C. B. Clarke) Bremek.
Strobilanthes secundus T. Anderson
Sympagis petiolaris (Nees) Bremek.
Thunbergia coccinea Wall.

VERBENACEAE

Callicarpa arborea Roxb.
C. rubella Lindl.
Caryopteris foetida (D.Don) Thell.
Clerodendrum bracteatum Wall. ex Walp.
C. colebrookianum Walp.
C. divaricatum Jack.
C. hastatum (Roxb.) Lindl.
C. lasicephalum C.B. Clarke
C. vilosum Blume
C. wallichii Merr.
Gmelina arborea Roxb.
Lantana camara L. var. **aculeata** (L.) Moldenke
Premna milleflora C. B. Clarke

LAMIACEAE

Achyrospermum densiflorum Blume
Clinopodium umbrosum (Bieb.) Koch.
Elsholtzia blanda (Benth.) Benth.
Gomphostemma parviflora Wall. ex Benth.
Leucoceptrum canum Smith
Mosla dianthera (Buch.-Ham. ex Roxb.) Maxim.
Melissa axillaries (Benth.) Bakh. f.
Orthosiphon wattii Prain
Pogostemon benghalense (Burm. f.) Kuntze
P. brachystachys Benth.
P. manthoides Blume

PLANTAGINACEAE

Plantago erosa Wall.

AMARANTHACEAE

Achyranthes aspera L.
A. bidentata Blume
Alternanthera sessilis (L.) R. Br.
Amaranthus spinosus L.
Celosia argentea L.
Cyathula prostrata (L.) Blume
Deeringia amaranthoides (Lam.) Merr.

POLYGONACEAE

Fagopyrum dibotrys (D.Don) Hara
F. esculentum Moench
Persicaria capitata (Buch.- Ham. ex D. Don) H. Gross
P. chinensis (L.) H. Gross
P. hydropiper (L.) Spach.
P. posumba (Buch.-Ham. ex D.Don) H. Gross
P. strigosum (R. Br.) Nakai
P. tenella (Blume) Hara
Polygonum auriculatum Meissn.
P. rude Meissn.

RAFFLESIACEAE

Sapria himalayana Griff.

ARISTOLOCHIACEAE

Aristolochia platanifolia Duchart.

PIPERACEAE

Peperomia heyneana Miq.
P. tetraphylla (G. Forst.) Hook. & Arn.
Piper bochmerifolia (Miq.) DC.
P. clarkia C. DC.
P. griffithii C. DC.
P. hymenophyllum Miq.
P. manii C. DC.
P. mullesua D.Don
P. nigrum L. var. **macrostachyum** C. DC.
P. sylvaticum Roxb.
P. thomsonii (C. DC.) Hook. f.

SAURURACEAE

Houttuynia cordata Thunb.

CHLORANTHACEAE

Chloranthus elatior R. Br.
C. glaber (Thunb.) Makino

MYRISTICACEAE

Knema cinerea (Poir.) Warb. var. **andamanica** (Warb.) Sinclair

LAURACEAE

Actinodaphne obovata (Nees) Blume
Beilschmiedia roxburghiana Nees
Cinnamomum bejolghota (Buch.- Ham.) Sw.
C. glanduliferum (Wall.) Meissn.
C. pauciflorum Nees
C. tamala (Buch. - Ham.) Nees & Eberm.
Litsea cubeba (Lour.) Pers.
L. lancifolia (Roxb. ex Nees) Hook.f.
L. monopetala (Roxb.) Pers.
L. salicifolia (Roxb. ex Nees) Hook. f.
Neocinamomum caudatum (Nees) Merr.
Neolitsea foliosa (Nees) Gamble
Persea bombycina (King ex Hook. f.) Kosterm.
Phoebe lanceolata (Nees) Nees

THYMELAEACEAE

Aquilaria khasiana Hall.
A. malacensis Lam.
Edgeworthia gardneri (Wall.) Meissn.

ELAEAGNACEAE

Elaeagnus infundibularis Momiy.
E. parvifolia Wall. ex Royle
E. pyriformis Hook. f.

LORANTHACEAE

Helixanthera ligustrina (Wall.) Dans.
H. parasitica Lour.
Macrosolen cochinchinensis (Lour.) Van Tiegh.
Scurrula pulverulenta (Wall.) G. Don
Taxillus umbellifer (Schult.) Danser
T. vestitus (Wall.) Danser

SANTALACEAE

Osyris quadripartita Salzm. ex Decne.

BALANOPHORACEAE

Balanophora dioica Royle
Rhopalocnemis phalloides Jungh

DAPHNIPHYLLACEAE

Daphniphyllum himalense (Benth.) Muell. Arg.

EUPHORBIACEAE

Actephila excelsa (Dalz.) Muell. Arg.
Antidesma acuminatum Wall. ex Wight
A. bunius (L.) Spreng.
A. nigricans Tul.
A. roxburghii Wall. ex Tul.
Aporusa octandra (Buch.- Ham. ex D. Don) Vickery
Arachne cordifolia (Decne.) Hurusawa
Baccaurea ramiflora Lour.
Baliospermum calycinum Muell. Arg.
B. micranthum Muell. Arg.
Bridelia pubescens Kurz
Claoxylon longipetiolatum Kurz
Cleidion spiciflorum (Burm.f.) Merr.
Croton caudatus Geisel.
C. joufra Roxb.
C. roxburghii N.P. Balakr.
Drypetes assamica (Hook. f.) Pax. & Hoffm.
Euphorbia hirta L.
Homonoia riparia Lour.
Macaranga denticulata (Blume) Muell. Arg.
Mallotus roxburghianus Muell. Arg.
M. tetracocus (Roxb.) Kurz
Ostodes paniculata Blume
Phyllanthus debilis Klein ex Willd.
P. reticulatus Poir.
P. urinaria L.
Ricinus communis L.
Sapium baccatum Roxb.
Sauropus androgynus (L.) Merr.
S. stipulatus Hook. f.
Securinega virosa (Roxb. ex Willd.) Baill.
Tragia involucrata L.

BISCHOFIACEAE

Bischofia javanica Blume

ULMACEAE

Celtis tetrandra Roxb.
Trema orientalis (L.) Blume

CANNABACEAE

Cannabis sativa L. ssp. **indica** (Lam.) Wehmer

MORACEAE

Artocarpus chama Buch.- Ham.
A. heterophyllus Lam.
Cudrania cochinchinensis (Lour.) Kudo & Masam.
Ficus altissima Blume
F. **auriculata** Lour.
F. **drupacea** Thunb. var. **pubescens** (Roth) Corner
F. **elastica** Roxb. ex Hornem.
F. **fistulosa** Reinw.
F. **heteropleura** Blume
F. **hirta** Vahl
F. **ischnopoda** Miq.
F. **laevis** Blume
F. **mclelandi** King var. **rhododendrifolia** (Miq.) Corner
F. **nervosa** Heyne ex Roth
F. **oligodon** Miq.
F. **rigida** Jack.
F. **sarmentosa** Buch.- Ham. ex Sm.
F. **semicordata** Buch.- Ham. ex Sm.
F. **sinuta** Thunb.
F. **squamosa** Roxb.
F. **subulata** Blume

URTICACEAE

Boehmeria glomerulifera Miq.
B. hamiltoniana Wedd.
B. macrophylla Hornem.
B. penduliflora (Wedd.) Long
Debregeasia longifolia (Burm. f.) Wedd.
D. sessile Forst.
Elatostema platyphyllum Wedd. var. **platyphyllum**
Girardinia diversifolia (Link) Friis
Laportea terminalis Wight
Oreocnide integrifolia Miq.
Pilea glabrrima (Blume) Blume
P. scripta (Buch.-Ham. ex D. Don) Wedd.
Poikilospermum naucleiflorum (Lindl.) Chew
Pouzolzia bennettiana Wight
P. sanguinea (Blume) Merr. var. **sanguinea**
P. sanguinea (Blume) Merr. var. **fulgens** (Wedd.) Hara
Procris crenata C. B. Robinson

JUGLANDACEAE

Engelhardtia spicata Lesch. ex Blume

BETULACEAE

Alnus nepalensis D. Don
Betula alnoides Buch. - Ham. ex D. Don

FAGACEAE

Castanopsis armata Spach.
C. echinocarpa Miq.
C. indica (Roxb.) A. DC.
C. lancifolia (Roxb.) Hockel & A. Camus
C. tribuloides (Sm.) A. DC.
Lithocarpus dealbatus (Hook. f. & Thomson ex Miq.) Rehder
Quercus lamellosa Sm.
Q. semiserrata Roxb.

MONOCOTYLEDONS

ORCHIDACEAE

Aerides multiflora Roxb.
A. odorata Lour.
Anoectochilus roxburghii (Wall.) Lindl.
A. sikkimensis King & Pantl.
Arundina graminifolia (D. Don) Hochr.
Bulbophyllum careyanum (Hook.) Spreng.
B. delitescens Hance
B. devangiriensis Balkr.
B. helenae (Kuntze) Sm.
B. ornatissimum (Reichb.f.) Sm.
B. reptans (Lindl.) Lindl.
B. viridiflorum (Hook.f.) Schltr.
B. xylophyllum Pax. ex Reichb.f.
Calanthe densiflorum Lindl.

C. alismaefolia Lindl.
Ceratostylis subulata Blume
C. griffithii Lindl.
C. pusilla Lindl.
Chiloschista lunifera (Reichb. f.) Sm.
Cleisostoma simondii (Gagnep.) Seidenf.
C. subulatum Blume
Coelogyne fuscescens Lindl.
C. prolifera Lindl.
Cymbidium dayanum Reichb.f.
C. eburneum Lindl.
Dendrobium cathcartii Hook.f.
D. kentrophyllum Hook. f.
D. letuiflorum Lindl.
D. longicornu Lindl.
D. nobile Lindl.
D. ruckeri Lindl.
D. sulcatum Lindl.
Diplomeris pulchella D. Don
Eria acervata Lindl.
E. amica Reichb.f
E. clausa King & Pantl.
E. clavicaulis Wall. ex Lindl.
E. discolor Lindl.
E. ferruginea Lindl.
E. lasiopelata (Willd.) Ormonde
E. paniculata Lindl.
E. pannea Lindl.
E. stricta Lindl.
Esmeralda cathcartii (Lindl.) Reichb. f.
E. clarkei Reichb.f.
Galeola altissima (Blume) Reichb. f.
G. falconeri Hook. f.
Gastrochilus calceolaris D. Don
G. dasypogon (Smith) Kuntze
G. procera (Ker-Gawl.) Hook.
Habenaria furcifera Lindey
Hetaeria rubens (Lindl.) Benth. ex Hook.f.
Liparis assamica King & Pantl.
L. bootanensis Griiff.
L. delicatula Hook.f.
L. distans C.B. Clarke
L. plantaginea Lindl.
L. viridiflora (Blume) Lindl.
Oberonia iridifolia (Roxb.) Lindl.
O. myriantha Lindl.
Otochilus fuscus Lindl.
O. porrectus Lindl.
Phaius mishmensis (Lindl. ex Paxton) Reichb. f.
P. tancervilleae (Banks ex L. Herit) Bl.
Phalanopsis manii Reichb. f.
P. parishii Reichb.f.
Pholidota articulata Lindl.
P. convallariae (Reichb.f.) Hook.f.
P. imbricata (Roxb.) Lindl.
P. rubra Lindl.
Pleione maculata (Lindl.) Lindl.
P. praecox (Sm.) D.Don
Podochilus khasianus Hook.f.
Pteroceras suaveolens (Roxb.) Holttum
Schoenorchis gemmata (Lindl.) Sm.
Tainea latifolia (Lindl.) Benth. ex Hook.f.
Tropidia angulosa (Lindl.) Blume
T. curculigoides Lindl.
Uncifera acuminata Lindl.
Vandopsis undulata (Lindl.) Sm.

ZINGIBERACEAE

Alpinia nigra (Gaertn.) Burt.
Amomum aromaticum Roxb.
A. dealbatum Roxb.
Catimbium malacense (Burm. f.) Holttum
Cautleya gracilis (Sm.) Dandy
Costus speciosus (Koen.) Sm.
Curcuma aromatica Salisb.
Globba clarkei Baker
G. multiflora Wall. ex Baker
Hedychium coccineum Buch.- Ham. ex Sm.
H. coronarium Koen.
H. venustum Wight
H. villosum Wall.
Hitchinea careyana Benth.

MARANTACEAE

Phrynium capitatum Willd.
P. placentarium (Lour.) Merr.
P. pubinerve Blume

CANNACEAE

Canna coccinea Mill.

MUSACEAE

Ensete glaucum (Roxb.) Cheesman
Musa velutina Wendl. & Drude

HYPOXIDACEAE

Curculigo capitulata (Lour.) Kuntze
C. crassifolia (Baker) Hook. f.

AGAVACEAE

Dracaena angustifolia Roxb.

TACCACEAE

Tacca integrifolia Ker.-Gawl.

DIOSCOREACEAE

Dioscorea alata L.
D. belophylla (Prain) Voigt ex Haines
D. pentaphylla L.
D. watii Prain & Burkill

STEMONACEAE

Stemona tuberose Lour.

LILIACEAE

Disporum cantoniense (Lour.) Merr.
Ohiopogon intermedius D.Don
Peliosanthes teta T. Anderson ssp. **humilis** (T. Anderson) Jessop
Pleomele angustifolia (Roxb.) N.E. Br.
P. terniflora (Roxb.) Merr.

SMILACACEAE

Smilax perfoliata Lour.

PONTEDERIACEAE

Monochoria hastata (L.) Solms

COMMELINACEAE

Aclisia subumbellata (C.B. Clarke) C.B. Clarke
Amischotolype mollissima (Blume) Hassk.
Commelina diffusa Burm. f.
C. paludosa Blume var. **paludosa**
Dictyospermum scaberrimum (Blume) J.K. Morton
Floscopa scandens Lour.
Murdannia bhemei (Hassk) M. Braman
Pollia hasskarlii Roxb.

ARECACEAE

Calamus erectus Roxb.
C. floribundus Griff.
C. gracilis Roxb.
C. leptospadix Griff.
Caryota urens L.
Didymospermum nana H. Wendl. & Drude
Livistonia jenkinsiana Griff.
Phoenix rupicola T. Anderson
Pinanga gracilis (Roxb.) Blume
Wallichia densiflora Mart.
Zallacea secunda Griff.

ARACEAE

Pothos cathcartii Schott
P. scandens L.
Rhaphidophora grandis Schott
R. hookeri Schott

CYPERACEAE

Carex baccans Nees
C. cruciata Wahlenb.
C. filicina Nees
C. vesiculosa Boott
Cyperus brevifolius (Rottb.) Hassk.
C. diffusus Vahl
C. distans L. f. var. **pseudonutans** Kuekenth.
C. exaltatus Retz.
C. haspan L.
C. kyllingia Endl.
C. sanguinolentus Vahl
Eleocharis acutangula (Roxb.) Schult.
E. atropurpurea (Retz.) J. Presl & K. Presl
E. complanta (Retz.) Link
Fimbristylis dichotoma (L.) Vahl
F. schoenoides (Retz.) Vahl
Hypolytrum nemorum (Vahl) Spreng.
Scirpus juncoides Roxb.
S. ternatanus Reinw. ex Miq.

S. laevis Retz.
Scleria terrestris (L.) Fass

POACEAE

Arundinaria hookeriana Munro
Arundinella nepalensis Trin.
A. setosa Trin.
Arundo donax L.
Bambusa tulda Roxb.
Cephalostachyum fuchsianum Gamble
C. pallidum Munro
Chimonobambusa griffithiana (Munro) Nakai
Coix gigantea Koenig ex Roxb.
C. lacryma - jobi L.
Crytococcum oxyphyllum (Steud.) Stapf
Dendrocalamus hamiltonii Nees & Arn. ex Munro
D. hookeri Munro
Echinochloa crusgalli (L.) P. Beauv. var. **breviseta** (Doell) Neilr.
Eragrostis unioloides (Retz.) Nees ex Steud.
Erianthus longisetosus T. Anderson
Garnotia acutigluma (Steud.) Ohwi
Imperata cylindrica (L.) P. Beauv.
Isachne albens Trans.
Lophatherum gracile Brongn.
Microstegium ciliatum (Trin.) A. Camus
Neyraudia reynaudiana (Kunth) King & Hitchc.
Oplismenus compositus (L.) P. Beauv.
Paspalum conjugatum Berg.
Phragmites karka (Retz.) Trin. ex Steud.
Pogonatherum crinitum (Thunb.) Kunth
P. panicum (Lam.) Hack.
Pseudostachyum polymorphum Munro
Sacciolepis myosuroides (R. Br.) A. Camus
Setaria pallidefusca (Schum.) Stapf & Hubb.
S. palmifolia (Koenig) Stapf
Themeda villosa (Poir.) A. Camus
Thysanolaena maxima (Roxb.) Kuntze

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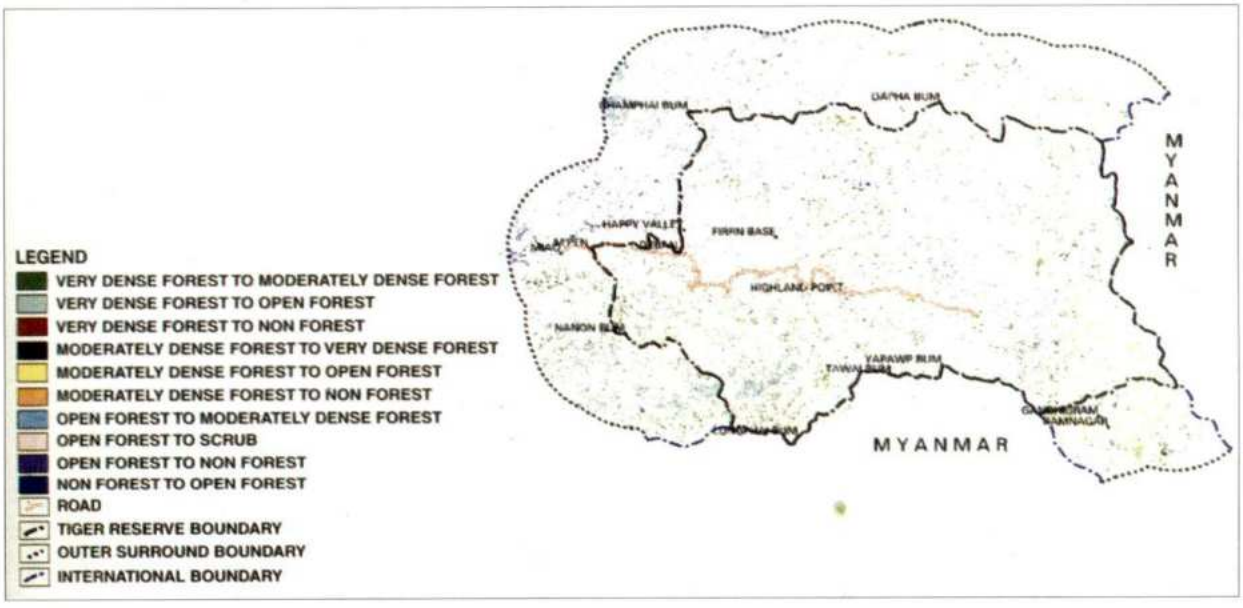
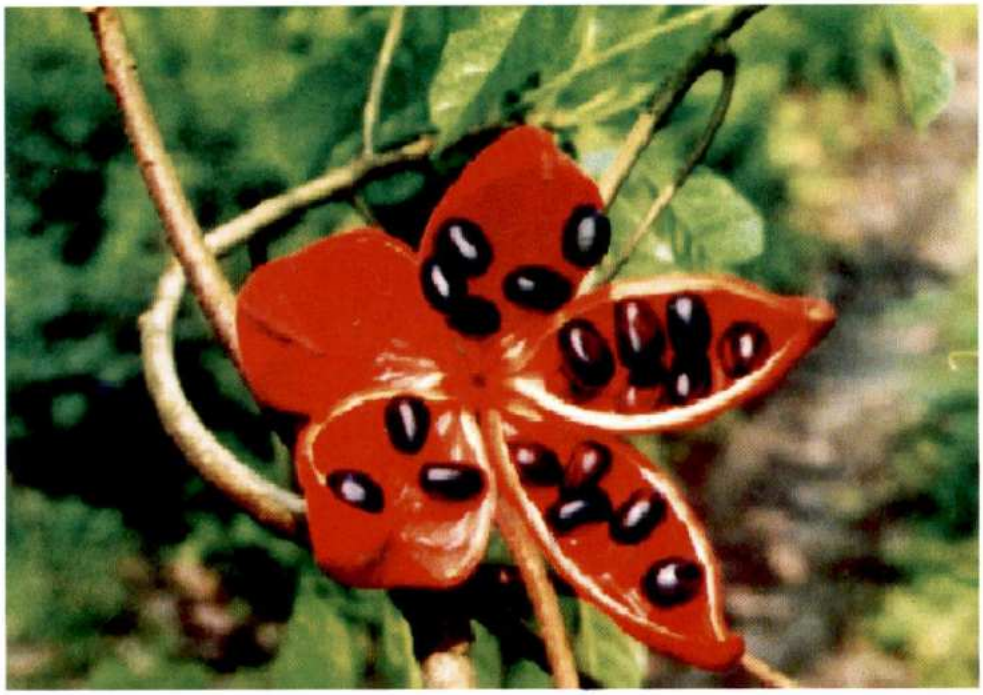


Map of Namdapha Tiger Reserve

Sterculia hamiltonii (Courtesy : M.K. Pathak)



SALIENT FEATURES

Area

Core	:	1807.820 sq km
Buffer	:	177.425 sq km
Total	:	1985.245 sq km
Longitude	:	96° 16' E to 96° 59' E
Latitude	:	27° 17'E to 27° 40' N
Altitude	:	200 m-4571 m above MSL
Rainfall	:	1485 mm - 2508 mm
Temperature		
Minimum	:	8° C
Maximum	:	37° C

Seasons

Mainly summer, rainy and winter.

APPROACH

By Rail :

Nearest railway station Margherita is connected by local passenger train with Tinsukia which in turn is connected with major cities of India.

By Air :

Nearest airport Dibrugarh (140 kms) is connected with Calcutta by Indian Airlines as well as pvt. airlines.

By Road :

Good motorable roads connect Miao (entry point of the park) to Dibrugarh (140 kms), Tezu (182 kms), Sibsagar (199 kms), Guwahati (561 kms) etc. From Tinusukia or Dibugarh, the journey to Miao, headquarters of the National Park and the Tiger Reserve, has to be done by road, over a distance of 150-km. Then, a forest road stretching over around 28-km gives access to the protected area up to a place called Deban, which has a lovely forest rest house and some other accommodation for the field staff. Beyond this area there is no road as such and all movement inside the reserve has to be on foot through dense forest and steep hill ranges with streams and rivers flowing in between.

Trevesia palmata *(Roxb.) Devis.* (Courtesy : M.K. Pathak)

Pakke Tiger Reserve

S Phukan, SS Begum & NN Rabha
Botanical Survey of India, Eastern Circle, Shillong-793003

Tiger is our National Animal and considered as a keystone species. But the population of this species is decreasing day by day due to various reasons leading to endangered category. To conserve this species along with its habitat Government of India launched the " Project Tiger" on 1st April 1973 (Singh & Singh, 2002). These tiger reserves harbour rich floristic diversity and contain many rare, endangered and endemic plant species. Thus, these reserves can be considered as *in-situ* conservation of these rare and endangered plant species.

Pakke (formerly known as Pakhui) Tiger Reserve was established in 25th April 2002 and covers an area of 861 sq km. It is situated in the east Kameng district of Arunachal Pradesh and lies between lat. 26°56'-27°14'N and long. 92°35'-93°06'E. This area is located in the outer range of Himalayas at the junction of western end of Arunachal Pradesh. It is surrounded by the Tenga Reserve Forest in the north; the starting point of inner-line (Assam-Arunachal Pradesh interstate boundary) and Doimara Reserve Forest from west direction. The Papum Reserve Forest and some agricultural lands surrounded the reserve from the east; Nameri National Park from the south. It is blessed by nature's bounty of natural resources and one of the richest and naturally protected areas by the Kameng River and Pakke River. It is famous for the good population of tigers. According to 1993 census 39 tigers are found in this reserve. Besides, birds, reptiles, butterflies and moths are also found. This rich wildlife is supported by its vegetation and diverse species of plants. The reserve is covered with tropical to subtropical forest. Due to its unique geographical position, the vegetation of this reserve is still pristine and virgin.

The present communication on the botany of the Pakke Tiger Reserve deals with the vegetation types, economically important plant species and wild relatives of cultivated plants that are found in this reserve. It also highlights the animal and plant relationships, threats and conservation aspects of the reserve.

Geomorphology: Pakke Tiger Reserve is almost hilly with altitudinal ranges starting from 100 m to 2040 m above mean sea level. The terrain occupied by the forest is gentle sloping towards south and is highly rugged with mountainous ranges with a narrow plain and valley having hill slopes. Peripheral zone and valleys are alluvial plains.

The reserve is drained by several rivers, streams and nallahs. Pakke, Kameng, Khari, Nameri, Upper Dikorai, Diju and Lalung are important rivers of the reserve.

The soil on the hills is moderately deep moist, fertile loamy on upper layer of which are stained with humus. The sub-soil in the foothills consists of boulders and pebbles, superimposed by a layer of humus.

Rocks found in the reserve are of Selas group consisting of Schist, Quartzite, Silicate and Amphibolites, Dolomite, Gondwana group of gritty

Pakke Tiger Reserve along the Pakke River

sandstone, gray and carbonaceous shale and lances of coal. These rocks contain good fossils. These rocks are mostly sedimentary of tertiary period.

Climate: Climate is mostly subtropical in the reserve. It receives rainfall from southwest monsoon (May-September) and northeast monsoon (November-April). The southwest monsoon is responsible for more than three fourth of the annual rains. The average annual rainfall is 2500 mm.

Winds are generally of moderate velocity, cyclonic storms occasionally occur in March-April.

The temperature ranges in the reserve from 12°-36°C. Winter is moderately cold and damp. Summer is warm and humid. There is a significant variation in temperature inside and outside the reserve.

The area is quite humid in summer with low humidity during February to March. In general, humidity is 70%-80% in winter. Inside the forest air is having more moisture than the open areas.

Fauna

Tiger, Leopard, Clouded Leopard, Jungle Cat, Wild Dog, Jackal, Himalayan Black Bear, Biturong, Elephant, gaur, samber, hog deer, barking beer, wildboar, yellow throated martin, malayan giant, squirrel, flying squirrel, civet, capped langur, rhesus macaque, assamese macaque, bison etc. The presence of stamp tailed macaque has been reported by one researcher.

Vegetation

As per the Champion and Seth's classification Forest type of Pakke Tiger can be classified as follows:

1. Assam valley tropical semi evergreen forest.
2. Sub Himalayan light alluvial semi evergreen forest 92b/C/151).
3. Eastern Hollock forest (3/152(b)).
4. Upper Assam valley tropical evergreen forest (IB/C2B).
5. Tropical reverine forests (4E/RSI).
6. Secondary moist bamboo tract (E1/2/SI).

Vegetation of Pakke Tiger Reserve is remarkable in having different types of forests with tropical and subtropical elements (Singh, 1991). The vegetation of the reserve can be classified into following types :

1. Tropical semi evergreen forest
2. Tropical evergreen forest
3. Subtropical broad leaved forest
4. Bamboo forest
5. Riparian forest

1. Tropical semi evergreen forest: This type of vegetation is seen along the lower plains and foothills of the reserve. The major tree species include *Aesculus assamica, Aglaia hiernii, Altingia excelsa, Anthocephalus chinensis, Artocarpus lacucha, Bischofia javanica, Salmalia malabarica (Bombax ceiba), Canarium strictum, Castanopsis indica, C. tribuloides, Chukrasia tabularis, Dillenia indica, D. pentagyna, Duabanga grandiflora, Dysoxylum binectariferum, D. gobara, Elaeocarpus aristatus, Gmelina arborea, Phoebe goalparensis, Pterospermum acerifolium, Sterculia villosa, Sterospermum chelonoides, Terminalia myriocarpa, Tetrameles nudiflora,* etc.

The second storey is represented by small trees and climbers. Some of them are *Croton roxburghii, Ficus* spp., *Litsea glutinosa, L. salicifolia, L. monopetala, Meliosma simplicifolia, Turpinia nepalensis,* etc. *Ardisia* sp., *Boehmeria* sp., *Clerodendrum* spp., *Phlogacanthus* spp., *Strobilanthus* ssp. are commonly found in the reserve.

The herbaceous flora is most luxuriant during monsoon period. The ground floor is dominated by the species like *Ageratum conyzoides, Amorphophallus* sp., *Arisaema* sp., *Colocasia esculenta, Costus speciosus, Impatiens* spp., *Phrynium* sp., etc.

Common climbers are *Beaumontia fragrans, Gouania tiliaefolia, Stixis suaveolens, Thunbergia grandiflora,* etc.

Epiphytic flora of the reserve is very rich. Different orchids and pteridophytes are grown on the branches and trunks of the trees. Orchid species like *Cleisostoma* spp., *Coelogyne punctualata, C. griffithii, C. ovalis, C. occultata, Aerides multiflorum, Bulbophyllum* spp., *Cymbidium aloifolium, Dendrobiun acinaciforme, D. aphyllum, Epigenium amplum, Eria acervata , E. flava, Papilionanthe teres, Tainia latifolia* etc. and other species like *Hoya parasitica, Dischidia rafflesiana* are also very common. Among pteridophytes *Asplenium nidus, Drynaria quarcifolia,* etc. are common.

2. Tropical evergreen forest: This is the most common type of forest found in the reserve. This type is characterized by a dominance of evergreen elements with a few emergent tree species. The upper canopy mainly consist of tall tree species like *Aglaia hiernii, Altingia excelsa, Artocarpus chama, Bischofia javanica, Bombax ceiba, Callicarpa arborea, Canarium bengalense, Castanopsis indica, Chukrasia tabularis, Dillenia indica, Dipterocarpus retusus, Duabanga grandiflora, Echinocarpus* sp., *Lagerstroemia reginae, Mesua ferrea, Shorea assamica, Terminalia myriocarpa,* etc.

Second canopy is represented by small trees and shrubs. Some of them are *Ardisia crispa, Baliospermum corymbiferum, Boehmeria macrophylla, Buddleja asiatica, Clerodendrum bracteatum, C. colebrookianum, C. serratum, Coffea bengalensis, Ficus hispida, Goniothalamus sesquipedalis, Leea compactiflora, Micromelum minutum, Mussaenda roxburghii, Saurauia punduana, Solanum torvum, Sterculia hamiltonii, Styrax serrulatum,* etc. Cane species like *Calamus floribundus, C. erectus, C. flagellum* are also found. Palms are also met within the forest, the most common species are *Arenga pinnata, Caryota urens, Didymospermum nana, Licuala peltata, Livistona jenkinsiana, Pinanga gracilis* are found to grow on the hill slopes. *Pandanus* sp., *Cyathea gigantea, Angiopteris evecta* are growing in the moist places within the reserve. *Musa velutina* is one of the prominent features of this forest.

Wild Elephant found in the Reserve

In this forest, trees are densely covered with climbers and epiphytes. Due to conducive climatic conditions the forest is rich in epiphytic flora and lians. Some common orchid genera are *Aerides, Coelogyne, Cymbidium, Dendrobium, Eria, Pholidota, Rhynchostylis, Cleisostoma,* etc.

The ground floor mainly composed of herbaceous elements such as *Begonia roxburghii, Commelina* spp., *Deeringia amaranthoides, Floscopa scandens, Globba* spp., *Lindenbergia indica, Lobelia pyramidalis, Murdania nudiflora, Oxalis corniculata, Polygonum* spp., etc. *Arundina graminifolia* commonly known as 'bamboo orchid' is found on the hill slopes. At lower elevation along the streams and moist places *Tacca* sp., is also found. Several terrestrial orchids like *Goodyera procera, Calanthe* sp., *Gaeodorum densiflorum, Malaxis latifolia, Phaius tankervittae* etc. and fern and fern allies are *Pteridium equilinum , Diplazium dialatatum, D. esculantum, Pteris* sp., *Equisetum* sp., *Lycopodium* sp., *Selaginella* sp., are of common occurrence. Among the interesting root parasites, *Balanophora dioca* infesting the roots of many tree species. The saprophytic orchids like *Epipogium roseum, Galeola falconari* occur in moist, shady humus rich soils of the reserve.

3. Subtropical broad-leaved forest: This type of forest occurs at the elevation of 900-1800 m and basically evergreen and dense in nature. The layered structure also is discernible. The main tree species are of Fagaceae, Lauraceae, Magnoliaceae families. Some of them are *Quercus lamellosa, Castanopsis tribuloides, C. purpurella, Quercus* sp., *Alnus nepalensis, Betula alnoides, Michelia* spp., *Magnolia* spp., *Engelhardia spicata, Albizia* spp., *Lindera* spp., *Litsea* spp., etc.

Macropanax undulatus, Saurauia napaulensis, Wendlandia speciosa, Schima wallichii, Lonicera

angustifolia, Lyonia avalifolia etc. are some of smaller trees found in this forest.

The herbaceous flora is also dense and gregarious. *Polygonum* spp., *Impatiens* spp., *Justicia khasiana, Leucas* spp., *Osbeckia stellata, Plantago major, Potentilla khasiana* are found along with several ground orchids and ferns. Common ground orchids are *Goodyera procera, Malaxis latifolia, Phaius tankervelii* etc.

Thick fern and orchid flora are noticeable which form the bulk of epiphytic growth. Some common fern species are *Asplenium* sp., *Drynaria propinqua, Lepisorus* spp., *Pyrrosia* sp. etc. In this type of forest, density of epiphytic orchid is very high. Some common orchid genera are *Bulbophyllum, Coelogyne, Dendrobium, Otochilus, Pholidota* etc.

4. **Bamboo forest:** The reserve as a whole of abode of bamboo species. There are 8 species of bamboo are found in this reserve. *Dendrocalamus hamiltonii* which occur gregariously in this reserve. Other species are *Bambusa pallida, Schizostachyum polymorphum, Chimonobambusa callosa, Schizostachyum latifolium, C. capitatum, Arundinaria* sp., *Phyllostachys* sp., etc.

5. **Riparain forest:** Such type of vegetation is confined along the river like Khari, Pakke, Upper Dikorai, Kameng etc. In this vegetation type tree species are generally lack of dense canopy. The top canopy is dominated by the species like *Alstonia scholaris, Albizia lebbeck, A. lucida, Bischofia javanica, Bombax ceiba, Dalbergia sissoo, Dillenia indica, Duabanga grandiflora, Lagerstroemia reginae, Sterculia villosa, Terminalia myriocarpa, Ficus* spp., *Litsea* spp., *Meliosma* spp., *Turpinia pomifera* , *Villebrunea* sp. etc. are commonly found. Various grass species are also found in this forest type.

Interesting Elements

The rich and diverse flora of Pakke Tiger Reserve harbours some interesting plant species. Among these plant species *Balanophora dioca* is commonly found, associated with the roots of several tree species. Saprophytic orchids *Epipogium indicum, E. roseum* are found in dense humid forest floor. From the mixed deciduous forest of the reserve *Epipogium africanus* is discovered as new record for India. The reserve has been refuged for some rare and endangered species like *Angiopteris evecta, Gnetum scandens, Galeola lindleyana* etc.

Economically important plants

The flora of Pakke Tiger Reserve contains a large number of economically important plants such as medicinal, ornamental, timber yielding etc.

A. Medicinal: The reserve contains a large number of medicinal plants. *Acorus calamus, Costus speciosus, Dillenia indica, Tinospora cordifolia, Sida acuta, S. rhombifolia, Oxalis corniculata, Impatiens tripetala, Spondias pinnata, Rubus moluccanus, Terminalia chebula, T. bellerica, Maesa indica, Solanum nigrum, S. ferox, Scoparia dulcis, Oroxylum indicum, Phlogacanthus thyrsiflorus, Plantago major, Ficus* sp., *Pothos scandens, Litsea cubeba, L. glutinosa* etc.

B. Ornamental: Various wild ornamental plants are found in the reserve. These plants include Orchids, Begonias, Impatiens, Rhododendron and others. Some of them are *Aerides multiflorum, Arundina graminifolia, Begonia roxburghii, Calanthe masuca, Coelogyne flavida, C. longipes, C. punctulata, Cymbidium aloifolium, Dendrobium acinaciforme, D. adancum, D. aphyllum, D. farmeri, D. fimbriatum, Phaius tankervillae, Pholidota imbricata, Rhyncostylis retusa,* etc. Others are *Impastiens* spp., *Tacca* sp., *Ixora* sp., *Melastoma* sp., *Phlogacanthus* sp., *Musa velutina, Rhaphidophora* sp., *Thunbergia* sp., *Rhododendron* sp., etc.

C. Timber yielding plants: *Altingia excelsa, Alnus nepalensis, Aglaia hiernii, Albizia lebbeck, Bischofia javanica, Bombax ceiba, Pterospermum acerifolium, Dipterocarpus retusus, Pterospermum lancifolium, Sterculia villosa, Elaeocarpus* sp., *Gmelina arborea, Dalbergia sissoo, Terminalia myriocarpa, Castanopsis indica, Dysoxylum gobara, Phoebe goalparensis, Tetrameles nudiflora, Duabanga grandiflora,* etc. are some of the common timber yielding plants found in the reserve.

Wild relatives of cultivated crop plants

Some of the wild relatives of cultivated plants are known from the reserve. These are *Artocarpus chama, Coffea bengalensis, Mangifera sylvatica, Musa velutina* etc.

Ethnobotanically important plants

The relationship of plants with tribal people is well known. There are many forest villages in the reserve. Several tribal communities are living in these villages. The important tribes are Akas, Mijis and Nyshis etc. In their day to day life these people are using plants or parts of plants for food, medicine, dye making, preparing local drinks etc. Some common plants along with their uses are mentioned below :

Plant name	Family	Uses
Artocarpus chama	Moraceae	Fruit is edible
Arundina graminifolia	Orchidaceae	Leaves are edible and whole plant is used for decoration during festivals
Baliospermum montanum	Euphorbiaceae	Leaves are used for snake bite and used as vegetable
Bidens biternata	Asteraceae	Leaves are used in headache
Buddleja asiatica	Buddlejaceae	Leaves are used in the preparation of local drink
Calamus erectus	Arecaceae	Fruits are edible. Stems are used for making bags, baskets, containers etc.
Callicarpa arborea	Verbenaceae	Barks are used as substitute for Betel nut
Chenopodium album	Chenopodiaceae	Seeds are used for preparing local drinks Leaves are used as vegetable
Chlorophytum arundinaceum	Liliaceae	Whole plant is used as vegetable and substitute for onion
Clerodendrum colebrookianum	Verbenaceae	Leaves are used as vegetable and used in fever, cough, diarrhea, stomach pain etc.
Costus speciosus	Costaceae	Stem is used for burning sensation on urination
Crassocephalum crepidioides	Asteraceae	Leaves are used on cuts and wounds. Whole plant is eaten as raw or boiled
Cyathea gigantea	Cyatheaceae	Pith is edible
Dendrocalamus strictus	Poaceae	Planted near the houses in spiritual belief
Diplazium esculantum	Athyriaceae	Fronds are used as vegetable
Dysoxylum binectariferum	Meliaceae	Fruits are edible
Ficus benjamina	Moraceae	Stem is used for stomach trouble
Scoparia dulcis	Scrophulariaceae	Tender shoots are used
Solanum ferox	Solanaceae	Fruits are edible

Evergreen vegetation in the Reserve

Plant and animal relationships

Pakke Tiger Reserve harbors rich faunal diversity. It is an example of balanced environment and abode of aesthetic beauty. It offers good habitat for elephant, tiger, leopard, gaur, sambar, barking deer, wild dog and many other animals. There are different types of rare and endangered animal and birds species are found in the reserve. For example 15 endangered mammals, 5 species of birds etc.

Overall, 228 species of birds and 86 species of butterflies are already reported from the reserve. According to 1993 census 39 tigers are found in this reserve.

The flora of the reserve provides food and shelter to the animals and birds.

There are a number of plant species that are directly or indirectly important as food for various animal species. Some of them are *Spondias pinnata, Terminalia bellirica, T. chebula, T. citrina, Elaeocarpus floribundus, Echinocarpus* sp., *Musa velutina, Sterculia hamiltonii, Castanopsis* sp., *Ficus* spp., *Saurauia* sp., *Oreocnide* sp., *Garcinia* sp., *Melia* sp., etc. The underground corms and tubers of plants like *Alpinia nigra, Costus speciosus, Colocasia esculanta, Lasia spinosa* are favorable for many animals. Birds, Squirrels etc. prefer the fruits of *Bridelia stipularis, Ficus benghalensis, Syzygium* sp., *Zizyphus mauritiana* etc. Some herbivores prefer mainly large number of grasses and herbaceous species. The reserve is also a rich storehouse of fodder plants as well. Many species

like *Bombax ceiba, Gmelina arborea, Sterculia villosa, Erythrina* sp., provide shelter for different birds and animals.

Threats and Conservation Strategies

1. Habitat destruction: As Pakke Tiger Reserve is surrounded by human settlement, human activities are most important biotic factors for this reserve. People collect firewood and other non -timber forest product (NTFP) such as medicinal, wild edible plants from the reserve.

2. Grazing: The domestic live stock grazing is limited in the reserve. But these animals are destroying the herbaceous and shrubby under growth of the forest.

The wild herbivores are facing competition for food from the domestic ones.

3. Hunting: The reserve is surrounded by many tribal communities who still depend on the reserve for their various requirements. For meat, teeth, feather, beak etc, they have killed many wild animals.

4. Fire: Every year in this reserve the forest department burns grasses. Although burning is useful for luxuriant growth of grass but it destroys the other herbaceous plants leaving only the bulbous, rhizomes, which penetrate deep underground.

5. Weeds: Infestation of different weeds on grassland is one of the major threats to the reserve. Some of them are *Ageratum conyzoides, Bidens biternata, Lantana camara, Mikenia micrantha, Eupatorium odoratum,* etc.

Conservation Strategies

For an effective conservation of biodiversity of the reserve an Ecodevelopment programme should be launched involving local communities. It is necessary to create awareness among local people for protection and conservation of plant as well as animal resources of the reserve. Above all, the forest authorities should ensure that the needs of local communities are met the provision of alternative sources of income and the forest product are used sustainably.

Forest types with Major Species

The major tree species include, *Terminalia myriocarpa* (Hollock), *Ailanthus excelsa* (Barpat), *Duabanga grandiflora* (Khokan), *Canarium strictum, Trewia nudiflora, Tetrameles nudiflora, Sterculia villosa, Macropanax dapermus, Syzigium macrocarpum, Garcinia species, Quercus lamellosa, Castonopis indica, Phoebe goalparensis, Amora wallichii, ailanthus grandis, Pterspermum scerifoloium, Dillenia indica, Artocarpus chaplas, Bischofia japonica* (Uriam), *Albizia procere* and *Bombax ceiba* (Simul).

The important bamboo species are *Dendroclamus hamitonii, Bambusa pallida* and *Pseudostachym polymorphum*. The cane species are *Calamus erectus, Calamus tenuis* and *Calamus flagella*.

Avi fauna : Hornbil, White winged wood duck, Jungle Fowl, Peacock Phesant, Khaleej Pheasant, Dove, Barbets, Drongo, Scrpent eagle, Baaz eagles, etc.

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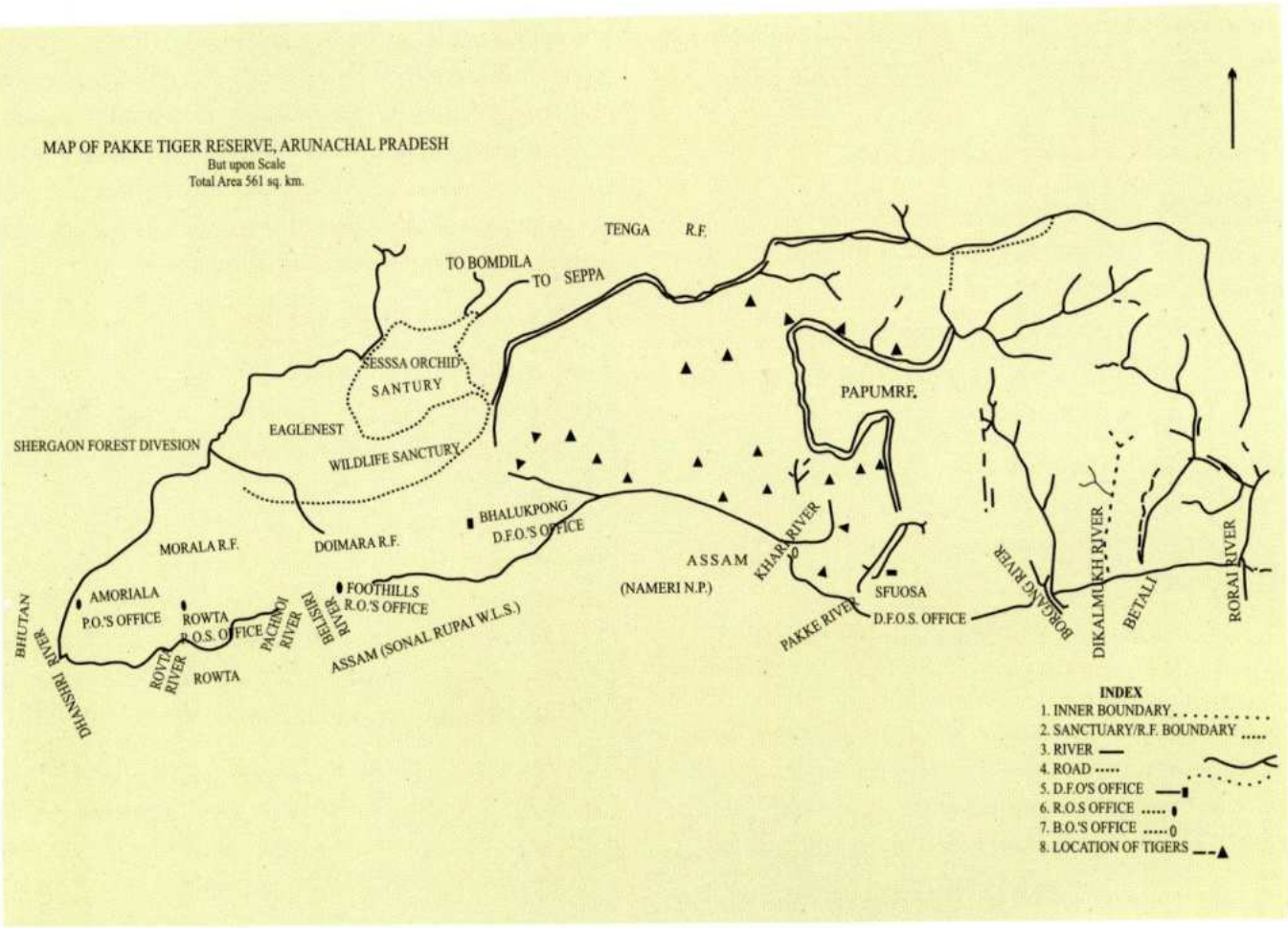


Map of Pakke Tiger Reserve

SALIENT FEATURES

Pakke Tiger Reserve is located in the east Kameng district of Arunachal pradesh with head quarter at Seijusa 21 km from Saibari in Assam off the national Highway- 52. The total area of the Tiger Reserve is 862 sq km bounded by Kemeng River in the west 7 North, Pakke River in the east iterate boundary with Assam in the south. The area of present Pakke Tiger Reserve was originally constituted as Pakke Reserve Forest vide notification No.FOR/32/54 dated 01.07.1966 and was declared as Camo Sanctuary vide notification No. For/32/54 dated 28.03.1977. Subsequently it was declared, as Pakhui Wildlife sanctuary vides notification No. CWl/D/26/94/1542-92 dated 18.04.02, and finally it was declared, as Pakke Tiger Reserve vides notification No. For/CWL/D/26/94/1742-91 dated 23.04.02 under Project Tiger scheme of Government of India.

Administrative set up

At present Pakke Tiger Reserve is under the administration of Divisional Forest Officer Pakke Wildlife Sanctuary Division with its Head Quarter at Seijusa, District- East Kameng, Arunachal

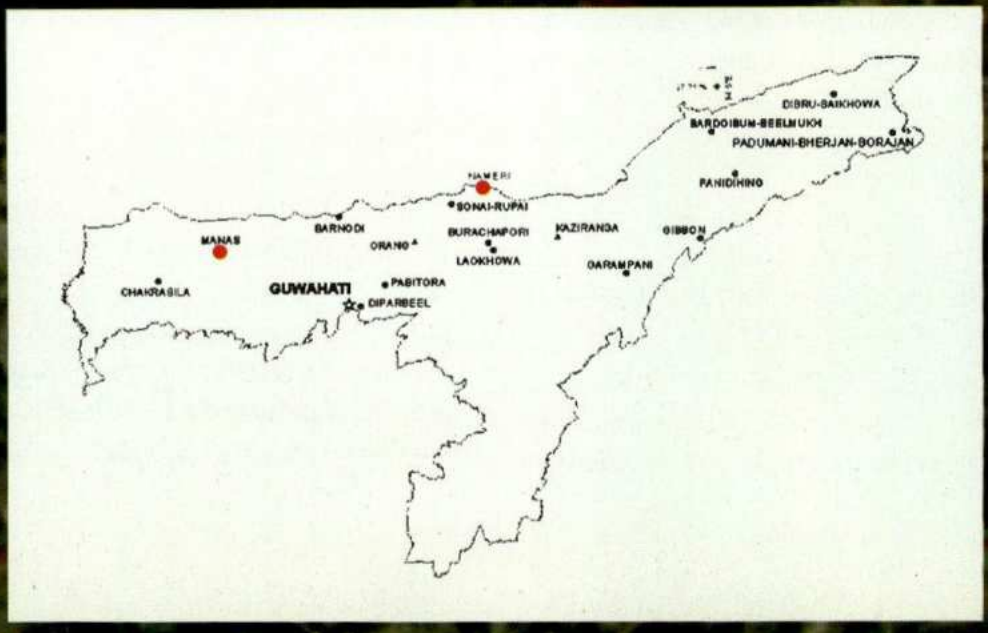
Entrance to Pakke Tiger Reserve

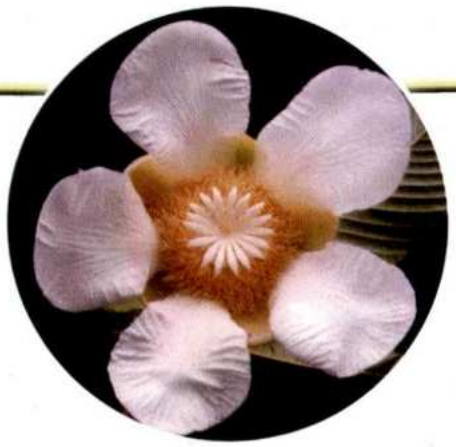
Pradesh, comprising 2 ranges i.e (i) Seijusa Wildlife Range with head quarter at west bank, (ii) Tipi Wildlife Range with head quarter at Tipi in west Kameng district. Shortly it will be under the administrative control of a field director, Project Tiger with a proposal of 1 (one) more range at Bana under east Kameng district.

Musa velutina - a common wild banana found in the Reserve

ASSAM

- **Manas Tiger Reserve**
- **Nameri Tiger Reserve**





Manas Tiger Reserve

S Phukan & BK Sinha,
Botanical Survey of India, Eastern Circle, Shillong-193003.

Manas Wildlife Sanctuary established in 1928 is one of the world famous Heritage Sites of IUCN (1987). It lies between lat. 26° 29' - 26° 54' N and long. 89° 51' - 91°56' E with a total area of 2840 sq km. It covers the districts of Kokrajhar, Bongaigaon, Barpeta, Nalbari, Kamrup and Darrang. The Reserve is further subdivided into the core and buffer zone. The core area is of 319 sq km of the total area with no human habitation and only dominated by continuous forest belt between the Sankosh river in the west and the Pagladia river in the east. The buffer zone extends up to the Nandi river in the east. Few important rivers draining from North to South are the Manas, Beki, Jangrang, Gyati, Garuchara, Rabang, Pagladia and numerous marshes and swamps locally referred as 'Beels' also abounds the area. The northern part of the reserve consisting of mixed forest belt is continuous with that of the Indo-Bhutan International border and the southern part being surrounded by paddy cultivated areas with the settlement of tribal village over two decades, the buffer zone has become fragmented. Towards the south the terrain is alluvial with an elevation that varies from 85 to 110 m above sea level. Further the unique warm and humid climatic condition that prevails with a maximum of 37°C during summer, 6°C during winters and mean annual rainfall of 4000 mm enhances the floral and faunal diversity of the reserve.

Baishya (1998), Jain & Hajra (1975), Kataki & Barua (1989) have discussed the biodiversity of the Manas Tiger Reserve, further study on its biodiversity will throw more light on the floristic diversity of the reserve. The paper deals on the types of vegetation and wild economic potential plants. Besides it also highlights the animal-plant relationship, the threats to biodiversity and present status of the reserve along with the enumeration of the species.

VEGETATION

The Manas Tiger Reserve forms a continuous forests belt along the Indo-Bhutan border comprising of 22-reserve forests and sanctuaries under 5-forest divisions in Lower Assam.The vegetation of Manas Tiger Reserve can be broadly classified into 5 types as follows:

1. Tropical semi-evergreen forests

These semi evergreen forests occurring mainly along the Indo-Bhutan boundary of the Tiger Reserve and the Northern parts of Barnadi, Khalingdar, Balipara R.F. and Sunai-Rupai Sanctuary represent the tropical rain forests with both tall and short trees. The common trees in top canopy are *Ailanthus grandis, Artocarpus chama, Aphanamixis polystachya, Anthocephalus chinensis, Canarium strictum, Dysoxylum binectariferum, Dipterocarpus retusus, Gynocardia odorata, Hydnocarpus kurzii, Kayea assamica, Kadsura heteroclita, Mesua ferrea, Mangifera sylvatica, Michelia doltsopa, Magnolia pterocarpa, Phoebe attenuata, P. lanceolata, P. goalparensis, Syzygium cumini, S. formosum, S. oblatum, Shorea assamica, Tetrameles nudiflora, Magnolia hodgsonii* and *Vatica lanceaefolia* etc. The second storey of the vegetation comprises of *Aglaia hiernii, Actinodaphne*

obovata, Cinnamomum tamala, Dillenia indica, Garcinia cowa, Ficus rhumphii, Lagerstroemia parviflora, Mallotus philippensis and *Terminalia* sp., etc. *Bauhinia variegata* with magnificent white flowers occasionally forms a dense canopy in slightly open places. Besides these, there are numerous species of *Annonacee, Lauraceae, Magnoliaceae, Meliaceae, Moraceae* and *Rutaceae,* etc. forming dense, lush and green vegetation. Woody lianas viz. *Derris robusta, Entada pursaetha,* etc., also extend throughout the forests.

The undergrowth in these forests are *Justicia adhatoda, Clerodendrum indicum, C. viscosum, Coffea bengalensis, Holmskioldia sanguinea, Leea alata, Phlogacanthus thyrsiflorus, Rauvolfia serpentina* etc. Large patches of *Alpinia nigra* associated with *Costus speciosus, Tacca laevis* and several other species of Cyperaceae make the vegetation richer in moist and shady places. *Angiopteris evecta,* wild *Musa,* and *Calamus floribundus* are also common.

The epiphytic flora of the forest consist of beautiful orchids comprising of *Acampe papillosa, Aerides multiflorum, A. rosea, Cymbidium aloifolium, Dendrobium aphyllum, D. moschatum, Rhynchostylis retusa, Papilionanthe teres,* etc. Among the pteridophytes the 'Bird-nest' fern viz. *Asplenium nidus, Drynaria quercifolia* and *Pseudodrynaria coronans* are common besides numerous polypodiacious species. Epiphytic climbers like *Dischidia rafflesiana* along with several species of *Hoya* and gregarious blechnoid fern *Stenochlaena palustris* are very common to notice in the forests.

2. Tropical moist and Dry deciduous forests

This type of vegetation prevails in the southwestern and eastern parts of the reserve comprising Kachugaon, Batabari, Subankhata, Nauduar, Balipara, Gahpur and parts of Darranga R.F. The dominant trees of these forests area are *Haldina cordifolia, Aesculus assamicus, Albizia odoratissima, Anthocephalus chinensis, Bombax ceiba, Butea monosperma, Spantholobus parviflorus, Callicarpa arborea, Careya arborea, Cassia fistula, Cordia dichotoma, Duabanga grandiflora, Gmelina arborea, Kydia calycina, Macaranga denticulata, Marsdenia tenacissima, Oroxylum indicum, Radermachera gigantea, Sterculia villosa., Sapium baccatum, Toona ciliata* and many species of *Ficus*, etc. A climax type of vegetation in Batabari and Subankhata R.F. is seen prevailing with *Embilca officinalis* along with *Rhamnus nepalensis, Zizyphus mauritiana, Z. funiculosa and Micromelum minutum. Bauhinia vahlii, Combretum alatum* and *Uncaria sessilifructus* are common lianas while *Dioscorea bulbifera, D. pentaphylla, Hodgsonia macrocarpa, Stephania japonica* and several other species of Convolvulaceaee and Cucurbitaceeae are among the common climbers and twiners in the deciduous forests.

Although the undergrowth in the forests is poor, species like *Artemisia nilagirica, Buddleja asiatica, Cassia occidentalis, Clerodendrum viscosum, Eupatorium odoratum, Flemingia strobilifera, Grewia elastica, Maesa indica, Melastoma malabathricum* etc. are seen along with some ground orchids such as *Peristylus constrictis, Geodorum densiflorum. Shorea robusta*-a single species also dominate the deciduous forests along with occasionally occurring *Bombax ceiba* and *Gmelina arborea.*

3. Riparian forests

Riparian forests mostly extend over all alluvial formation along rivers and rivulets in the area. Common tree species are *Alstonia scholaris, Bischofia javanica, Dillenia indica,* inter mixed with *Dillenia pentagyna, Callicarpa arborea, Dalbergia sissoo, Glycosmis arborea, Holmskioldia sanguinea, Premna bengalensis, Sapium baccatum* and many species of *Ficus* sp., *Bombax ceiba, Oroxylum indicum* and *Cassia fistula* grow gregariously in the river banks and slopes. *Arundina graminifolia* is a common orchid in the shady hill slopes of the river bank. There are certain patches of single species composition in this forest

along riverbeds and banks. *Tamarix dioica* and *Imperata cylindrica* are most common species forming such extensive single species vegetation.

4. Alluvial grasslands

The grassland vegetation occupying the major portion of the Manas Tiger Reserve extends from the western boundary to the extreme eastern boundary with more concentration in the core area of the reserve with tall grasses providing an ideal habitat for tigers. The grasses comprises of *Arundinella bengalensis, Arundo donax, Saccharum longisetosum, S. ravennae, Imperata cylindrica* var. *major, Phragmitis karka, Saccharum arundinaceum, S. procerum, S. spontaneum, Themeda arundinacea, T. villosa, Thysanolaena maxima, Vetiveria zizanioides,* etc. These grasses are supplemented by the less thickets forming species like *Capillipedium assimile, Chrysopogon aciculatus, Echinochloa colona, Eleusine indica, Neyraudia reynaudiana* and several other species of *Digitaria, Eragrostis, Panicum* etc. Amidst these grasses grow some species of *Zeuxine* viz. *Zeuxine clandestina, Z. longilabris* and *Z. strateumatica.*

The grassland vegetation is characterized by the presence of many isolated trees. Such as *Bombax ceiba, Dillenia indica, Emblica officinalis, Semecarpus anacardium, Zizyphus mauritiana,* etc. The overall grassland vegetation represents degraded and secondary vegetation due to combined effect of flood and excessive cattle grazing.

5. Swamps

In the core area of the Manas there are many pools and large 'beels' being harboured by free-floating hydrophytes such as *Azolla pinnata, Eichhornia crassipes, Monochoria hastata* etc. Among the other hydrophytes *Alternanthera philoxeropides, Limnophiia sessiliflora, Ottelia alismoides, Nymphaea nouchali* are also common. Formation of floating thick mass in the swamps with clumps of tall *Typha elephantina, Lasia spinosa* and several other sedges like *Cyperus* and *Kyllinga* in close association with other hydrophytes provide an ideal habitat for the wild animals. *Ipomoea aquatica* is the most obnoxious weed forming thickets in the marshy land.

The species diversity of Manas being rich in contrast to the other parts of Brahmaputra valley has contributed to the socio-economic upliftment of the common people inhabiting in the areas. From core area of the reserve about 591 species belonging to 372 genera and 111 families (Table-I) have so far been recorded the dicots are represented by 162 species belonging to 93 genera and 17 families. The family Poaceae is the most dominant family in the flora followed by Leguminosae & Orchidaceae (Table-II).

Several Timbers, medicinal plants, bamboos, canes and primitive plants of botanical importance etc. enrich the evergreen forest along the Indo-Bhutan boundary of the reserve. The floristic diversity is further enriched by the presence of several Burmese, Chinese and Malayan elements which are represented by species like *Anthocephalus chinensis, Garcinia cowa, Dipterocarpus retusus, Michelia doltsopa, Mallotus philippensis* and several other species belonging to *Elaeocarpus, Magnolia, Altingia, Ficus, Magnolia,* etc.

Primitive flowering plants such as *Actinodaphne obovata, Beilschmiedia assamica, B. brandisii, Cinnamomum tamala, Magnolia griffithii, M. pterocarpa, Polyalthia jenkinsii, P. longifolia, Phoebe cooperiana, P. goalparensis,* etc. and pteridophytes like *Angiopteris evecta, Ceratopteris thalictroides, Helminthostachys zeylanica* etc. serves as a storehouse for the flora of Manas.

Certain endangered species like *Stephania japonica, Dioscorea bulbifera, D. pentaphylla, Hydnocarpus kurzii, Gynocardia odorata* are the most exploited medicinal plants in the reserve and prominent bamboo species includes *Bambusa balcooa,* thorny *Bambusa bambos, B. tulda, B. nutans,*

B. vulgaris, Dendrocalamus longispathus, D. hamiltonii etc. *Gnetum montanum* is the only representative of Gymnosperm rarely found in the semi-evergreen forests. Finally pteridophytes represent 30 species belonging to 21 genera and 17 families.

FLORISTICT DIVERSITY OF MANAS TIGER RESERVE

Analysis on the floristic diversity of Manas Tiger Reserve revealed about 622 species under 394 genera and 129 families of which 591 species belonging to angiosperms, 1 in gymnosperms and 30 in pteridophytes.

Table-I: Statistics of the flora:

Group	No. of families	No. of Genera	No. of species
Angiosperms	111	372	591
Dicots	(94)	(279)	(429)
Monocots	(17)	(93)	(162)
Gymnosperms	01	01	01
Pteridophytes	17	21	30
Total	**129**	**394**	**622**

Table-II: Dominant Families of Manas Tiger Reserve

Families	Genera	Species
Poaceae	35	64
Fabaceae	26	54
Orchidaceae	20	35
Euphorbiaceae	20	34
Asteraceae	21	31
Rubiaceae	12	17
Cyperaceae	04	16
Verbenaceae	08	14
Acanthaceae	11	.13
Moraceae	05	13

Tectona grandis - plantation in the Reserve

ENDEMIC PLANTS

The following 4 endemic species have been recorded from ManasTiger Reserve:

Table-III

Name of the species	Family
Curcumorpha longiflora	Zingiberaceae
Parakaempferia synantha	Zingiberaceae
Sloanea sterculiacea var. *assamica (Echinocarpus assamicus)*	Elaeocarpaceae
Paspalum longifolium var. *lorirhachis*	Poaceae

ECONOMIC POTENTIAL

The rich floral diversity of the Tiger Reserve harbours enormous plant species having economic potential. A detail list of the uses as medicine, edible fruits, vegetable, timber, fiber, fish-poison, insecticide and fodder of the wild economically important plant species based on information gathered from the foresters, people inhabiting in the area and literature has been described. (Table-IV).

Table-IV: Wild economic plants of Manas Tiger Reserve

Botanical names	Family	Parts used	Medicine	Edible fruits	Vegetable	Timber	Fiber	Fish-poison	Insecticide	Fodder
Abelmoschus manihot var. *pungens*	Malvaceae	Barks	+	-	-	-	-	-	-	-
Adhatoda zeylanica	Acanthaceae	Leaves, roots	+	-	+	-	-	-	-	-
Alpinia nigra	Zingiberaceae	Fruits, rhizome	+	-	-	-	-	-	-	-
Amaranthus spinosus	Amaranthaceae	Whole plant	+	-	-	-	-	-	-	-
Andrographis paniculata	Acanthaceae	Whole plant	+	-	-	-	-	-	-	-
Antidesma bunius	Euphorbiaceae	Leaves, barks, roots	+	-	-	-	-	-	-	-
Artemisia nilagirica	Asteraceae	Whole plant	+	-	-	-	-	-	-	-
Azadirachta indica	Meliaceae	Whole plant	+	-	-	-	-	-	-	-
Biophytum reinwardtii	Geraniaceae	Leaves & roots	+	-	-	-	-	-	-	-
Boerhavia diffusa	Nyctaginaceae	Whole plant	+	-	-	-	-	-	-	-
Butea monosperma	Leguminasae	Seeds	+	-	-	-	-	-	-	-
Careya arborea	Barringtoniaceae	Barks & fruits	+	-	-	-	-	-	-	-
Casearia vareca	Flacourtiaceae	Roots	+	-	-	-	-	-	-	-
Cassia fistula	Leguminasae	Roots & fruits	+	-	-	-	-	-	-	-
Cassia tora	Leguminasae	Leaves	+	-	-	-	-	-	-	-
Cissampelos pareira	Menispermaceae	Leaves & roots	+	-	-	-	-	-	-	-
Cleome gynandra	Capparaceae	Leaves, roots seeds	+	-	-	-	-	-	-	-
Clerodendrum serratum	Verbenaceae	Roots	+	-	-	-	-	-	-	-
Costus speciosus	Zingiberaceae	Roots	+	-	-	-	-	-	-	-
Crataeva magna	Capparaceae	Barks & wood	+	-	-	+	-	-	-	+
Croton caudatus	Euphorbiaceae	Roots & fruits	+	-	-	-	-	-	-	-
Cuscuta reflexa	Cuscutaceae	Twigs	+	-	-	-	-	-	-	-
Cynodon dactylon	Poaceae	Roots	+	-	-	-	-	-	-	+
Datura metel	Solanaceae	Leaves	+	-	-	-	-	-	-	-
Desmodium gangeticum	Leguminasae	Roots	+	-	-	-	-	-	-	-
D. pulchellum	Leguminasae	Barks	+	-	-	-	-	-	-	-

Botanical names	Family	Parts used	Medicine	Edible fruits	Vegetable	Timber	Fiber	Fish-poison	Insecticide	Fodder
D. lorum	Leguminasae	Leaves	+	-	-	-	-	-	-	-
Dillenia indica	Dilleniaceae	Fruits, wood	+	+	+	+	-	-	-	-
Dioscorea alata	Dioscoreaceae	Tubers	+	-	-	-	-	-	-	-
D. bulbifera	Dioscoreaceae	Tubers	+	-	+	-	-	-	-	-
D. pentaphylla	Dioscoreaceae	Tubers	+	-	-	-	-	-	-	-
Elephantopus scabar	Asteraceae	Roots	+	-	-	-	-	-	-	-
Flacourtia jangomas	Flacourtiaceae	Leaves & fruits	+	+	-	-	-	-	-	-
Ficus racemosa	Moraceae	Roots, fruits & latex	+	-	-	-	-	-	-	-
Garcinia cowa	Clusiaceae	Fruits	+	+	-	-	-	-	-	-
G. tictoria	Clusiaceae	Fruits	+	-	-	+	-	-	-	-
Gmelina arborea	Verbenaceae	Leaves & wood	+	-	-	-	-	-	-	-
Gnetum scandens	Gnetaceae	Whole plant	-	+	-	+	-	+	-	-
Hodgsonia microcarpa	Cucurbitaceae	Fruits	+	-	-	-	-	-	-	-
Holarhaena pubescens	Apocynaceae	Barks & seeds	+	-	-	-	-	-	-	-
Houttuynia cordata	Piperaceae	Stem & leaves	+	-	-	-	-	-	-	-
Hiptage benghalensis	Malpighiaceae	Leaves	+	-	-	-	-	-	+	-
Homonoia riparia	Euphorbiaceae	Roots	+	-	-	-	-	-	-	-
Hyptis suaveolens	Lamiaceae	Leaf & seeds	+	-	-	-	-	-	-	-
Imperata cylindrica	Poaceae	Roots	+	-	-	-	-	-	-	-
Kydia calycina	Malvaceae	Leaves & barks	+	-	-	-	+	-	-	-
Lasia spinosa	Araceae	Leaves & roots	+	+	+	-	-	-	-	-
Lantana camara	Verbenaceae	Whole plant	+	-	-	-	-	-	-	-
Leea aequata	Leeaceae	Tubers & leaves	+	-	-	-	-	-	-	-
Leucus indica	Lamiaceae	Leaves	+	-	-	-	-	-	-	-
Magnolia pterocarpa	Magnoliaceae	Wood	-	-	-	+	-	-	-	-
Mimosa pudica	Leguminasae	Whole plant	+	-	-	-	-	-	-	-
Morus australis	Moraceae	Fruits	+	-	-	-	-	-	-	-
Murraya koenigii	Rutaceae	Leaves & barks	+	-	-	-	-	-	-	-
Nymphoea nouchali	Nymphaeaceae	Root & seeds	+	+	-	-	-	-	-	-
N. pubescens	Nymphaeaceae	Roots	+	-	-	-	-	-	-	-
Oroxylum indicum	Bignoniaceae	Roots, barks, leaves, seed	+	-	-	-	-	-	-	-

Botanical names	Family	Parts used	Medicine	Edible fruits	Vegetable	Timber	Fiber	Fish-poison	Insecticide	Fodder
Oxalis corniculata	Oxalidaceae	Whole plant	+	-	+	-	-	-	-	-
Phyla nodiflora	Verbenaceae	Whole plant	+	-	-	-	-	-	-	-
Emblica officinalis	Euphorbiaceae	Fruits	+	+	-	-	-	-	-	-
Polyalthia simiarum	Annonaceae	Wood	-	-	-	+	-	-	-	-
Polygala arvensiss	Polygalaceae	Roots	+	-	-	-	-	-	-	-
Portulaca oleracea	Portulacaceae	Whole plant	+	-	+	-	-	-	-	-
Premna herbaceae	Verbinaceae	Whole plant	+	-	+	-	-	-	-	-
Randia spinosa	Rubiaceae	Barks & roots	+	-	-	-	-	-	+	-
Rauvolfia serpentina	Apocynaceae	Roots	+	-	-	+	-	-	-	-
Rorippa indica	Brassicaceae	Whole plant	+	-	-	-	-	-	-	-
Sloanea sterculiacea var. *assamica*	Elaeocarpaceae	Wood	-	-	-	+	-	-	-	-
Smilax perfoliata	Smilacaceae	Roots	+	-	-	-	-	-	-	-
Solanum nigrum	Solanaceae	Leaves & fruits	+	-	-	-	-	-	-	-
Stellaria media	Caryophyllaceae	Whole plant	+	-	-	-	-	-	-	-
Stephania japonica	Menispermaceae	Roots	+	-	-	-	-	-	-	-
Sterculia urens	Sterculiaceae	Wood-sap	+	-	-	-	-	-	-	-
Streblus asper	Moraceae	Leaves & fruits	+	-	-	-	-	-	-	-
Tamarix dioica	Tamaricaceae	Young-twigs	+	-	-	-	-	-	-	-
Terminalia bellirica	Tiliaceae	Whole plant	+	-	-	-	-	-	-	-
Urena lobata	Malvaceae	Roots	+	-	-	-	-	-	-	-
Vernonia albicans	Asteraceae	Whole plant	+	-	-	-	-	-	-	-
Vitex negundo	Verbinaceae	Whole plant	+	-	-	-	-	-	-	-
Woodfordia fruticosa	Lythraceae	Flower	+	-	-	-	-	-	-	-
Zingiber zerumbet	Zingiberaceae	Rhizome	+	-	-	-	-	-	-	-

ANIMAL - PLANT RELATIONSHIP

The extensive grassland vegetation of the Manas Tiger Reserve provides an ideal habitat for a large number of diverse fauna (higher vertebrates, invertebrates, reptiles and avian). A sum total of 60 mammals have been recorded from the Reserve. Out of which 21 are placed in Schedule I category of the IBWL Act for protection. The important mammals of which the reserve takes pride are the Golden Langur, the Royal Bengal Tiger, the Great Indian one horned Rhinoceros, the Asiatic Buffalo, the Hispid Hare and the Pigmy Hog. Further ca 40 reptiles, ca 312 species of birds; numerous vertebrates and invertebrates have also been recorded from the reserve. Of the total 376 tigers in Assam, 88 are found in the core zone of the Manas (1984 census report). The Bengal Floricans falling

in schedule-I category of birds has a world population of about 400-500, of which ca 80 are recorded from Manas by *Bombay Natural History Society* (1985-1989).

The rich flora of the Tiger reserve not only provides shelter but also food to the herbivorous animals in abundance. The High-grass upland savannah situated along the Indo-Bhutan boundary of the core zone comprises of tall grasses viz. *Vetiveria zizanioides,* species of *Erianthus, Saccharum,* etc. This grassland is the most preferred habitat for the herbivores (Pigmy Hog and the Hispid Hare) because their food is totally dependant on the roots of the grasses. Similarly the Buffalo and the Rhinoceros feed on the leaves of *Alpinia allughas, Hygroryza aristata, Musa* sp., *Saccharum spontaneum, Typha elephantina,* etc. The common Deer besides other grasses feeds on fruit of *Emblica officinalis* in the *Emblica officinalis*-scrub. Further numerous tall trees viz. *Albizia odoratissima, A. procera, Anthocephalus chinensis, Artocarpus chama, Bombax ceiba, Dillenia, Ficus, Syzygium* sp., etc. provide fodder to various mammals particularly the apes and monkeys relish their inflorescence and ripe fruits.

PRESENT STATUS OF MANAS TIGER RESERVE

Although the Manas Tiger Reserve is one of the safest habitats for the common wildlife and for the 18 world's endangered species of Schedule-I category, on the other hand the Reserve has been selected as hideout of extremist organizations. Further, uncontrollable felling of trees and poaching in Panbari and Bhuyanpara range areas, smuggling of timber trees, frequent burning and devastating floods have resulted in the habitat degradation in a large extent thereby forcing the wildlife of Manas to migrate to the neighbouring Bhutan hills. Hence it is of utmost need to check the above few factors in the Manas Tiger Reserve to preserve the wonderful world site from further degradation.

THREATS AND CONSERVATION

The Manas Tiger Reserve being affected by biotic and natural calamities requires utmost attention. The major factors leading to the loss of biodiversity are degradation of habitats due to the devastating floods and insufficient infrastructure. Therefore in order to preserve the unique plant diversity of the reserve the following proposals are of utmost importance as a measure of conservation for proper maintenance and management of the Tiger Reserve.

1. The biodiversity of the Tiger Reserve can be prevented from destruction by creating awareness among all ethnic groups of people in the region.
2. Advance technology such as Remote Sensing with the help of Geographic Information System (G.I.S.) would be helpful to detect the changing pattern of habitats and ecosystem as a whole for proper management of biodiversity.
3. Management of the reserve also demands collaboration with the neighboring country Bhutan as the reserve falls along the Indo-Bhutan border.

ENUMERATION

PTERIDOPHYTES

HUPERZIACEAE

Phlegmariurus phlegmaria (L.) Sen & Sen

SELAGINELLACEAE

Selaginella semicordata (Wall. ex Hook. & Grev.) Spring

EQUISETACEAE

Equisetum diffusum D.Don
E. ramosisimum Desf.

HELMINTHOSTACHYACEAE

Helminthostachys zeylanica (L.) Hook.

ANGIOPTERIDACEAE

Angiopteris evecta (Forst.) Hoffm.

POLYPODIACEAE

Goniophlebium amoenum (Wall. ex Mett.) J. Smith
Leptochilus axillaries (Cav.) Kaulf.

Microsorium puntatum (L.) Copel.
Pyrrosia flocculosa (D.Don) Ching
P. lanceolata (L.) Farw.
P. longifolia (N.L. Burm.) Morton.
P. stigmosa (Sw.) Ching

DIPTERIDACEAE

Dipteris propinqua (Wall. ex Mett.) Sm.

LYGODIACEAE

Lygodium flexuosum (L.) Sw.
L. japonicum (Thunb.) Sw.

CHEILANTHACEAE

Cheilanthus farinosa (Forssk.) Kaulf

CRYPTOGRAMMACEAE

Onchium siliculosum (Desv.) C. Chr.

PTERIDACEAE

Pteris biaurita L.
P. cretica L.
P. ensiformis Burm.f.

ADIANTACEAE

Adiantum caudatum L.
A. philippens L.

ANTROPHYACEAE

Antrophyum reticulatum (Forst.) Kaulf

VITTARIACEAE

Vittaria flexuosa Fee

THELYPTERIDACEAE

Cyclosorus unitus (L.) Ching
Thelypteris multilineata (Wall. ex Hook.) Morton

DENNSTAEDTIACEAE

Drynaria qurcifolia (L.f.) Sm.

Microlepia speluncae (L.) Moore

ASPLENIACEAE

Asplenium nidus L.

NEPHROLEPIDACEAE

Nephrolepis cordifolia (L.) Presl

BLECHNACEAE

Blechnum orientale L.

STENOCHLANAECEAE

Stenochlaena palustre (N.L. Burm.) Bedd.

AZOLLACEAE

Azolla pinnata R.Br.

SALVINIACEAE

Salvinia natans (L.) All. (*S. cucullata* Roxb. ex Bory.)

GYMNOSPERM

Gsnetum scandens Roxb.

ANGIOSPERMS
DOCOTYLEDONS

RANUNCULACEAE

Clematis gouriana Roxb.
Naravelia zeylanica DC.

DILLENIACEAE

Dillenia indica L.
D. pentagyna Roxb.

MAGNOLIACEAE

Kadsura heteroclita Craib
Magnolia pterocarpa Roxb.
M. griffithii Hook. f. & Thomson
M. hodgsoni (Hook. f. & Thomson) H. Keng
Michelia champaca L.
M. doltsopa Buch. - Ham. ex DC.

ANNONACEAE

Desmos dumosus (Roxb.) Safford
Polyalthia jenkinsii Benth. & Hook. f.
P. simiarum (Hook.f. & Thomson) Hook. f. & Thomson.

MENISPERMACEAE

Cissampelos pareira L.
Parabaena sagittata Miers
Stephania japonica (Thunb.) Miers

NYMPHAEACEAE

Nymphaea nouchali Burm. f.
N. pubescens Willd.

BRASSICACEAE

Rorippa indica (L.) Hochr.

CAPPARACEAE

Capparis olacifolia Hook. f. & Thomson
Crataeva magna (Lour.) DC.
C. religiosa Forst.
Cleome gynandra L.

FLACOURTIACEAE

Casearia vareca Roxb.
C. glomerata Roxb.
Flocourtia jangomas (Lour.) Raeusch
Hydnocarpus kurzii (King) Warb.
Xylosma longifolium Clos.

POLYGALACEAE

Polygala arvensis Willd.
P. chinensis L.

PORTULACACEAE

Portulaca oleracea L.

CARYOPHYLLACEAE

Drymaria cordata Willd.
Stellaria media (L.) Vill

HYPERICACEAE

Hypericum japonicum Thunb. ex Murray

CLUSIACEAE

Garcinia acuminata Planch. & Triana
G. cowa Roxb. ex DC.
G. tinctoria (DC.) W.F. Wight
Kayea assonica Prain
Maesua ferrea L.

THEACEAE

Camellia caudata Wall.
Eurya acuminate DC.
Schima wallichii (DC.) Korth.

SAURAUIACEAE

Saurauia napaulensis DC.

DIPTEROCARPACEAE

Dipterocarpus retusus Blume
Shorea assamica Dyer
S. robusta Gaertn.
Vatica lanceaefolia Blume

MALVACEAE

Abelmoschus moschatus Medik.
A. manihot (L.) Medik. sp.
tetraphyllus
var. **pungens** (Roxb.) Hochr.
Abutilon indicum Sw.
Kydia calycina Roxb.
Sida acuta Burm. f.
S. cordata (Burm. f.) Bors. - Walk.
Urena lobata L.

BOMBACACEAE

Bombax ceiba L.

BIXACEAE

Gyriocardia colonata R. Br.

STERCULIACEAE

Abroma angusta (L.) L. f.
Pterospermum acerifolium Willd.
Sterculia villosa Roxb. ex DC.
S. urens Roxb.

BYTTNERIACEAE

Byttneria grandifolia DC.

TAMARICACEAE

Tamarix dioca Roxb.

TILIACEAE

Grewia abutilifolia Vent. ex Juss.
G. denticulata Wall. ex Voigt

G. desperma Rottb.
G. elastica Royle
G. sapida Roxb.
Triumfetta pilosa Roth
T. rhomboidea Jacq.

ELAEOCARPACEAE

Sloanea sterculiacea (Burm.f.) Rehdes & E.H. Wilson var. **assamica** (Benth.) Coodeuem

LINACEAE

Linum usitatissimum L.
Reinwardtia indica Dum.

MALPHIGHIACEAE

Aspidepterys indica (Roxb.) Hochr.
Hiptage benghalensis (L.) Kurz

OXALIDACEAE

Biophytum reinwardtii (Zucc.) Klotz.
B. sensitivum (L.) DC.
Oxalis corniculata L.
O. debilis Kunth var. **corymbosa** (DC.) Lour.

BALSAMINACEAE

Impatiens trilobata Coleb.
I. tripetala Roxb. ex DC.

RUTACEAE

Citrus medica L.
Glycosmis arborea (Roxb.) DC.
Micromelum minutum (Forst. f.) Wight & Arn.
Murraya paniculata (L.) Jack.
M. koenigii (L.) Spreng.
Zanthoxylum acanthopodium DC.

SIMAROUBACEAE

Ailanthus integrifobia Lam.
A. kurzii Hook. f. & Thomson

BURSERACEAE

Canarium strictum Roxb.
Garuga floribunda Decne. var. **gamblei** (King ex Smith) Kalk.
G. pinnata Roxb.

MELIACEAE

Aglaia hiernic King.
Aphanamixis polystachya (Wall.) Parker
Azadirachta indica A. Juss.
Chukrasia tabularis A. Juss.
Dysoxylum binecteriferum Hook. f. & Bedd.
Melia azedarach L.
Toona ciliata Roem.

OLACACEAE

Olax nana Wall.

ICACINACEAE

Natsiatum herpeticum Buch.- Ham. ex Arn.

CELASTRACEAE

Celastrus paniculatus Willd.
Euonymus glaber Roxb.

HIPPOCASTANACEAE

Aesculus assamica Griff.

HIPPOCRATEACEAE

Reissantia arborea (Roxb.) Hara

RHAMNACEAE

Rhamnus napalensis (Wall.) M.A. Lawson
Ventilago denticulata Willd.
Ziziphus funiculosa Buch.-Ham. ex M.A., Lawson
Z. mauritiana Lam.

VITACEAE

Cayratia pedata (Lour.) Juss. ex Gagnep.
C. trifolia (L.) Domin
Cissus adnata Roxb.
C. assamica (Lows.) Craib
C. repens Lam.
Tetrastigma leucostaphylum (Dennst.) Alston
T. planicaulis (Hook. f.) Gagnep.

LEEACEAE

Leea aequata L.
L. alata Edgew.
L. crispa L.

SAPINDACEAE

Allophylus distachys (DC.) Radlk.
A. zeylanicus L.var. **grandifolia** Hiern
Cardiospermum helicacabum L.
Lapisanthes erecta (Thw.)Leenh.
L. erecta (Thw.) Leenh.
L. senegalensis (Juss. ex Poir.) Leenh.
Nephelium mutabile Blume

SABIACEAE

Meliosma pinnata (Roxb.) Walp.
M. simplicifolia (Roxb.) Walp.
Sabia paniculata Edgew.

ANACARDIACEAE

Mangifera sylvatica Roxb.
Pegia nitida Colebr.
Semecarpus anacardium L.f.
Spondias pinnata (L.f.) Kurz

MORINGACEAE

Moringa oleifera Lam.

LEGUMINOSAE PAPILISNOIDEAE

Alysicarpus vaginalis (L.) DC.
Atylosia goensis (Dalz.) Dalz.
A. scarbaeoides (L.) Benth.
Butea monosperma (Lam.) Taub.
Cajanus cajan (L.) Druce.
Clitoria ternatea L.
Crotalaria anagyroides Kunth
C. albida Heyne ex Roth
C. bialata Schrank.
C. pallida Ait.
C. sessiliflora L.
Dalbergia sericea G. Don
D. sissoo Roxb.
Derris marginata Benth.
D. robusta (Roxb. ex DC.) Benth.
Desmodium caudatum (Thunb.) DC.
D. gangeticum (L.) DC.
D. gyroides (Link) DC.
D. heterocarpon (L.) DC.
D. motorium (Houtt.) Merr.
D. pulchellum Benth.
D. triangulare (Retz.) Merr.
D. triflorum (L.) DC.
D. triquetrum DC. ssp. **pseudotriquetrum** (Schin.) Prain
D. velutinum (Willd.) DC.
Flemingia macrophylla (Willd.) Kuntze ex Merr.
F. strobilifera (L.) R. Br.
Indigofera arrecta Hochst. ex A. Rich.
Millettia pachycarpa Benth.
Mucuna bracteata Kurz
M. pruriens (L.) DC.
Pueraria subspicata Benth.
Sportholobus parviforus (DC.) Kuntze
Tephrosia candida DC.
Uraria arboreum (D. Don) G. Don
U. picta Desv.
U. rufescens (DC.) Schindl.
Vigna trilobata (L.)Verd.

LEGUMINOSAE - CAESALPINIOIDAE

Bauhinia acuminata L.
B. purpurea L.
B. scandens L. var. **horsfieldii** (Miq.) Ohashi
B. vahlii Wight & Arn.
B. variegata L.
Caesalpinia bonduc Roxb.
C. pulcherrima G. Don
Cassia alata L.
C. fistula L.
C. hirsuta L.
C. mimosoides L.
C. tora L.
C. occidetalis L.
C. siamea Lam.
Mezoneuron cucullatum (Roxb.) Wight & Arn.

LEGUMINOSAE - MIMOSOIDEAE

Acacia caesia (L.) Willd. var. **subnuda** (Craib.) Niels.
A. catechu Willd.
Albizia lebbek (L.) Benth.
A. odoratissima (L. f.) Benth.
A. procera (Roxb.)Benth.
A. pinnata Dalz. & Gibs.

Entada rheedi Spreng.
ssp. **sinohimalensis** Grierson & Long
Mimosa pudica L.
M. rubicaulis Lam. subsp. **himalayana** (Gamble) Ohashi

ROSACEAE

Photinia integrifolia Lindl.
Rubus paniculatus Sm.

HYDRANGEACEAE

Hydrangea robusta Hook.f. & Thomson

COMBRETACEAE

Combretum alatum Craib
Combretum roxburghii Spreng.
Terminalia arjuna (DC.) Wight & Arn.
T. bellirica (Gaertn.) Roxb.
T. chebula Retz.

BARRINGTONIACEAE

Careya arborea Roxb.

RHIZOPHORACEAE

Carallia branchiate (Lour.) Merr.

MYRTACEAE

Syzygium cumini (L.) Skeels
S. formosum (Wall.) Masam.
S. oblatum (Roxb.) Wall. ex A.M. Cowan & J.M. Cowan

MELASTOMATACEAE

Melastoma malabathricum L.
Osbeckia nepalensis Hook.
O. nutans Triana
O. rostrata D. Don var. **pulchella** Benth.

LYTHRACEAE

Lagerstroemia parviflora Roxb.
L. reginae Roxb.
L. speciosa (L.) Pers.

Woodfordia fruticosa (L.) Kurz

SONNERATIACEAE

Duabanga grandiflora (Roxb. ex DC.) Walp.

ONAGRACEAE

Fissendocarpa linifolia (Vahl) Bennet
Ludwigia octovalvis (Jacqem.) Raven
L. octovalvis (Jacqem.) Raven ssp. **sessiliflora** (Mik.) Raven
L. prostrata Roxb.

PASSIFLORACEAE

Adenia trilobata (Roxb.) Engl.
Passiflora foetida L.

CUCURBITACEAE

Brynopsis laciniosa L.
Coccinia grandia Voigt
Gymnopetalum cochinchinensis (Lour.) Kurz
Hodgsoria macrocarpa Cogn.
Luffa cylindrica (L.) Roem.
Melothria heterophylla (Lour.) Cogn.
M. maderaspatana (Lour.) Cogn.
Momordica dioica Roxb. ex Willd.
Trichosanthes bracteata (Lam.) Voigt

TETRAMELACEAE

Tetrameles nudiflora R.Br.

MOLLUGINACEAE

Mollugo pentaphylla L.

BEGONIACEAE

Begonia barbata Wall. ex DC.
B. cathcartii Hook. f. & Thomson

APIACEAE

Centella asiatica (L.) Urban
Hydrocotyle javanica Thunb.
Oenanthe benghalensis Benth.
O. javanica (Blume) DC.

ALANGIACEAE

Alangium chinense (Lour.) Harms

Tropical Evergreen Vegetation along the River Jia-Bhoreli

CAPRIFOLIACEAE

Lonicera macrantha (D. Don) Spreng.

SAMBUCACEAE

Sambucus javanica Blume

RUBIACEAE

Anthocephalus chinensis (Lam.) A. Rich. ex Wall.
Borreria articularis (L. f.) F. N. Williams
Catunaregam spinosa (Thunb.) Tiruv.
Coffea benghalensis Heyne ex Roem. & Schult.
Fagerlindia fasciculata (Roxb.) Tiruv.
Halolinia cordifolia (Roxb.) Ridsdale
Hedyotis scandens Roxb.
H. costata (Roxb.) Kurz
H. tenelliflora Blume
Ixora acuminata Roxb.
Knoxia corymbosa Willd.
Meyna spinosa Roxb. ex Link
Mussenda roxburghii Hook. f.
M. incana Wall.
Paederia foetida L.
P. scandens (Lour.) Merr.
Pavetta indica L.
Randia cochinchinensis (Lour.) Merr.
R. spinosa (L.f.) Poir.
Uncaria macrophylla Wall.
U. sessilifructus Roxb.
Wendlandia grandis (Hook. f.) Cowan
W. tinctoria (Roxb.) DC.

ASTERACEAE

Ageratum conyzoides L.
Artemisia nilagirica (C.B. Clarke) Pampan.
Bidens biternata (Lour.) Merr. & Scherff
B. pilosa L.
Blumea fistulosa (Roxb.) Kurz
B. lanceolaria (Roxb.) Druce
B. sessiliflora Decne.
Chromolaena odorata (L.) King & Robinson
Cotula hemispherica (Roxb.) Wall. ex C.B. Clarke
Crassocephalum crepidioides (Benth.) S. Moore
Elephantopus scaber L.
Eupatorium odoratum L.
Gnaphalium pensylvanicum Willd.

G. purpureum L.
Mikania cordata (Burm.f.) B.L. Rob.
Senecio sisymbriformis DC.
Sonchus asper Hill.
Spilanthes paniculata Wall. ex DC.
Syndrella nodiflora (L.) Gaertn.
Vernonia cinerea (L.) Lees. var. **cineria**
var. **hispida** (Blume) Koster.
V. cinerea (L.) Lees. var. **linifolia** (Blume) Koster.
V. saligna DC.
Wedelia wallichii Less.
Xanthium indicum Koen.

LOBELIACEAE

Lobelia montana Reinw. ex Blume

MYRSINACEAE

Ardisia solanacea Roxb.
Maesa indica (Roxb.) A. DC.

OLEACEAE

Jasminum amplexicaule Buch.- Ham. ex G. Don
J. multiflorum (Burm.f.) Andr.
J. sambac (L.) Ait.
Olea dioica Roxb.

APOCYNACEAE

Allamanda cathartica L.
Alstonia scholaris R.Br.
Holarrhena pubescens (Buch. - Ham.) Wall. ex G. Don
Ichnocarpus frutiscens (L.) R. Br.
Rauvolfia serpentina Benth. ex Kurz
Tabernaemontana divaricata (L.) Roem. & Schult.

ASCLEPIADACEAE

Calotropis acia Buch.-Ham.
C. gigantea Dryand
Cryptolepis buchanani Roem. & Schult.
C. sinensis (Lour.) Merr.
Holostemma annulare (Roxb.) K. Schum.
Marsdenia tenacissima (Roxb.) Moon

BUDDLEJACEAE

Buddleja asiatica Lour.

GENTIANACEAE

Exacum teres Wall.
Nymphoides cristata (Roxb.) Kuntze

STRYCHNACEAE

Strychnos quintuplinervis A. W. Hill

HYDROPHYLLACEAE

Hydrolea zeylanica (L.) Vahl

CORDIACEAE

Cordia dichotoma Forst.f.

BORAGINACEAE

Cynoglossum glochidiatum Wall. ex Benth.
C. zeylanicum (Vahl ex Hornem.) Thunb. ex Lehm.

CONVOLVULACEAE

Argyreia argentea (Roxb.) Choisy
A. nervosa (Burm. f.) Bojer
A. roxburghii Choisy
Ipomoea aquatica Forssk.
I. carnea Forst. f.
Merremia umbellata (L.) Hall. f.
M. vitifolia (Burm. f.) Hall. f.
Porana paniculata Roxb.

CUSCUTACEAE

Cuscuta reflexa Roxb.

SOLANACEAE

Capsicum annuum L.
C. frutescens L.
Datura metal L.
Nicandra physaloides (L.) Gaertn.
Physalis peruviana L.
P. minima L.
Solanum aculeatissimum Jacq.

S. nigrum L.
S. incanum Kit ex Schult.
S. torvum Sw.

SCROPHULARIACEAE

Limnophila chinensis (Osbeck) Merr.
L. hetrophylla Benth.
L. indica (L.) Druce
L. sessiliflora (Vahl) Blume
Lindera crustacea (L.) F. Muell.
Lindernia cordifolia (Colsm.) Merr.
L. montana (Blume) Koord.
Torenia asiatica L.
T. diffusa D. Don

GESNERIACEAE

Aeschynanthus bracteatus Wall. ex DC.
Chirita mishmiensis Debb. & Biswas

BIGNONIACEAE

Oroxylum indicum (L.) Vent.
Radermachera gigantea (Blume) Miq.

ACANTHACEAE

Adhatoda zeylanica Medik.
Andrographis paniculata Nees
Barleria cristata L.
Dicliptera roxburghii Nees
Eranthemum nervosum (Vahl) R. Br.
Hygrophylla polysperma (Roxb.) T. Anderson
Goldfussia discolor Nees
Justicia simplex D. Don
Lepidagathis incurva Buch. - Ham. ex D. Don
Phaulopsis dorsiflora (Retz.) Santapau
Phlogacanthus thyrsiflorus (Roxb.) Nees
Rungia repens Nees
R. parviflora Nees
Thunbergia coccinea Wall.
T. grandiflora (Roxb. ex Rottl.) Roxb.

VERBENACEAE

Callicarpa arborea Roxb.
C. macrophylla Vahl
Clerodendrum colebrookianum Walp.
C. indicum (L.) Kuntze
C. fragrans Willd.
C. kaempferi (Jacq.) Seib. ex Steud.
C. serratum (L.)Moon
C. viscosum Vent.
Gmelina arborea Roxb.
Holmskioldia sanguinea Retz.
Lantana camara L. var. **aculeata** (L.) Moldenke
Phyla nodiflora (L.) Green
Premna bengalensis C. B. Clarke
P. cordifolia Roxb.
P. herbacea Roxb.
P. latifolia Roxb.
Pygmaeopremna herbacea (Roxb.) Moldenke
Vitex glabrata R. Br.
V. negundo L.

LAMIACEAE

Acrocephalus hispidus (L.) Nicol. & Steud.
Ajuga macrosperma Wall. ex Benth.
Anisochilus indica (L.) Kuntze
Hyptis suaveolens (L.) Poir.
Leucas indica (L.)R. Br.
Ocimum gratissimum L.
Orthodon scaber (Thunb.) Hand.-Mazz.
Pogostemon benghalense (Burm. f.) Kuntze
P. auricularis (L.) Hassk.
Plectranthus ternifolius Don

PLANTAGINACEAE

Plantago erosa Wall.

AMARANTHACEAE

Achyranthes aspera L.
A. bidentata Blume
Aerva sanguinolenta (L.) R. Br.
A lternanthera philoxeroides Griseb.
A. sessilis (L.) R. Br.
Amaranthus gracilis Desf.
A. spinosus L.
Celosia argentea L.
Cyathula prostrate (L.) Blume
Deeringia amaranthoides (Lam.) Merr.

NYCTAGINACEAE

Boerhavia diffusa L.

POLYGONACEAE

Fagopyrum esculentum Moench
Persicaria capitata (Buch.-Ham. ex D. Don) H. Gross
P. chinensis (L.) H. Gross
P. hydropiper (L.) Spach.
P. posumbu (Buch.-Ham. ex D.Don) H. Gross
P. strigosum (R. Br.) Nakai
Polygonum auriculatum Meissn.
P. barbatum L.
P. perfoliatum L.

ELAEGNACEAE

Elaegnus pyriformis Hook.f.

ARISTOLOCHIACEAE

Aristolochia bracteolata Lam.

PIPERACEAE

Houttuynia cordata Thunb.
Peperomia pellucida (L.) Kunth
Piper acutistigmum C. DC.
P. diffusum Vahl
P. longum L.
P. pedicellosum Wall.

SAURURACEAE

Houttuynia cordata Thunb.

LORANTHACEAE

Macrosolen cochinchinensis (Lour.) van Tiegh.

CHORANTHACEAE

Chloranthus elatior R. Br.
C. glaber (Thunb.) Makino

LAURACEAE

Actinodaphne obovata (Nees) Blume
Beilschmeidia assamica Meissn.
B. branolisii Hook. f.
Cinnamomum tamala (Buch.-Ham.) Nees & Eberm.
Litsea glutinosa (Lour.) C.B. Robins.
L. monopetala (Roxb.) Pers.
L. salicifolia (Roxb. ex Nees) Hook. f.
Machilus villosa Hook.f.
Phoebe attenuata (Nees) Nees
P. cooperiana P. C. Kanj. & Das
P. goalparensis Hutch.

THYMELAEACEAE

Aquilaria malaccensis Lam.

ELAEAGNACEAE

Elaeagnus parvifolia Wall. ex Royle
E. pyriformis Hook. f.

LORANTHACEAE

Dendrophthoe falcata (L. f.) Etting.
Loranthus falcatus L. f.
Tolypanthus involucratus (Roxb.) Blume
Viscum nepalense Spreng.

SANTALACEAE

Osyris quadripartita Salzm. ex Decne.

BALANOPHORACEAE

Balanophora dioica Royle

EUPHORBIACEAE

Actephila excelsa (Dalz.) Muell. Arg.
Antidesma bunius (L.) Spreng.
A. diandrum (Roxb.) Roth
A. ghaesembilla Gaertn.
Aporusa oblonga Muell. Arg.
Baliospermum calycinum Muell. Arg.
Breynia rhomnoides Muell. Arg.
B. monoica (Lour.) Merr.
B. montana Wall.
B. stipularis (L.) Blume
Chamaesyce hirta (L.) Millsp.
Croton caudatus Geisel.
C. joufra Roxb.
C. roxburghii N.P. Balakr.
Emblica officinalis Gaertn.
Euphorbia hirta L.
Glochidon assamicum Hook. f.
G. oblatum Hook. f.

Homonoia riparia Lour.
Macaranga denticulata (Blume) Muell. Arg.
Mallotus philippensis (Lam.) Muell. Arg.
Phyllanthus debilis Willd.
P. simplex Retz.
P. urinaria L.
P. virgatus Forst. f.
Ricinus communis L.
Sapium baccatum Roxb.
Sauropus androgynus (L.) Merr.
Securinega virosa (Roxb. ex Willd.) Baill.
Trewia nodiflora L.
T. polycarpa Benth.

BISCHOFIACEAE

Bischofia javanica Blume

ULMACEAE

Celtis tetrandra Roxb.
Trema orientalis (L.) Blume

CANNABACEAE

Cannabis sativa L.

MORACEAE

Artocarpus chaplasha Roxb.
A. chama Buch. - Ham.
A. heterophyllus Lam.
A. gomezianus Wall.
Ficus altissima Blume
F. auriculata Lour.
F. curtipes Corner
F. gasparriniana Miq.
F. geniculata Kurz
F. heterophylla L.f. var. **assamica** (Miq.) Corner
F. hispida L.f.
F. racemosa L.
F. rumphil Blume
F. semicordata Buch.- Ham. ex Sm.
Morus indica L.
Streblus asper Lour.

URTICACEAE

Boehmeria malabarica Wedd.
B. platyphylla D. Don
B. macrophylla Hornem.
Debregeasia longifolia (Burm. f.) Wedd.
Elatostema platyphyllum Wedd. var. **platyphyllum**
E. sessile Forst.
Pilea glabrrima (Blume) Blume
P. scripta (Buch.-Ham. ex D. Don) Wedd.
Poikilospermum naucleiflorum (Lindl.) Chew
Pouzolzia bennettiana Wight
P. pentandra Benn.
P. zeylanica (L.) Benn.
Sarcochalmys pulcherrima (Roxb.) Gaud.
Urtica parviflora Roxb.

FAGACEAE

Quercus lanceaefolia Roxb.

CERATOPHYLLACEAE

Ceratophyllum demersum L.

MONOCOTYLEDONS

HYDROCHARITACEAE

Ottelia alisnoides (L.) Pers.
Vallisnaria spiralis L.

ORCHIDACEAE

Acampe papillosa Lindl.
Aerides multiflora Roxb.
A. odorata Lour.
A. rosea Lodd. ex Paxt.
Anoectochilus roxburghii (Wall.) Lindl.
Esmeraldacathcartii (Lindl.) Reichb. f.
E. clarkei Reichb.f.
Arundina graminifolia (D.Don) Hochr.
Bulbophyllum careyanum (Hook.) Spreng.
B. devangiriensis Balkr.
B. ornatissimum (Reichb.f.) Sm.
B. reptans (Lindl.) Lindl.
B. viridiflorum (Hook.f.) Schltr.
Calanthe angusta Lindl.
C. densiflorum Lindl.
Ceratostylis subulata Blume
Cheirostylis pusilla Lindl.
Chiloschista lunifera (Reichb. f.) Sm.
Cleisotoma appendiculatus (Lindl.) Hook. f.

C. subulatum Blume
C. fuscescens Lindl.
C. prolifera Lindl.
Cymbidium aloifolium (L.) Sw.
C. dayanum Reichb.f.
C. eburneum Lindl.
Dendrobium aciniciforme Roxb.
D. anceps Sw.
D. aphylum (Roxb.) C.E.C. Fisch.
D. cathcartii Hook.f.
D. fimbriatum Hook.f.
D. lindleyi Steud.
D. moschatum Griff.
D. nobile Lindl.
D. sulcatum Lindl.
Eria acervata Lindl.
E. discolor Lindl.
E. pannea Lindl.
E. lariopetala (Willd.) Ormeroo
E. tomentosa Lindl.
E. stricta Lindl.
Eulophia manii Hook.f.
Flickingeria fugax (Reichb.f.) Seid.
Gastorchilus inconpicuus (Hook.f.) Kuntze
Goodyera procera (Ker-Gawl.) Hook.
Geodorum densiflorum Schlter.
Habenaria rubens (Lindl.) Benth. ex Hook.f.
Liparis assamica King & Pantl.
L. delicatula Hook.f.
L. viridiflora (Blume) Lindl.
Oberonia iridifolia (Roxb.) Lindl.
O. myriantha Lindl.
Otochilus porrectus Lindl.
Paplionanthe teres (Roxb.) Schult.
Peristylus constrictus Lindl.
Phaius mishmensis (Lindl. ex Paxton) Reichb. f.
P. tancervilleae (Banks ex L' Herit.) Blume
Phalanopsis manii Reichb. f.
Pholidota articulata Lindl.
P. imbricata (Roxb.) Lindl.
P. rubra Lindl.
Pleione maculata (Lindl.) Lindl.
P. praecox (Sm.) D.Don
Rhynchostylis retusa Blume
Smitinandia micrantha (Lindl.) Holtt.
Zeuxine clandestina Blume
Z. longilabris Thimen
Z. strateumatica Schlter

ZINGIBERACEAE

Alpinia allughas (Retz.) Rosc.
A. nigra (Gaertn.) Burtt.
Amomum aromaticum Roxb.
A. dealbatum Roxb.
Costus speciosus (Koen.) Sm
Curcuma aromatica Salisb.
Curcumorpha longiflora Rao & Verma
Globba clarkei Baker
Parakaemferia synantha Rao & Verma
Zingiber capitatum Roxb.
Z. perpureum Rosc.
Z. rubens Roxb.
Z. zerumbet (L.) Sm.

MARANTACEAE

Phrynium capitatum Willd.
P. pubinerve Blume

CANNACEAE

Canna coccinea Mill.

MUSACEAE

Ensete glaucum (Roxb.) Cheesman
Musa velutina Wendl. & Drude
M. ornata Roxb.

HYPOXIDACEAE

Curculigo capitulata (Lour.) Kuntze
C. orchioides Gaertn.

AGAVACEAE

Dracaena angustifolia Roxb.

TACCACEAE

Tacca integrifolia Ker-Gawl.
T. laevis Roxb.

DIOSCOREACEAE
Dioscorea alata L.
D. belophylla (Prain) Voigt ex Haines
D. bulbifera L.

D. glabra Roxb.
D. hamiltonii Hook.f.
D. hispida Dennst.
D. pentaphylla L.

LILIACEAE

Asparagus racemosus Willd.
Chlorophytum arundinaceum Baker
Disporum cantoniense (Lour.) Merr.
Ohiopogon intermedius D.Don

SMILACACEAE

Smilax perfoliata Lour.

PONTEDERIACEAE

Monochoria hastata (L.) Solms
Eichhornia crassipes (Mart.) Solms

TYPHACEAE

Typha elephantina Roxb.

COMMELINACEAE
Aclisia subumbellata (C.B. Clarke) C.B. Clarke
Amischotolype mollissima (Blume) Hassk.
Aneilema scabarrimum Kunth
Commelina appendiculata C.B. Clarke
C. diffusa Burm.f.
C. longifolia Lam.
C. paludosa Blume var. **paludosa**
C. suffruticosa Blume
Floscopa scandens Lour.
Murdannia nudiflora (L.) Brenan
M. elata (Vahl) Bruck.
Pollia hasskarlii Roxb.

ARECACEAE

Calamus erectus Roxb.
C. floribundus Griff.
Caryota urens L.
Livistonia jenkinsiana Griff.
Pinanga gracilis (Roxb.) Blume

ARACEAE

Arisaema nepanthoides Mart.
Cryptocoryne retrospiralis Fisch.
Lasia spinosa (L.) Thwaites
Pothos scandens L.
Rhaphidophora grandis Schott
R. hookeri Schott

CYPERACEAE

Cyperus brevifolius (Rottb.) Hassk.
C. compactus Retz.
C. comressus L.
C. cyperoides (L.) Kuntz
C. cyperoides var. **evolutor** (C.B. Clarke) Kuken
C. cyperoides var. **bengalensis** (C.B. Clarke) Kuken
C. diffusus Vahl
C. diffusus Vahl ssp. **macrostachyus** Boeck
C. digitatus Roxb.
C. distans L. f.
C. exaltatus Retz.
C. haspan L.
C. iria L.
C. kyllingia Endl.
C. pilosus Vahl
C. sanguinolentus Vahl
Eleocharis acutangula (Roxb.) Schult.
E. atropurpurea (Retz.) J. Presl & K. Presl
Fimbristylis dichotoma (L.) Vahl
F. schoenoides (Retz.) Vahl
Hypolytrum nemorum (Vahl) Spreng.
Scirpus juncoides Roxb.
S. laevis Retz.
Scleria terrestris (L.) Fass

POACEAE

Apluda mutica L.
Arundinella bengalensis (Spreng.) Druce.
A. decempedalis (Kuntze) Janaws.
A. nepalensis Trin.
A. setosa Trin.
A. villosa Arn. ex Steud.
Arundo donax Georgi
Bambusa arundinacea Ait.
B. balcooa Roxb.
B. bambos (L.) Voss.
B. nutans Wall. ex Munro
B. tulda Roxb.
B. vulgaris Nees
Brachiaria distachya (L.) Stapf
Cephalostachyum pallidum Munro
Capillipedium assimile (Steud.) A. Camus

Chrysopogon aciculatus (Retz.) Trin.
Cymbopogon exertus (Hack.) A. Camus
Cynodon dactylon (L.) Pers.
Crytococcum accrescens (Trin.) Stapf
C. oxyphyllum (Steud.) Stapf
Dactyloctenium aegyptium (L.) P. Beauv.
Dendrocalamus hamiltonii Nees & Arn. ex Munro
D. hookeri Munro
D. longispathus Kurz
Digitaria abludens (Roem. & Schult.) Veldk.
D. ciliaris (Retz.) Koel.
D. longiflora (Retz.) Pers.
D. setigera Roth et Roem. & Schult.
D. violescens Link
Echinochloa colona (L.) Link
Elusine indica (L.) Gaertn.
Eragrostis pilosa (L.) P. Beauv.
E. tenella (L.) P. Beauv.
Erianthus longisetosus T. Anderson
Hemarthia compressa (L. f.) R. Br.
H. protense Steud.
Imperata cylindrica (L.) P. Beauv.
Microstegium ciliatum (Trin.) A. Camus
Narenga porphyrocoma (Hance)Bor
Neyraudia reynaudiana (Kunth) King. ex Hitch.
Oplismenus burmanii (Retz.) P. Beauv.
O. compositus (L.) P. Beauv.
O. megaphyllus Stapf ex Haines
Panicum aurium Presl ex Nees
P. brevifolium L.
P. conjugatum Berg.
P. longifolium Roxb.
P. notatum Retz.
P. paludosum Roxb.
P. sarmentosum Roxb.
P. orbiculare Forst.
P. walense Mez
Paspalum longifolium Roxb. var. **lorishachis** Bor
Phragmites karka (Retz.) Trin. ex Steud.
Pogonatherum crinitum (Thunb.) Kunth
P. paniceum (Lam.) Hack.
Rottbollia exaltata L. f.
Saccharum arundinaceum Retz.

Shorea robusta - plantation in the Reserve

S. spontaneum L.
S. longisetosum (Ander) Narayan ex Bor
S. procerum L.
S. avennae Bleb.
Sclerostachya fusca (Roxb.) A. Camus
Setaria palmifolia (Koenig) Stapf
S. pumila (Poir.) Roem. & Schult.
Sporobolus indicus (L.) R. Br. var. **diandra** (Retz.) Jov.
S. indicus (L.) R. Br. var. **fertilia** (Steud.) Jov.
Themeda subericans (Nees ex Steud.) Ridley
T. arundinacea Hack
T. villosa (Poir.) A. Camus
Thysanolaena maxima (Roxb.) Kuntze
Vetiveria zizanoides (L.) Nash.

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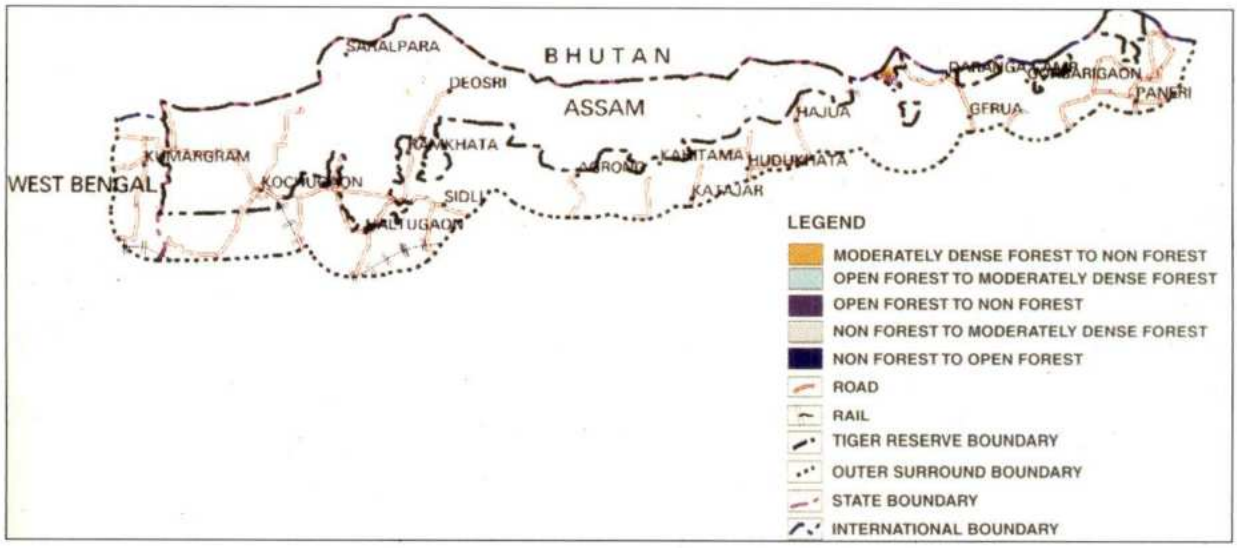

Map of Manas Tiger Reserve, Assam

SALIENT FEATURES

Area

Core	:	520 sq km
Buffer	:	2317 sq km
Total	:	2837 sq km
Longitude	:	89°51' to 91°56' East
Latitude	:	26°29' to 26°54' North
Altitude	:	61m to 110 m above M.S.L.
Rainfall	:	333 cm

Temperature

Minimum : 15°C
Maximum : 37°C

Seasons

Monsoon : June - September
Winter : December - February
Summer : March - May

HIGHWAYS

The National Highway No.31 adjoins Barpeta Road which happens to be the headquarters of Manas Tiger Reserve. The nearest point on the southern boundary of Manas National Park is 22 km from the N. H., and 19 km from the town itself.

PLACES NEARBY

The state capital Guwahati is barely 176 km from Manas. It is a historical city formerly known as Pragjyotishpur. Situated on the banks of the mighty Brahmaputra, it is famous for the temple of Goddess Kamakhya, the shrine of Shakti worship built by the Koch king Naranarayan.

Orang and Pabitora are two wildlife sanctuaries worth visiting. The one-horned rhino *(Rhinoceros unicornis)* and various species of deer abound here.

The town of Hajo (25 km west of Guwahati) is a sacred place for Hindus, Muslims and Buddhists. The town also boasts of the Hayagriba Madhava Temple, accessible via a long stone stairway. Hajo and the adjacent Sarthebari village are renowned for their bell metal work.

The nearby town Barpeta is notable for the monastery and shrine dedicated to the Vaishnavite saint, Sankardeva.

REACHING THERE

Manas Tiger reserve is 176 km from Guwahati, from where one can drive down to the park. The journey lasts approximately five and a half hours. The nearest rail junction is at Barpeta Road, 136 km from Guwahati. Guwahati in turn is a well-connected rail junction as well as an airport. The regular bus services to the park by the state transport as well as the private operators is yet another option.

Nameri Tiger Reserve

SS Begum, S Phukan, NN Rabha & TM Hynniewta
Botanical Survey of India, Eastern Circle, Shillong-793003

Nameri Tiger Reserve was declared as Tiger Reserve on 1st March 2000. It is situated in the Sonitpur district of Assam along the foothills of Eastern Himalayas. The reserve lies between lat. 26°48'-27°03'N and long. 92°38'-93°04'E and covers an area of 344 sq km. There are two sections -a core zone of 200 sq km as Nameri National Park and other section is buffer zone with 144 sq km. In this reserve east buffer is felling towards Nauduar Reserve Forest and extended upto Ghiladhari River with 80 sq km and west buffer with Balipara Reserve Forest and is falling upto Balipara-Bhalukpong Railway line with 64 sq km. It is surrounded by Pakke Tiger Reserve of Arunachal Pradesh in the north and well demarcated by Inter-state boundary of Assam-Arunachal Pradesh. Southern boundary with the old course of Bardikorai River. Due to its unique geographical location the reserve supports a rich floral as well as faunal diversity. It is famous for the good population of endangered bird species White Winged Wood Duck *(Cairina scutulata)*. Besides, other animals viz. Elephant, Indian Bison, Tiger, Leopard, Clouded Leopard, Pangolin, Indian Wild Dog, Civet Cat, Capped Languor, Jackal are also found. According to 2000 census 26 tigers are found in this reserve. It also provides a suitable elephant corridor to nearby Arunachal Pradesh. It is also an abode of a number of birds and fishes. The rich vegetation with diverse plant species of the reserve provides fodder, shelter and camouflage for this wildlife.

The present communication on the botany of Nameri Tiger Reserve deals with the vegetation types, economically important plant species which are found in the reserve. It also highlights the animal and plant relationships, threats and conservation aspects of the reserve.

Geomorphology : Nameri Tiger Reserve consists of plains and hilly areas. Altitude varies from 100-275 m above mean sea level. The reserve is criss-crossed by the river Jia-Bhoreli and its tributaries namely Diji, Dinai, Doigurung, Nameri, Khari etc. A few perennial water bodies are also present in the area (Anonymous, 1999). The soil of the reserve is composed of clay loam with fine sand.

Climate: The reserve is especially influenced by typical monsoon climate. Climate can be broadly divided into three seasons-summer season from March to May. Rainy season from June to October. Winter from November to February.

The average annual rainfall ranges between 2500-3100 mm with heavy precipitation during the month of May to July.

The mean annual temperature ranges from 6°-40° C (as recorded from 1997-2000) and the average relative humidity varies from 73%-96% respectively.

GENERAL ACCOUNT OF VEGETATION

Vegetation of Nameri Tiger Reserve is mainly composed of tropical elements. The vegetation types can broadly be classified as -

1. Tropical evergreen forest
2. Tropical semievergreen forest
3. Tropical moist desiduous forest

4. Riparain forest
5. Grassland

1. Tropical evergreen forest: This type of forest is found in the hilly regions of the reserve. Tree species like *Altingia excelsa, Artocarpus chama, A. lacucha, Canarium bengalense, Dysoxylum binectariferum, Mesua ferrea, Stereospermum chelonoides, Vatica lanceaefolia* form the main canopy and primarily dominate this forest type. Smaller trees and shrub species including *Bauhinia purpurea, Cinnamomum bejolghota, Jxora acuminata, Saurauia roxburghii, Pavetta indica* are also common. Various climbers and lianas like *Acacia caesia* var. *subnuda, Pothos scandens, Thunbergia grandiflora, Combretum alatwn, Poikilospermum suaveolens* are associated with the trees. Several species of Pabn like *Calamus* spp. and *Pinanga gracilis* are common in damp slopes. Along the river bank *Cyathea gigantea* and *Angiopteris evecta* are commonly found.

2. Tropical semi evergreen forest: Tropical semi-evergreen forest is the most common type of forest found in the reserve. The common tree species in this forest type are *Albizia lebbeck, A. procera, Dittenia indica, Gmelina arborea, Magnolia hodgsonii, Phoebe goalparensis, Toona cttiata, Tetrameles nudiflora, Sterculia villosa,* etc. Other small tree species are *Bauhinia purpurea, Callicarpa arborea, Mallotus philippensis* also grow profusely in this forest. Epiphytic plants such as *Aeschynanthus parasiticus, Asplenium nidus, Cymbidium aloifolium, Dendrobium aphyttum, D. moschatum, Hoya parasitica* are commonly available in most of these tree species. The undergrowth of this forest is very rich and diverse. Species like *Alpinia nigra, Clerodendrum viscosum, Coffea bengalensis, Costus speciosus, Holmskioldia sanguinea, Leea crispa, Litsea* spp., *Morinda angustifolia, Phlogacanthus thyrsiflorus* are very common

3. Tropical moist deciduous forest: Moist deciduous forest is dominated by many species like *Bischofia javanica, Bombax ceiba, Dalbergia sissoo, Duabanga grandiflora, Lagerstroemia speciosa, Pterospermum acerifolium, Pterygota alata, Sterculia villosa, Trewia nudiflora, Zizyphus mauritiana,* etc. *Antidesma acidum, Buddleja asiatica, Clerodendrum serratum, C. viscosum, Litsea salicifolia, Maesa indica, Mussaenda roxburghii,* etc. are also growing in association with these tree species. Here *Mikania micrantha, Dioscorea pentaphylla, Smilax perfoliata, Stephania japonica,* etc. are found to associate with the tree and shrub species. The ground cover is mainly composed of under shrubs, herbs with different fern species. Characteristic floristic elements of the ground cover are *Ageratum conyzoides, Alternanthera sessilis, Impatiens tripetala, Chenopodium album, Cassia sophera, Solanum torvum, Spilanthes panicutata, Urena lobata,* etc. Fern species commonly found in this forest are *Diplazium esculantum, Pteridium aquilinum, Equisetum* sp.

4. Riparain forest: As the reserve is criss -crossed by many rivers, the riparian forest are primarily confined to various riverbanks and dominated by species like *Albizia lebbeck, Alstonia scholaris, Bischofia javanica, Bombax ceiba, Dalbergia sissoo, Dillenia indica, Duabanga grandiflora, Lagerstroemia speciosa* are found along with *Leea asiatica, Homonoia reparia, Alpinia nigra, Typha elephantina* and *Tamarix dioica.* Various grass species are also common in this forest.

5. Grassland: The common grass species that are growing abundantly are *Arundo donax, Imperata cylindrica, Phragmites karka, Saccharum spontaneum, Axonopus compressus, Thysanolaena maxima, Fimbristylis dichotoma, Cyperus rotundus, Cyperus halpan, Carex fuscifructus.* Several tree species like *Bombax ceiba, Alstonia scholaris, Lagerstroemia speciosa, Sterculia villosa* and *Zizyphus mauritiana* can also be seen in the grassland.

INTERESTING ELEMENTS OF NAMERI TIGER RESERVE

The flora of Nameri Tiger Reserve is enriched by the presence of rare, endangered and endemic plant

species of India. The information pertaining to these plants have been gathered from the available literatures published by Assam Science Society and Botanical Survey of India for Flora of Assam (Baishya 1999). Some rare, endangered and endemic plants of the reserve are mentioned here- *Acorus calamus, Aquilaria malaccensis, Costus speciosus, Cyathea gigantea, Livistona jenkinsiana, Phoebe goalparensis, Tacca laevis,* etc.

ECONOMICALLY IMPORTANT PLANTS OF NAMERI TIGER RESERVE

The flora of Nameri Tiger Reserve contains several plant species which possess economic potential. These economically important plant resources are mentioned below :

1. Wild edible plants: Several edible plants are found in this reserve. Various animal and bird species depend on the plants for their food. The most common plants are *Antidesma acidum, Artocarpus chama, A. lacucha, Dillenia indica, Melastoma malabathricum, Emblica officinalis, Solanum nigrum, Syzygium cumini, Ziziphus mauritiana, Alocasia fornicata, Alternanthera sessilis, Chenopodium album, Colocasia esculenta, Oxalis corniculata* etc.

Musa velutina - in fruiting condition

2. Plants for timber and wood work: Many plant species yield valuable timber e.g. *Albizia lebbeck, Altingia excelsa, Artocarpous chama, Dalbergia sissoo, Gmelina arborea, Tectona grandis, Mesua ferrea, Bombax ceiba, Bischofia javanica, Duabanga grandiflora, Phoebe goalparensis, Sterculia villosa, Toona ciliata, Tetrameles nudiflora,* etc.

3. Plants for fibers, dye, thatching and mats: Many species provides fibres for common use e.g. *Bombax ceiba, Imperata cylindrica, Sida acuta, S. rhombifolia, Sterculia villosa,, Urena lobata,* etc. Buds of *Magnolia hodgsonii* are used for dye. *Imperata cylindrica* and *Vetiveria zizanioides* are used for thatching.

4. Medicinal plants: A good number of medicinal plants are found in the reserve. Some of the commonly used medicinal plants are *Acorus calamus, Ageratum conyzoides, Alstonia scholaris, Amaranthus spinosus, Centalla asiatica, Clerodendrum colebrokianum, Costus speciosus, Dillenia indica, Eclipta prostrata, Litsea glutinosa, Paederia foetida, Emblica officinalis, Sida rhombifolia, Spilanthes paniculata, Streblus asper, Terminalia bellirica, Vitex negundo,* etc.

ETHNOBOTANICALLY IMPORTANT PLANTS

There are many forest villages in Nameri Tiger Reserve. Several tribal communities are living in these villages. The important tribes are *Mishing* (earlier known as *Miri) Garo, Karbi* (earlier known as *Mikir), Bodo* etc. These peoples are using plants in various aspects in their day-to-day life. Some common plants along with their uses are mentioned here :

Plant Name	Family	Uses
Acorus calamus	Araceae	Rhizome applied in cuts
Alpinia nigra	Zingiberaceae	Tender shoots are used as vegetables
Amorphophallus bulbifer	Araceae	Used in stomach pain
Bauhinia purpurea	Caesalpiniaceae	Tender leaves are used as vegetable
Eupatorium odoratum	Asteraceae	Leaf juice is used in cuts.
Clerodendrum colebrookianum	Verbenaceae	Tender leaves are used in high blood pressure
Curcuma zedoaria	Zingiberaceae	Rhizome is taken to cure pneumonia
Eclipta prostrata	Asteraceae	Decoction of leaves is used in intestinal ulcer
Euphorbia hirta	Euphorbiaceae	Plant juice is taken to cure dysentery
Ficus hispida	Moraceae	Tender leaves are used as vegetable
Leea asiatica	Leeaceae	Tender leaves are used as vegetable
Leucas plukenetii	Lamiaceae	Flowers eaten as raw to cure tonsillitis
Mikania micrantha	Asteraceae	Leaf juice is used in stomach pain
Oxalis corniculta	Oxalidaceae	Plant juice is used in blood dysentery
Scoparia dulcis	Scrophulariaceae	Paste obtained from plant is used for larval infection of cattle
Paederia feotida	Rubiaceae	Tender leaves are used in stomach problem
Vitex nigundo	Verbenaceae	Leaves are used to reduce the muscular pain in the body

PLANT AND ANIMAL RELATIONSHIPS

Nameri Tiger Reserve harbors rich faunal diversity. It is a repository of rare and endangered faunal species like White Winged Wood Duck *(Cairina scutulata)*. Besides, other animals viz. Elephant, Indian Bison, Tiger, Leopard, Clouded Leopard, Pangolin, Indian Wild Dog, Civet Cat, Capped Languor, Jackal are also found. According to 2000 census 26 tigers are found in this reserve. It provides a suitable elephant corridor to nearby Aruunachal Pradesh. There are 113 elephants recorded from the reserve. It is also an abode of a number of birds, fishes and moths. Over, 310 avian species are recorded from the core zone. The core zone is a paradise for the entomologists also. The *Atlas Moth* with a world record of 10 inches wingspan was recorded from the core zone. The river Jia-Bhoreli in the reserve is famous for mighty fish " Mahseer" -the king of river, right from the British period. The primate group is poorly represented in the reserve. The Capped Languor, Rhesus Macaque and the Assamese Macaque are recorded so far. The vegetation along with diverse plant species of the reserve provides fodder, shelter and camouflage for this wildlife. There are many plant species that are directly or indirectly consumed by this wildlife. Some of them are

Antidesma acidum, Baccaurea ramiflora, Dttlenia indica, Dysoxylum binectariferum, D. gobara, Emblica officinalis, Maesa indica, Syzygium spp., *Terminalia chebula, T. bellirica, Musa velutina, Ficus* spp. and different grass species. Many tall trees like *Gmelina arborea, Bombax ceiba, Sterculia villosa, Dysoxylum gobara, Pterospermum acerifolium,* etc. provide shelter for different animals and birds.

THREATS AND CONSERVATION STRATEGIES

Poaching: There is no organized poaching in the reserve. Earlier sporadic poaching was taking place as fun and adventure. Whenever any trespass was encountered it was dealt with strictly as per law.

Illegal felling of trees: Illegal felling of trees are rare in the core area of the reserve. When the east and west buffer areas are concerned, these areas are under heavy biotic pressure and illegal felling of trees are regularly take place.

Removal of non wood product (NWP): Collections of barks from *Litsea glutinosa* and *Oroxylum indicum* were detected from the reserve. Fire wood, cane, medicinal plants were collected from the buffer area.

Encroachment: Like other protected areas, this reserve is also facing the encroachment problem. The left bank of Jia- Bhoreli river and right bank of Bordikorai river precisely towards south were under encroachment and cleared during 2002 by evicting the encroachers. More or less entire east buffer is under encroachment and full of human settlement. In west buffer about 30 sq km of forest is under encroachment.

Domestic livestock grazing: In buffer areas domestic livestock grazing is very common. Cattles from near by the human settlement areas are disturbing the vegetation of the reserve.

Weeds: Invasion of various native and exotic weeds like *Mikania micrantha, Ageratum conyzoides, Eupatorium odoratun, Lantana camara,* etc. are another threats that disrupts the natural growth of many important plant species of the reserve.

Flood: Seasonal flood coupled with soil erosion not only destroys the ground vegetation but also uproots many important tree species of the reserve.

CONSERVATION STRATEGIES

Nameri Tiger Reserve possesses rich diversity of both flora and fauna. It is imperative that all the living being of the reserve should be conserved for the future generation. For an effective conservation, following measures should be taken.

1. Create awareness among the villagers for the protection of plant as well as animals of the reserve.

2. The Forest Department, the District Administration and NGOs should come forward to help the villagers who are living nearby the reserve and depending on the reserve for their day-to-day life. These departments and organizations should help the villagers to understand the pooling of resources through the State Government Rural Development Scheme and Joint Forest Management Scheme and the Central Governments Eco-Development Scheme and Biodiversity Conservation Project (Chetry & al., 2003).

3. Concerned authorities should take effective measures to save this reserve from seasonal flood and soil erosion.

4. Effective measures should be taken to save this reserve from the encroachers because buffers areas of the reserve are highly vulnerable to encroachment that ultimately lead to the conversion of forest areas into agricultural fields in many cases even human settlement as well.

PLANT SPECIES COLLECTED FROM NAMERI TIGER RESERVE, ASSAM

Following is a list of 235 plant species belonging to 81 families. This includes 73 families of Angiosperm plants having 227 species and 8 families of Pteridophytes having 8 species.

Costus speciosus (Courtesy : P. Singh)

DILLENIACEAE

Dillenia indica L.
D. pentagyna Roxb.

MAGNOLIACEAE

Magnolia hodgsonii (Hook.f. & Thomson) Keng.

ANNONACEAE

Polyalthia simiarum (Hook.f. & Thomson) Hook.f. Thomson
Miliusa roxburghiana (Wall.) Hook. f. Thomson

MENISPERMACEAE

Stephania japonica (Thunb.) Miers

CAPPARIDACEAE

Cleome gynandra Roxb.
Stixis suaveolens (Roxb.) Pierre

FLACOURTIACEAE

Gynocardia odorata R. Br.
Caesearia vareca Roxb.

TAMARICACEAE

Tamarix dioica Roxb.

CLUSIACEAE

Mesua ferrea L.

MALVACEAE

Sida cordata (Brum. f.) Borss.-Walk.
S. rhombofolia (L.) Borss.-Walk.
Kydia calycina Roxb.
Urena lobata L.

BOMBACACEAE

Bombax ceiba L.

STERCULIACEAE

Sterculia villosa Roxb.
Pterospermum acerifolium Willd.
Pterygota alata (Roxb.) R. Br.

TILIACEAE

Triumfeta rhomboidea Jacq.

ELAEOCARPACEAE

Elaeocarpus rugosus Roxb.

OXALIDACEAE

Oxalis corniculata L.
O. debilis Kunth

BALSAMINACEAE

Impatiens balsamina L.

RUTACEAE

Citrus limon (L.) Burm. f.

BURSERACEAE

Canarium bengalensis Roxb.

MELIACEAE

Amoora chittagongna Heirn
Dysoxylum binecteriferum Hook. f. & Bedd.
D. gobara (Buch.- Ham.) Merr.
Toona ciliata M. Roem.
Aglaia hiernii Visw. & Ramch.

RHAMNACEAE

Zizyphus rugosa L.
Z. mauritiana Lam.

VITACEAE

Tetrastigma dubium (M.A. Lawson) Planch.

LEEACEAE

Leea indica (Burm. f.) Merr.
L. crispa Merr.

ANACARDIACEAE

Mangifera indica L.

LEGUMINOSAE-PAPILIONODEAE.

Atylosia scarabaeoides Benth.
Crotolaria bialata Schrank.
Desmodium gangeticum (L.) DC.
D. heterocarpon (L.) DC.
D. triflorum DC.
Tephrosia candida (Roxb.) DC.

LEGUMINOSAE-CAESALPINIODEAE

Bauhinia variegata L.
Cassia obtusifolia L.
C. sophera L.
Dalbergia sissoo Roxb. ex DC.

LEGUMINOSAE-MIMOSOIDEAE

Acacia caesia var. **subnuda** (Craib.) Nielson.
Albizia lebbek. (L.) Benth.
A. procera (Roxb.) Benth.
Mimosa pudica L.

ROSACEAE

Rubus malaccensis Gentil

HAMAMELIDACEAE

Altingia excelsa Norenha.

COMBRETACEAE

Terminalia arjuna Bedd.
T. bellirica (Gaertn.) Roxb.
T. myriocarpa Heurck & Muell. Arg.

MYRTACEAE

Syzygium fruticosum DC.
S. cumini (L.) Skeels

MELASTOMATACEAE

Melastoma malabathricum L.
Osbeckia nepalensis Hook.f.

LYTHRACEAE

Cuphea balsamana L.
Duabanga grandiflora (Roxb. ex DC.) Walp.
Lagerstroemia reginae Roxb.

ONAGRACEAE

Ludwigia octovalis (Jacq.) Raven.
L. perennis L.

CUCURBITACEAE

Trichosanthes cordata Roxb.

TRAPACEAE

Trapa bispinosa L.

River Jia-Bhoreli flowing through the Reserve

BEGNONIACEAE

Begonia roxburghii A. DC.

DATISCACEAE

Tetrameles nudiflora R. Br.

APIACEAE

Centella asiatica (L.) Urban
Hydrocotyl sibthorpioides Lam.

ARALIACEAE

Schefflera venulosa (Wight & Arn.) Harms

CORNACEAE

Alangium barbatum Baill.
A. chinense (Lour.) Harms

RUBIACEAE

Anthocephalus chinensis (Lam.) A. Rich. ex Walp.
Coffea bengalensis Roxb.
Hedyotis brunonis Merr.
Mussaenda roxburghii Hook. f
Paederia foetida L.
Pavetta indica L.
Psychotria denticulata Wall.

ASTERACEAE

Ageratum conyzoides L.
Bidens biternata (Lour.) Merr.
Eclipta prostrata (L.) L.
Elephantopus scaber L.
Eupatorium odoratum L.
Pseudognaphalium luteo-album (L). Hillard & Burtt.
Mikania micrantha Kunth
Spilanthes paniculata DC.
Vernonia albicans DC.
Youngia japonica (L.) DC.

MYRSINACEAE

Maesa indica (Roxb.) Wall.
Ardisia paniculata Roxb.

APOCYNACEAE

Alstonia scholaris (L.) R. Br.
Rauvolfia densiflora (Wall.) Hook.f.
Tabernaemontana divaricata (L.) R. Br.
Vallaris solanacea (Roth) Kuntze

ASCLEPIADACEAE

Hoya parasitica Wall.

LOGANIACEAE

Buddleja asiatica Lour.

CONVOLVULACEAE

Ipomaea purpurea Lam.

SOLANACEAE

Physalis minima L.
Solanum myriacanthum Dunal
S. nigrum L.
S. torvum Sw.

SCROPHULARIACEAE

Limnophylla heterophylla C. B. Clarke
Lindernia ruellioides (Colsm.) Rennell
Lindenbergia hookeri Hook. f.
Micardenia dianthera (Sw.) Pennel
Scoparia dulcis L.

GESNERIACEAE

Aeschynanthus parasiticus (Roxb.) Wall.

BIGNONIACEAE

Andrographis paniculata Nees
Oroxylum indicum (L.) Vent.
Stereospermum chelonoides (L.f.) DC.

ACANTHACEAE

Eranthemum pulchellum Andrews
Justicia adhatoda L.
Lepidagathis incurva D. Don
Peristrophe roxburghiana (Schult.) Bremek.
Phlogacanthus thyrsiflorus Roxb.
P. tubiflorus (Hardw.)Mabb.
Thunbergia grandiflora Roxb.

VERBENACEAE

Callicarpa arborea Roxb.
Clerodendrum colebrookianum Walp.
C. serratum Soreng
C. viscosum Vent.
Gmelina arborea Roxb.
Holmskioldia sanguinea Retz.
Lantana camara L.
Premna barbata Wall.
Stachytarpheta dichotoma Vahl
Tectona grandis L.f.

LAMIACEAE

Craniotome furcata (Link) Kuntze
Hyptis suaveolens (L.) Poir.
Leucas plukenetii (Roth) Spreng.
Plectranthus japonicus (Burm. f.) Koidz.

AMARANTHACEAE

Alternanthera sessilis (L.) R. Br. ex DC.
A. spinosus L.
A. viridis L.

CHENOPODIACEAE

Chenopodium album L.

POLYGONACEAE

Polygonum chinense L.
P. hydropiper L.
P. scandens L

PIPERACEAE

Piper sylvaticum Roxb.
P. trioicum Roxb.
Piper wallichii (Miq.) Hand.-Mazz.
Poporomia pellucida (L.) Kunth

CHLORANTHACEAE

Chloranthus elatior R. Br.

LAURACEAE

Alseodaphne andersonii (King ex Hook.f.) Kost.
Cinnamomum bejolghota (Buch. -Ham.) Sw.
Litsea monopetala (Roxb.) Pers.
L. glutinosa (Lour.) Robin.
L. salicifolia Roxb.
Phoebe cooperiana Kanjilal
P. goalparensis Hutch.

EUPHORBIACEAE

Antidesma acidum Retz.
Baccaurea ramiflora Lour.
Bischofia javanica Blume
Croton caudatus Geisel
Euphorbia hirta L.
Homonoia reparia Lour.
Phyllanthus emblica L.

P. reticulatus Poir.
Macaranga denticulata Muell. Arg.
Mallotus philippensis (Lam.) Muell. Arg.
Trewia nudiflora L.

CANNABINACEAE
Cannabis sativa L.

MORACEAE

Artocaropus chama Buch. - Ham.
A. lacucha Buch.- Ham.
Ficus benghalensis L.
Morus alba L.
M. macroura Miq.
Poikilospermum suaveolens (Blume) Merr.
Streblus asper Lour.

URTICACEAE

Pouzolzia zeylanica (L.) Bennett & Brown
Trema orientalis (L.) Blume
Dendrocnide meycniana (Walp.) Chew.

MONOCOTYLEDONS

ORCHIDACEAE

Cleiosostoma paniculata Garay
Cymbidium aloifolium Sw.
Dendrobium aphyllum C. E. C. Fisher
D. moschatum Sw.
Papilionanthe teres Schltr.

ZINGIBERACEAE

Alpinia galanga (L.) Sw.
A. nigra (Gaertn.) Burtt
Curcuma zedoria Rosc.

COSTACEAE

Costus speciosus Sm.

PONTEDERIACEAE

Eichornia crassipes Mart.

ARECACEAE

Licuala peltata Roxb.
Pinanga gracilis Blume

ARACEAE

Acorus calamus L.
Alocasia fornicata (Roxb.) Schott
Colocasia esculanta (L.) Schott
Pothos scandens L.

TYPHAECEAE

Typha elephantina Roxb.

CYPERACEAE

Cyperus brevifolius (Rottb.) Hassk.
C. cyperoides L.
C. halpan L.
C. rotundus L.
Frimbristylis dichotoma (L.) Vahl
Kyllinga nemoralis Hutch. & Dalziel
Cyperus diffuses Vahl
Pycreus flavidus (Retz.) T. Koyama

POACEAE

Apluda mutica L.
Arundo donax L.
Arundinella bengalensis (Spreng.) Druce
Axonopus compressus (Sw.)P. Beauv.
Bothriochloa intermedia A. Camus
Cynodon dactylon (L.) Pers.
Digitaria didactyla Willd.
Eleusine indica Gaertn.
Hemarthria compressa R. Br.
Imperata cylindrica (L.) P. Beauv.
Oplismenus compositus P. Beauv.
Panicum notatum Retz.
Paspalum conjugatum P. Beauv.
P. dilatum Poir.
Phragmites karka Steud.
Saccharum spontaneum L.
S. arundinaceum Retz.
S. glauca (L.) P. Beauv.
S. pallide-fusca (Schum.) Stapf & Hubb.
Sclerostachya fusca (Roxb.) A. Camus
S. pumila (Poir.) Roem. & Schult.
Sporobolus indicus R. Br.
Themeda villosa Trin.
Thysanoleana maxima (Roxb.) Kuntze

PTERIDOPHYTES

SELAGINALLACEAE

Selaginella semicordata Sw.

EQUISETACEAE

Equisetum ramosissimum Desf.

PTERIDACEAE

Pteridium aquilinum (L.) Kuhn.

ATHYRIACEAE

Diplazium esculantum (Retz.) Sw.

ANGIOPTERIDACEAE

Angiopteris evecta (Frost.)Hoffm

ASPLENIACEAE

Asplenium nidus L.

CYATHEACEAE

Cyathea gigantea (Wall. ex Hook.)Holtt.

DRYNARIACEAE

Drynaria quercifolia (L.) Sm.

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Nameri Tiger Reserve

SALIENT FEATURES

Situated in the District of Sonitpur, the Nameri is the third National Park of Assam. The Pakhui (Pakke) Sanctuary of Arunachal Pradesh adjoins the Park on its North-Eastern point. The area is criss-crossed by the river Jia- Bhoroli and its tributaries namely the Diji, Dinai, Doigurung, Nameri, Dikorai, Kharietc. A few jheels (during the rainy seasons) also dot the area. The Jia – Bhoroli river and the tributaries display devilish look when the incessant downpour in the upper reaches during the rainy season make it swell. The in-accessibility and continuity with neibouring forest areas has helped the wildlife of Nameri to flourish. There is a good prey –base in the form of –Sambar,Barking Deer, Hog Deer, Wild Boar and gauri. About 3000 domestic cattle also form part of this prey base for Tiger and Leopards.

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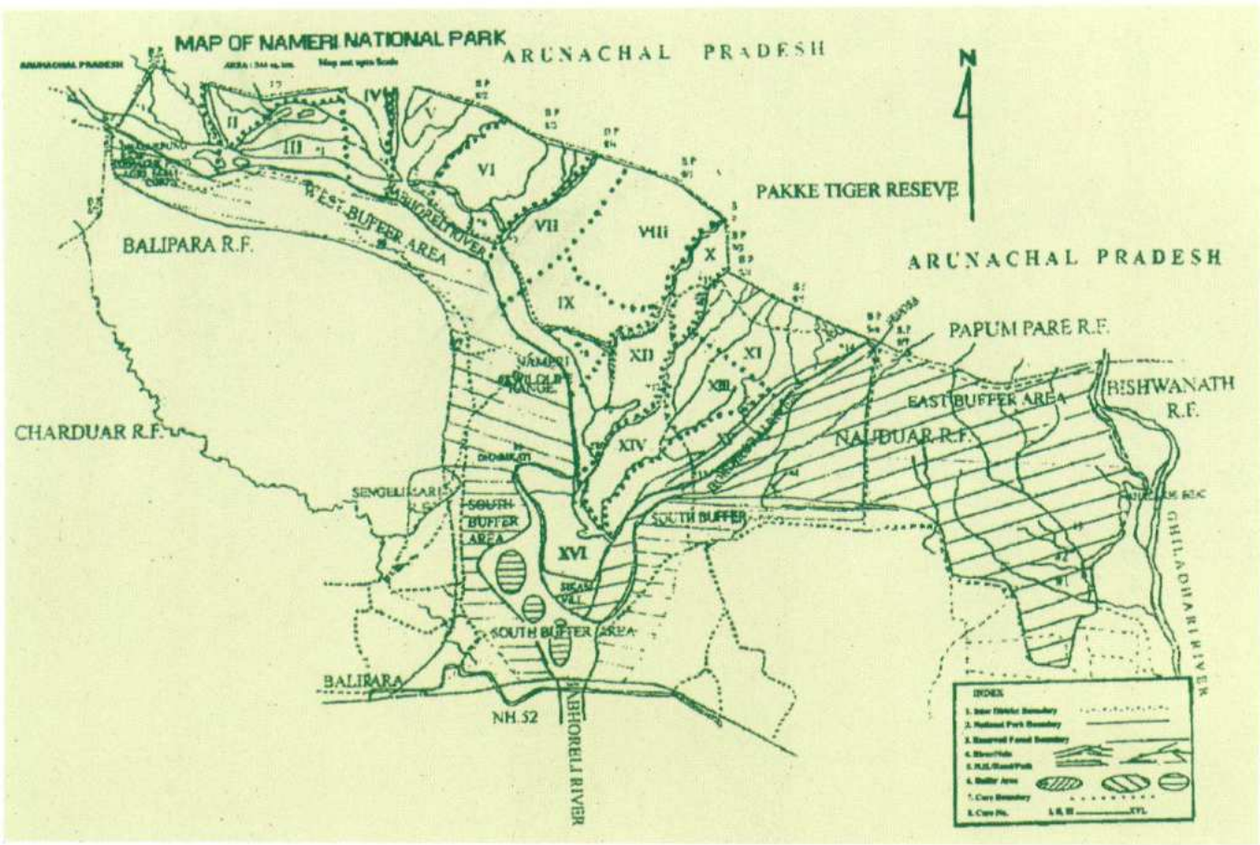
Nameri and the adjoining forest areas, declared reserved for a considerable time, also qualify to be an Elephant Reserve. The Elephant population estimated in 1997 was 225.

Nameri and Sonai-Rupai are only Protected Areas in the North Bank of the Brahmaputra in the Civil District of Sonitpur, Lakhimpur and Dhemaji.

Legal Status

Reserved Forest declared on 17-10-1878

Nameri Sanctuary (137 sq km) on 18-09-1985



Map of Nameri Tiger Reserve

Provisional Notification of National Park (212 sq km) on 27.02.97

Final Notification of National Park (200 sq km) on 09.09.1998 in Assam Gazette.

Area of the Tiger Reserve

Core Area- (Nameri National Park) = 200 sq km

Part of Naduar Reserve Forests Tezpur Sub Division upto Ghiladhari River = 80 sq km

Buffer Area – Part of Balipara Reserve Forests Area in between Jia-Bhoroli River and Rangapara – Bhalukpung Railway line = 64 sq m

Total Area = 344 sq km

Forest Types and Composition

- Assam Valley Tropical Evergreen Forests – IR/C 2b Mesua Sub type.
- Assam Alluvial Plains semi Evergreen Forests- 2B/C I. A. Phoebe- Amoora association
- Sub Himalayan light Alluvial Semi- Evergreen Forests 2B/I.S.I 78Mekahi Sub Type.
- Eastern Alluvial Secondary Semi Evergreen Forests- 2B/2.S. Cane Brakes- 2B/E.I.
- Wet Bamboo Brakes 2B/K.2.
- Northern Secondary Moist Mixed, Deciduous Forests – 3C/ 2.S.I.

- Low Alluvial savanna Wood Land- 3/ I.S.I.
- Eastern Hollock Forests –3/I.S.2b.
- 4.D/SSI Eastern Seasonal Swamp Forests.
- Eastern Dillenia Swamp Forests- 4D / SS Dillenia Altingia Association.
- Eastern wet Alluvial Grass land- 4.D / 2.5.2.

Habitat- Flora Fauna

The habitat of Nameri is made up of tropical evergreen, Semi-evergreen, moist deciduous forests with cane and bamboo brakes and narrow strips of open grassland along rivers. Grassland comprise of less than 10% of the total area of the park while the semi-evergreen and moist deciduous species dominate the area. Some notable species are Gamari, Titachopa, Amari, Bogipoma, Ajar, Urium poma, Bhelou, Agaru, Rudraksha, Bonjolokia, Hatipolia akhakan, ahollock, Nahor, Siya Nahar, Simul, Bonsum etc. Orchoids include Dendrobium, Cymbidium, Ladies Sleeper etc. Tree Fern,Lianas, creepers are some of the specialties of this forests.

The most prized and most significant finding is the White Winged Wood Duck which has a flourishing population in Nameri confirmed officially in 1995. Till now 315 avian species have been recorded in the Park.

Few notable among them are:-

(Mammals) More than 30 species : Tiger, Leopard, Black Panther, Clouded Leopard, Lesse Cats, Sloth Bear, Himalayan Black Bear, Elephant, Indian Bison, Dhole, Sambar, Barking Deer, Dog Deer, Fox, Hispid Hare, Indian Hare, Capped Langur, Slow Loris, Assamese Macaque, Rhesus Macaque, Himalayan yellow Throated Martin, Malayan giant Squirrel, Flying Squirrel, Wild Pig etc.

(Bird)315 species : White winged wood duck, Great Pied Hornbill, Wreathed Hornbill, Rufous Necked Hornbill, Black Stork, Ibis Bill, Large Whistling Teal, Common Mergernser, King Vulture, Long Billed Ring Plover, Khallej Pheasant, Hill Myna , Pin tailed green Pigeon, Himalayan pied Kingfisher, Three Toed kingfisher, Fairly Blue Bird Etc.

Reptiles King Cobra, Cobra, Pit Viper, Russels Viper, Banded Krait, Python, Rat Snake, Assam Roof Turtle, Malayan Box Turtle, Keeled Box Turtle, Asian Leaf Turtle, Narrow Headed soft Shelled Turtle, Indian soft Shelled Turtle.

Fishes Golden Mahseer, Shaort gilled Mahseer, Silghoria.

Number of tiger as per latest count (2002 count): 26

Constrains

There are as many as 25 Reserved Forests in these three districts where departmental logging is allowed. Habital shrinkag due to encroachment has put immense pressure on tiger population to move and seeka safer place. Hence there are local reports that the tiger concentration in Nameri has increased in the past few years. As a result o tiger population, Nameri is in need of a better conservation and protection measures.

The number of revenue villages in the core area:	Nil
Area covered by the villages:	Nil
Human Population :	1000 nos. of Taungya villagers. They are occupying 10 sq km of periphery of Nameri National Park. It is under the Process of shifting them outside the National Park.
Cattle Population	3000 nos they are under the process of rehabilitation.

Rauvolfia tetraphylla L. : under growth in Teak forest

BIHAR

Valmiki Tiger Reserve

Valmiki Tiger Reserve

Rajeev K Singh & HJ Chowdhery
Central National Herbarium, Botanical Survey of India, Howrah 711103

Valmiki Tiger reserve established in January, 1990 is named after the great saint 'Valmiki' and it is believed that it is the place where Valmiki created the epic of "RAMAYANA". It is situated in West-Champaran district of Bihar in the Champaran forest block between 27° 10′ and 27° 30′ - north latitude and 83° 45′ and 84° 20′ - east longitude. The reserve covers an area of about 840 sq km and is bounded by the river Gandak in the west and Royal Chitwan National Park, Nepal in the north. Inside the reserve is situated the Valmiki National Park spreading over an area of 335.65 sq km, which forms the core area of the Tiger reserve. The impenetrable cane brakes and dry tall grasses covering 335 sq km core area of this reserve provides ideal breeding ground and shelter for the tigers (Banerjee, 1998). Vegetation components like wet alluvial grasslands, mixed dry deciduous, moist dry deciduous and fresh water swampy forests provide potential energy source for a large number of herbivores inhabiting the core and buffer zones.

GEOLOGY AND SOIL

The Tiger reserve falls in the foothills of the Himalayan ranges and is quite distinct from other parts of the state. It is mainly composed of sand stones and gravels of the Siwalik system. The Gangetic plains between the older and newer alluvia and old and Kosi with many other smaller ones divide the alluvial plains into various topographic formations. The small hills found in this reserve are extension of the Siwalik range. Soil of this area is mainly of two types tarai soil and alluvial soil. Tarai soil is restricted in the forest areas and the alluvial soil occupies the cultivated areas. The soil remains wet for the six months in a year where sub-soil drainage is very low and evaporation is very high.

CLIMATE

The climate of this area is broadly divided into summer season: late March to May; rainy season: June to October and winter season: November to early March. Maximum temperature ranges between 21°C to 36°C and the minimum between 4°C to 15°C.

The rainfall in the area is very high with the average annual rainfall is between 3000 to 5000 mm. The month of June and July experiences the heaviest showers. The mean humidity is around 83 percent.

PEOPLE

The Tiger reserve is inhabited by Tharus, and aboriginal tribe who dwell in the sub-Himalayan tarai region. The origin of the Tharus has formed the subject of much controversy but the most acceptable explanation seems to be that they are a Dravidian race (O' Malley, 1907) whose ancestors once ruled the valley of Ganges and were gradually driven up into sub-Himalayan forests, where they came in contact with the Nepalese and other hilly tribes and as a result their physiognomy has acquired in some instances a slightly Mongolian features in having slanting eyes, high cheek-bones and scanty beards and moustaches. Their language is generally a mixture of Nepali and Bhojpuri Hindi.

FAUNA

The fauna of this tract is typical of dry deciduous forest type. The important carnivores in this reserve are Tiger, Leopard, Wolf, Wild Dog. Hyena, Jungle Cat, Jackal, Fox etc. The common herbivores are Gaur, Nilgai, Spotted Deer, Sambhar, Hog Deer, Chital, Wild Boar, Sloth Bear, Barking Deer, Antelope, Gaur, Langur, Hare, Porcupine, Rhesus Monkey, Mongoose, etc. The important birds are Koel, Maina,Vulture, Pea Fowl, Jungle Fowl, Spur Fowl, Hornbill, Partidges, Duck, Wood Pecker, etc. The common reptiles are Gharial, Python, Cobra and other snakes. One horned Rhinoceros and Bison often migrate from Royal National Park Chitwan to Valmikinagar.

The Tiger prefers to reside in alluvial grasslands, impenetrable canebrakes and dry tall grasses. During rainy season, when the grasslands are flooded with water the Tiger prefer sandstone hills. Sometimes they migrate to Royal Chitwan National Park of Nepal by crossing Gandak river. Gandak river is the boundary of this Reserve and also of India. After rainy season they come back to grasslands area.

BOTANICAL EXPLORATIONS

Although some workers have made plant collections from this district but most of these collections are from outside the Tiger reserve area. H. H. Haines (British Forester) collected plants from West-Champaran district in the year 1919 and 1925. But it is not clear whether he had visited this tiger reserve area or not. Banerjee and Banerjee collected few plants from this tiger reserve in the year 1963 and 1969. Thothathri (1965); Thothathri, Shetty and Hajra (1966) collected some plants from this district but not from the tiger reserve area. Bhattacharyya and Sarkar collected 4000 plant specimens belonging to 2000 field numbers and 1040 species in the year 1986 to 1990 with very few collections from the reserve area.

In connection with Ministry of Environment & Forests, Govt. of India funded project on the Floristic diversity in Protected Areas, the plant collections were made from the Valmiki Tiger reserve in all the 4 seasons between 2001 to 2004 and more than 2200 plant specimens representing about 726 species were collected.

VEGETATION

(a) Flowering plants

This reserve lies in West-Champaran district, which is included in the gangetic plain region. The northern portion of this reserve bordered by the Nepal Himalaya (Royal Chitwan National Park) is hilly due to the extension of Siwalik Himalayan ranges and Tarai land. As a result a number of Himalayan floral elements are also found in small patches.

I. Tropical dry deciduous forests : This type occupies most of the reserve area excepting the small forest tracts near Valmiki Nagar. The entire northern part of reserve is occupied by sandstone hills. The area is characterzed by the presence of trees like *Shorea robusta, Kydia calycina, Butea monosperma, Anogeissus latifolia, Aegle marmelos, Lagerstroemia parviflora, Bauhinia malabarica, B. purpurea, B. racemosa, Dalbergia sissoo, Bombax ceiba, Mangifera indica, Sterculia urens, S. villosa, Terminalia bellirica, T. alata, T. Chebula, Careya arborea, Haldina cordifolia, Neolamarckia cadamba, Mitragyna parviflora, Nyctanthes arbor-tristis, Holarrhena pubescens, Trema orientalis, Ficus semicordata, Salix tetrasperma, Albizia procera, Phyllanthus emblica, Syzygium cumini, Acacia catechu, Tamarindus indica,* etc.

The forest undergrowth is mainly occupied by shrubby elements like *Colebrookea oppositifolia, Murraya koenigii, Callicarpa macrophylla, Solanum surattense, Ziziphus oenoplia, Clerodendrum viscosum, Lantana* spp., etc. Some of the common undershrubs are *Desmodium gangeticum, D. laxiflorum, D. motorium, Urena sinuata, U. lobata, Plumbago zeylanica, Triumfetta rhomboidea, Cassia occidentalis, C. sophera, Crotalaria albida, C. spectabilis, Tephrosia purpurea, Sauropus quadrangularis, Rauvolfia*

serpentina, R. tetraphylla, Calotropis procera, Solanum anguivi, Anisomeles indica, Barleria spp., *Rhinacanthus nasuta,* etc. In moist areas herbaceous plants such as *Primula umbellata, Bothriospermum tenellum, Centaurium centaurioides, Hemigraphis hirta, Oldenlandia corymbosa, Salvia plebeia, Verbascum chinense,* etc. are commonly seen. Soon after the rainfall, plants like *Acalypha indica, Adenostemma lavenia, Evolvulus nummularius, Lindernia ciliata, L. antipoda, L. anagallis, Peperomia pellucida, Rungia pectinata,* etc. cover the forest floor. *Bauhinia vahlii, Spatholobus parviflorus, Capparis sepiaria, Acacia sinuata, Dalbergia volubilis, Derris scandens, Millettia extensa, Mucuna pruriens, Combretum roxburghii, Celastrus paniculatus, Reissantia arborea, Clematis gouriana, Tinospora cordifolia, Mezoneuron cucullatum, Tetrastigma thomsonianum* and *Dioscorea* spp. are some of the common lianas and climbers in this reserve. Tarai grasslands and Alluvial grasslands are characterized by grasses like *Arundo donax, Phragmites vallatoria, Cymbopogon* spp., *Eragrostis* spp., *Saccharum arundinaceum, S. procerum, S. spontaneum, Themeda arundinacea, T. caudata, T. laxa, Vitiveria zizanoides, Rottboellia cochinchinensis,* etc. while *Acacia* spp., *Grewia* spp., *Terminalia* spp., *Calotropis procera, C. gigantea,* etc. are some common trees and shrubs.

II. Tropical moist deciduous forests : Such forests are noticed in Valmiki Nagar and Ganauli in small patches. The following trees are characteristic of these forests *Shorea robusta, Terminalia alta, T. bellirica, Dalbergia sissoo, D. latifolia, Schleichera oleosa, Haldina cordifolia, Bombax ceiba, Lagerstroemia parviflora, Antidesma ghaesembilla, Gmelina arborea, Mallotus philippensis, Kydia calycina, Aphanamixis polystachya,* etc.

Among shrubby elements *Breynia retusa, B. vitis-idaea, Anisomeles indica, Colebrookea oppositifolia, Pogostemon benghalense, Hyptis suaveolens, Clerodendrum viscosum, C. indicum, Lippia alba, Barleria cristata, Petalidium barlerioides, Leea crispa, L. macrophylla, Desmodium* spp., *Bambusa tulda, B. vulgaris, Dendrocalamus stricutus, Calamus tenuis, C. viminalis,* etc. are common. Woody and herbaceous climbers include *Mucuna pruriens, Smilax ovalifolia, Dioscorea* spp., *Ichnocarpus frutescens, Paedaria foetida,* etc. The forest undergrowth consists of a large number of shrubs, herbs and grasses.

III. Fresh water swamp forests : Such forests are found in low-lying, waterlogged areas, along riverbeds, streambeds and nalas that remian under water during rains and sometimes many months thereafter. The aeration of soil is usually poor. The soil is rich in humus and consists of fine clay. Fresh water swamp forests are one of the conspicuous features of this reserve. This type of forests consists of evergreen trees in open areas mixed with dense growth of grasses and canes in many places. Some of the common associates in this type are *Barringtonia acutangula* mixed with *Syzygium cumini, Salix tetrasperma, Ficus racemosa, Streblus asper, Calamus tenuis, C. viminalis, Phragmites vallatoria, Leersia hexandra, Arundo donax, Vetiveria zizanioides, Saccharum spontaneum,* etc.

Aquatic and marshy vegetation : The tiger reserve has also some wetland areas, which harbour considerable aquatic and marshy vegetation, which can be grouped into following types :-

1. **Free floating hydrophytes** : *Pistia stratiotes, Lemna gibba, L. perpusilla, Spirodela polyrrhiza, S. punctata, Trapa natans, Eichhornia crassipes,* etc.
2. **Suspended submerged hydrophytes** : *Ceratophyllum demersum* and *Urticularia aurea.*
3. **Anchored submerged hydrophytes** : *Hydrilla verticillata, Blyxa octandra, Najas minor, Potamogeton nodosus, P. pectinatus, Urticularia aurea, Nechamandra alternifolia, Ottelia alismoides,* etc.
4. **Anchored hydrophytes with floating leaves** : *Monochoria hastata, M. vaginalis, Nymphaea*

River Great Gandak eroded the forest land

nouchali, N. pubescens, N. rubra, Nymphoides indica, N. hydrophylla, Nelumbo nucifera, Sagittaria guayanensis, etc.

5. **Anchored hydrophytes with floating shoot :** *Ipomoea aquatica, Alternanthera philoxeroides, Aponogeton natans, Ludwigia adscendens, Neptunia oleracea, Hygroryza aristata,* etc.
6. **Emergent amphibious plants (helophytes) :** *Polygonum hydropiper, P. glabrum, P. barbatum, Hygrophila schulli, Aeschynomene indica, Commelina logifolia, Cyperus articulatus, C. brevifolius, C. cyperoides, C. difformis, C. halpan, C. iria, C. kyllingia, C. niveus, C. nutans, C. radiatus, C. rotundus, C. sanguinolentus, C. triceps, Echinochloa colona, Elytrophorus spicatus, Enydra fluctuans, Typha elephantia, Ranunculus sceleratus, Commelina benghalensis, Bacopa monnieri, Melochia corchorifolia, Limnophyla indica, L. sessiliflora, Rotala rorea, R. rotundifolia, Scirpus articulatus, S. juncoides,* etc.

(b) Non flowering plants

I. Pteridophytes : Some of the pteridophytic flora noticed in the Tiger Reserve are *Adiantum philipense, Azolla pinnata, Blechnum orientale, Cheilanthes anceps, C. farinosa, Christella arida, C. dentata, C. parasitica, Equisetum ramosissimum subsp. debile, Helminthostachys zeylanica, Huperzia squarrosa, Lygodium flexuosum, Marsilea minuta, Pteris biaurita, P. vittata, Selaginella bryopteris, S. ciliaris, S. fulcrata,* etc.

II. Bryophytes : Some liverworts recorded from the Tiger Reserve are *Asterella wallichiana, Cyathodium cavernarum, Marchantia linearis, M. paleacea, Notothylas indica, Plagiochasma appendiculatum, Riccia billardieri, R. discolor, R. frostii,* etc. Moss like *Funaria hygrometica, Barbula constricta,* etc. are common on the forest floor.

WEEDS AND ALIENS OF TIGER RESERVE

Although, the weeds are usually undesirable plants but they have been proved useful in many cases as fodder for animals, food or medicine for man and also as ornamental. Some of the commonly found weeds

and aliens in this reserve are *Abutilon indicum, Acalypha indica, Achyranthes aspera, Aerva lanata, Ageratum conyzoides, Alloteropsis cimicina, Alternanthera sessilis, Alysicarpus bupleurifolius, A. monilifer, A. vaginalis, Amaranthus spinosus, A. tricolor, A. viridis, Ammannia baccifera, A. multiflora, Anagallis arvensis, Apuda mutica, Argemone mexicana, Aristida adscensionis, Bacopa monnieri, Barleria cristata, B. prionitis, Biophytum sensitivum, Boerhavia diffusa, Caesulia axillaris, Calotropis gigantea, C. procera, Canscora diffusa, Cardiospermum halicacabum, Cassia mimosiodes, C. tora, Cassytha filiformis, Celosia argentea, Centella asiatica, Chenopodium album, C. ambrosioides, C. murale, Chloris barbata, Conyza bonariensis, Corchorus aestuans, C. capsularis, C. olitorius, Croton bonplandianus, Cuscuta chinensis, C. reflexa, Cyanotis cristata, Cynodon dactylon, Cyperus difformis, C. halpan, C. iria, Dactyloctenium aegypticum, Datura metel, D. stramonium, Dendrophthoe falcata, Desmodium laxiflorum, Dichanthium annulatum, Digera muricata, Digitaria ciliaris, D. stricta, Echinochloa colona, Eclipta prostrata, Eichhhornia crassipes, Eleusine indica, Eragrostis gangetica, E. japonica, E. minor, E. tenella, E. unioloides, Eriocaulon quinquangulare, Euphorbia dracunculoides, E. hirta, E. parviflora, E. pulcherrima, E. thymifolia, Evolvulus alsinoides, Fimbristylis dichotoma, Fuirena ciliaris, Fumaria indica, Glinus lotoides, G. oppositifolius, Gloriosa suberba, Gomphrena globosa, Grangea maderaspatana, Heliotropium indicum, H. ovalifolium, Hemidesmus indicus, Heteropogon contortus, Hibiscus cannabinus, Hoppea dichotoma, Hybanthus enneaspermus, Hyptis suaveolens, Indigofera astragalina, I. linifolia, I. linnaei, I. trifoliata, Ischaemum indicum, Justicia adhatoda, Lantana camara, Launaea procumbens, Leonotis nepetifolia, Leptochloa chinensis, Leucas aspera, L. cephalotes, L. indica, Limnophila indica, L. sessiliflora, Linderbergia muraria, Lindernia ciliata, L. crustacea, L. multiflora, L. parviflora, Lobelia alsinoides, Malvastrum coromandelianum, Martynia annua, Melilotus indica, Melochia corchorifolia, Mirabilis jalapa, Mollugo pentaphylla, Monochoria vaginalis, Mukia maderaspatana, Oxalis corniculata, Parthenium hysterophorus, Paspalidium flavidum, Paspalum scrobiculatum, Pergularia daemis, Phalaris minor, Phyla nodiflora, Phyllanthus amarus, P. fraternus, P. lawii, P. urinaria, P. virgatus, Physalis minima, Pilea microphylla, Polycarpon prostratum, Polygala arvensis, Portulaca oleracea, Pouzolzia, Pupalia lappacea, Ricinus communis, Rorippa indica, Rotala indica, Ruellia tuberosa, Rungia repens, Saccharum, spontaneum, Scoparia dulcis, Sesamum orientale, Sesbania bispinosa, Sida acuta, S. cordata, S. rhombifolia, Solanum anguivi, S. nigrum, Striga angustifolia, S. asiatica, Synedrella nodiflora, Tephrosia purpurea, Thevetia peruviana, Tridax procumbens, Urena labata, Utricularia aurea, Vaccaria pyramidata, Vallisneria spiralis, Verbascum chinense, Vernonia cinerea, Vigna trilobata, Vitex negundo, Xanthium strumarium, Zornia gibbosa.*

DOMINANT FAMILIES

Out of the 122 families of flowering plants that are represented in the Valmiki Tiger Reserve area, the most dominant families are Poaceae, Leguminosae, Asteraceae, Euphorbiaceae, Rubiaceae, Acanthaceae, Malvaceae, Convolvulaceae, Cyperaceae and Scrophulariaceae.

DOMINANT GENERA

Out of the 723 species of 487 genera of Angiosperms recorded during the present studies *Cyperus, Eragrostis, Desmodium, Ficus, Blumea* and *Crotalaria* were found to be the most dominant genera in the Tiger Reserve Area.

FAMILIES REPRESENT BY SINGLE SPECIES

The following families are represented by a single species in the reserve area Aristolochiaceae *(Aristolochia indica),* Nelumbonaceae *(Nelumbo nucifera),* Ceartophyllaceae *(Ceratophyllum*

demersum), Papaveraceae *(Argemone mexicana),* Cannabaceae *(Cannabis sativa),* Plumbaginaceae *(Plumbago zeylanica),* Ochnaceae *(Ochna obtusata),* Diterocarpaceae *(Shorea robusta),* Begoniaceae *(Begonia picta),* Moringaceae *(Moringa oleifera),* Myrsinaceae *(Ardisia solanacea),* Alangiaceae *(Alangium salviifolium),* Olacaceae *(Olax scandens),* Viscaceae *(Viscum nepalense),* Hippocrateaceae *(Reissantia arborea),* Icacinaceae *(Natsiatum herpeticum),* Burseraceae *(Protium serratum),* Simaroubaceae *(Ailanthus exelsa),* Zygophyllaceae *(Tribulus terrestris),* Buddlejaceae *(Buddleja asiatica),* Alismataceae *(Sagittaria guayanensis),* Xyridaceae *(Xyris pauciflora),* Juncaeae *(Juncus prismatocarpus),* Costaceae *(Costus speciosus)* and Hypoxidaceae *(Curculigo orchioides).*

ENDEMIC PLANTS

Leucas helicterifolia and *Trachyspermum villosum* are endemic in West-Champaran district (Bhattacharyya and Sarkar, 1998) and during the course of present studies these two were also found in the tiger reserve area. *Tetrastigma alcicorne* and *Uraria pulchra* are rare and endemic in the Someshwar hills, area near by tiger reserve (Bhattacharyya and Sarkar, 1998).

RARE PLANTS

Some of the rare elements of the Tiger reserve area are *Abrus pulchellus, Agrostemma sarmentosum, Coffea khasiana, Lobelia nicotianaefolia, Naravelia zeylanica, Olax scandens, Pterospermum acerifolium, Saraca asoca, Trevesia palmata, Xantolis tomentosa, Leucas helicterifolia, Trachyspermum villosum* and *Peucedanum nagpurense.*

ECONOMIC PLANTS

A large number of species found in the reserve have high economic potential and the locals in their daily life use many of these. Some of the important ones are enumerated below :-

1. Wild edible plants

(A) Roots / Tubers : *Curculigo orchioides, Dioscorea alta, D. bulbifera, D. pentaphylla, D. glabra, D. pubera, D. wallichii, Nelumbo nucifera,* etc.

(B) Young leaves and tender : *Amaranthus viridis, Bauhinia purpurea, B. racemosa, Cassia tora, Cocculus hirsutus, Dendrocalamus strictus, Hibiscus sabdarifolia, Ipomoea aquatica, I. quamoclit, Murraya koenigii, Nymphoides indica, Oxalis corniculata, Phyla nodiflora, Polygonum barbatum, Portulaca oleracea, Sonchus* spp., *Rivea hypocrateriformis, Rotala rotundifolia, Tribulus terrestris,* etc.

(C) Flowers and inflorescence : *Artocarpus lakoocha, Bauhinia purpurea, B. racemosa, Indigofera cassioides, Madhuca longifolia* var. *latifolia, Moringa oleifera, Nelumbo nucifera, Oxystelma secamone, Pergularia daemia, Woodfordia fruticosa,* etc.

(D) Fruits : *Aegle marmelos, Alangium salviifolium, Annona reticulata, A. squamosa, Neolamarkia cadamba, Antidesma acidum, Artocarpus lakoocha, Borassus flabellifer, Buchanania lanzan, Carissa carandas, Cassia occidentalis, C. tora, Coccinia grandis, Diospyros malabarica, Erycibe paniculata, Ficus racemosa, F. semicordata, F. virens, Flacourtia indica, Gmelina arborea, Grewia* spp., *Phoenix acaulis, P. humulis, P. sylvestris, Emblica officinalis, Solanum nigrum, S. torvum, Syzygium cumini, S. heyneanum, Tamarindus indica, Terminalia bellirica, T. chebula, Ziziphus* spp., etc.

(E) Seeds (cooked or roasted) : *Bauhinia vahlii, Cassia occidentalis, Eleusine indica, Oryza rufipogon Paspalidium srobiculatum, Semecarpus anacardium, Sterculia urens, Vigna trilobata, Bridelia retusa, Buchanania lanzan,* etc.

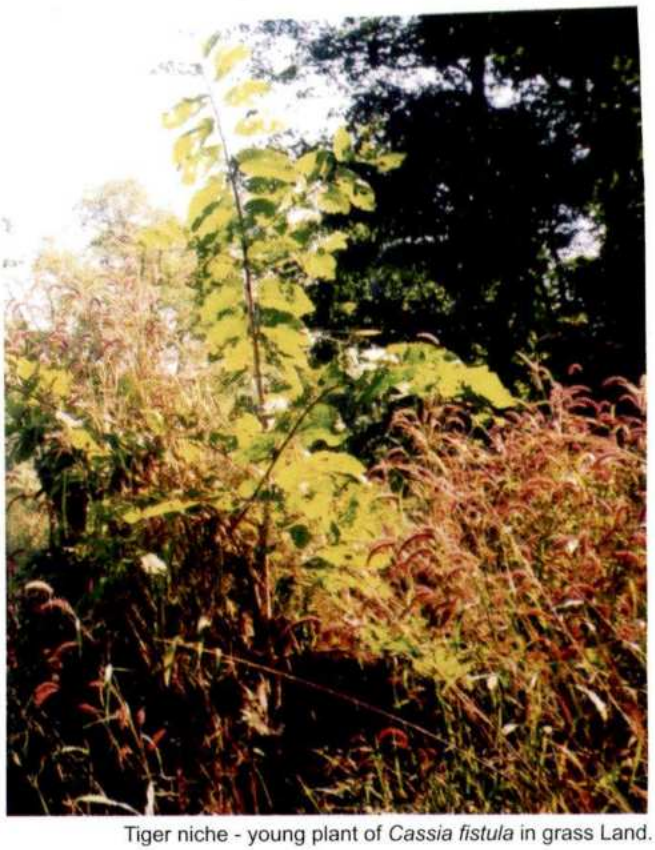
(F) Oil seeds : *Borassus flabellifer, Madhuca longifolia* var. *latifolia, Ricinus cummunis, Shorea robusta, Azadirachta indica, Schleichera oleosa, Pongamia pinnata,* etc.

2. **Timber yielding plants** : A number of tree species found in the reserve area are important source of valuable timber for the construction of furniture, building materials and agricultural implements. Some of the important timber yielding plants are *Anogeissus latifolia, Neolamarckia cadamba, Azadirachta indica, Bombax ceiba, Dalbergia sissoo, D. latifolia, Gmelina arborea, Haldina cordifolia, Mangifera indica, Mitragyna parviflora, Murraya paniculata, Drypetes roxburghii, Scheichera oleosa, Shorea robusta, Tectona grandis, Syzygium cumini, Terminalia alata, Wrightia arborea, W. tinctoria, Acacia nilotica, Lagerstoemia parviflora, Trewia nudiflora, Albizia chinensis, A. lebbeck, A. odaratissima, A. procera, Butea monosperma, Madhuca latifolia, Toona ciliata, Trema orientalis, Diospyros montata,* etc.

3. **Hut making and thatching :** *Borassus flabellifer, Dendrocalamus strictus, Bambusa tulda, Ehretia laevis, Lagerstroemia parviflora, Oryza sativa, Phoenix acaulis, P. humilis, P. sylvestris, Shorea robusta, Dalbergia sissoo, Saccharum arundinaceum, S. officinarum, S. spontaneum, Diospyros montana, Desmostachya bipinnata, Apluda mutica, Typha angustata, T. elephantia, Arundo donax, Phragmites wallotoria, Desmodium oojeinense, Kydia calycina,* etc. are variously used in the construction of thatched houses by the locals of the area.

4. **Plants with miscellaneous use :** *Arundo donax, Bauhinia purpurea, B. vahlii, Calamus tenuis Butea monosperma, Dendrocalamus strictus, Saccharum spontaneum, S. arundinaceum, Apuda mutica, Eulaliopsis binata, Hibiscus vitifolius, Marsdenia tenacissima, Phoenix acaulis, P. humilis, P. sylvestris, Porana paniculata, Typha angustata,* etc. are used for making various household and handicraft items like ropes, cordage, hats, mats, baskets, brooms, brushes, etc.

5. **Fodder :** *Desmodium motorium, D. pulchellum, Milletia extensa, Albizia* spp., *Ficus* spp., *Sesbania sesban, Bambusa tulda, Dendrocalamus strictus, Dalbergia sissoo, Bauhinia variegata, Butea monosperma, Moringa oleifera, Tinospora cordifolia, Alternanthera sessilis* and a number of grasses and sedges are collected and often stored for feeding the domestic cattle.



Tiger niche - young plant of *Cassia fistula* in grass Land.

6. **Dyes :** The vegetative and floral parts of species like *Acacia catechu, Butea monosperma, Lagerstroemia parviflora, Lawsonia inermis, Mallotus philippensis, Nyctanthes arbor-tristis, Curcuma longa, Indigofera astragalina, I. tinctoria, Wendlandia tinctoria, Woodfordia fruticosa,* etc. are used to extract dyes for domestic use.

7. **Musical instruments** : Wood obtained from *Mangifera indica, Gmelina arborea, Shorea robusta, Tectona grandis, Terminalia alata,* etc. is used for making musical instruments.

8. **Beverages and narcotics :** *Asparagus racemosus, Borassus flabellifer, Phoenix sylvestris, Piper longum,*

Madhuca longifolia var. *latifolia, Oryza sativa, Clerodendrum serratum, Croton roxburghii, Tamarindus indica, Cassia occidentalis, Canabis sativa,* etc. are used for preparing beverages (alcoholic and non-alcoholic) and drinks.

9. **Gums and resins :** *Acacia* spp., *Aegle marmelos, Anogeissus latifolia, Boswellia serrata, Butea monosperma, B. Parviflora, Shorea robusta, Sterculia urens, Mangifera indica, Cordia dichotoma, Lannea coromandelica, Azadirachta indica, Bombax ceiba, Buchanania lanzan,* etc. are important source of extracting gums and resins.

10. **Insecticides :** *Azadirachta indica, Ocimum basilicum, O. tenuiflorum, Cymbopogon martini, Murraya koenigii,* etc. are used as insect repellant and insecticides.

11. **Fibre yielding plants :** *Borassus flabellifer, Ficus hispida, F. rumphii, Abutilon indicum, Hibiscus cannabinus, H. vitifolius, Malachra capitata, Malvastrum coromandelianum, Pavonia repanda, Sida cordifolia, Urena lobata, Triumfetta rhomboidea, Typha angustata, Grewia* spp., *Corchorus* spp., *Melochia corchorifolia, Bauhinia purpurea, B. racemosa, B. vahlii,* etc. are used for extracting fibres which are used for various household purposes.

12. **Plants used for making umbrella :** Leaves and stems of many plants are used by locals for making umbrella for protection from sun rays and rains. The most commonly used plants are *Butea monosperma, Tectona grandis, Borassus flabellifer, Dendrocalamus strictus,* etc.

13. **Plants used for fishing / Fish poison :** Fruits of *Barringtonia acutangula, Casearia elliptica, C. graveolens, Catunaregam spinosa;* bark and leaves of *Tephrosia candida;* roots of *Derris cuneifolia, D. scandens* and *Milletia extensa,* etc. are used as fish poison by the locals.

14. **Host plants for Lac insect :** *Butea monosperma* and *Schleichera oleosa* are used for culturing and rearing the Lac insect. The finest quality of Lac is obtained from twigs of the latter.

15. **Bee pasturage plants :** Some plants growing in the reserve are nectar yielding and constitute an important source of honey. Some of the important plants commonly visited by honey bees are *Anogeissus latifolia, Azadirachta indica, Albizia lebeeck, A. odoratissima, Argemone mexicana, Aegle marmelos, Bauhinia vahlii, Butea monosperma, Bombax ceiba, Cassia fistula, Dendropthoe falcata, Justicia adhatoda, Madhuca longifolia* var. *latifolia, Moringo oleifera, Nelumbo nucifera, Nymphaea nouchali, Sesamum orientale, Syzigium cumini, Ventilago denticulata, Woodfordia fruticosa,* etc.

16. **Plants used for hunting :** Ripe fruits of *Cordia dichotoma*; seeds of *Strychnos mux-vomica;* gums of *Ficus benghalensis* are used for hunting birds and small animals.

17. **Sugar yielding plants :** *Borassus flabellifer, Phoenix* spp. And *Saccharum officinarum* are commonly used for making sugar and jaggery.

18. **Plants used in paper industry :** *Dendrocalamus strictus* is the most commonly and widely used plant in paper industry. Other plants used in paper industry are *Boswellia serrata, Helicteres isora, Hetropogon contortus, Imperata cylindrica, Kydia calycin, Themeda caudata, Sterculia urens, Trema orientalis,* etc.

19. **Tannin yielding plants :** Bark of *Acacia nilotica, Barringtonia acutangula, Bauhinia purpurea, Bridelia retusa, Buchanania lanzan, Casearia graveolens, Cassia fistula, Emblica officinalis, Ficus benghalensis, F. racemosa, Langerstroemia parviflora, Manilkara hexandra, Nyctanthus arbor-tristis, Terminalia alata, T. arjuna, T. bellirica, Tremma orientalis,* etc., fruits of *Terminalia arjuna, T. bellirica, Emblica officinlis,* etc. and leaves and twigs of *Anogeissus latifolia* yield tannin.

20. **Boat making :** The woods of *Barringtonia acutangula, Corida dichotoma, Lagerstroemia*

parviflora, Syzygium cumini, Thespesia populnea, etc. are used for making boats.

21. Medicinal plants

In addition various economically important plants found in the Vamiki Tiger Reserve, a large number of plants are available which are widely used by the locals in household remedies and many of them have potential to be exploited as commercial medicinal/drug plants. Some of the commonly used medicinal plants are :

Plants used for abortion and in menstrual disorders : *Alangium salvifolium, Annona squamosa, Elephantopus scaber, Gardenia turgida, Smilax ovalifolia, Abrus precatorius, Alternanthera sessilis, Amaranthus spinosus, A. tricolar, Chenopodium ambrosioides,* etc.

Plants used as antidote in snake bite and scorpion sting: *Achyranthus aspera, Amaranthus spinosus, Indoneesiella echioides, Aristolochia indica, Croton roxburghii, Curculigo orchioides, Esmodium gangeticum, Eclipta prostrata, Euphorbia hirta, Gmelina arborea, Spermacoce articularis, Plectranthus mollis, Hemidesmus indicus, Elephantopus scaber,* etc.

Plants used as antidiabetic : *Catharanthus roseus, Biophytum sensitivum, Helicteres isora, Geodorum densiflorum, Ficus benghalensis, Syzygium cumini, Pongamia pinnata, Gymnema sylvestre, Acacia nilotica, Scoparia dulcis, Coccinia grandis,* etc.

Plants used as antidysenteric : *Murraya koenigii, Acacia nilotica, Amaranthus tricolar, Asparagus racemosus, Bauhinia malabarica, Calotropis gigantean, Commelina longifolia, Curculigo orchioides, Alangium salvifolium, Holarrhena pubescens, Solanum nigrum, Terminalia bellirica,* etc.

Plant used in epilepsy and hysteria : *Borassus flabellifer, Cassine glauca, Colebrookea oppositifolia, Flemingia strobiligera, Mimosa himalayana, Hemidesmus indicus, Evolvulus alsinoides, Baccopa monnieri, Celastrus paniculatus,* etc.

Plants used in goitre : *Caesulia axillaris.*

Plants used as antiplague : Leaves of *Ocimum tenuiflorum,* leaves and fruit pulp of *Aegle marmelos.*

Plants used in gonorrhoea : *Soymida febrifuga, Amaranthus spinosus, Curculigo orchioides, Dalbergia sissoo, Equisetum debile, Gmelina arborea, Phyllanthus fraternus, Ocimum basilicum, Physalis minima, Pouzolzia zeylenica,* etc.

Plants used in cough, cold, asthma and bronchitis : *Abrus precatorius, Spilanthus calva, Achyranthus aspera, Haldina cordifolia, Vitex negundo, Madhuca longifolia* var. *latifolia, Costus speciosus, Acacia catechu, Calotropis procera, Terminalia chebula, Abutilon indicum, Barringtonia acutangula, Justicia adhatoda,* etc.

Plants used in antifertility : *Alysicarpus vaginalis, Annona squamosa, Cassia fistula, Croton roxburghii, Dandrophthoe falcate, Indigofera linnaei, Pentanema indicum, Plumbago zeylanica,* etc.

Plants used in impotency and other sexual disorders: *Chenopodium album, Asparagus racemosus, Chlorophytum tuberosum, C. arundinaceum, Curculigo orchioides, Hemidesmus indicus, Malvastrum coromandelianum, Moringa oleifera,* etc.

Plants used for easy delivery and to promote conception : *Achyranthus aspera, Indigofera cassioides,* etc.

Plants used for cooling effect : *Cassia fistula, Woodfordia fruticosa,* etc.

Plants used in headache : *Achyranthus aspera, Canscora diffusa, Clerodendrum viscosum, Desmodium pulchellum, Hygrophila polysperma, Teslosma pallida,* etc.

Plants used in hydrophobia : *Calotropis gigantea, Achyranthus aspera, Solanum nigrum,* etc.

Plant usd in deafness : *Catunaregum spinosa.*

Butea monosperma - Flame of the Forest

Plants used in bone fracture : *Hoppea dichotoma, Tinospora cordifolia, Vanda tessellata, Viscum nepalense,* etc.

Plants used in boils and blisters : *Heliotropium indicum, Trichosanthes cucumerina, Phyllanthus fraternus, Mirabilis jalapa, Wattakaka volubilis, Argemone mexicana, Capparis zeylanica, Ficus racemosa, Mallotus philippensis, Mucuna pruriens,* etc.

Plants used in cuts, wounds and burns : *Aerva lanata, Ageratum conyzoides, Argemone mexicana, Blumea lacera, Buchanania lanzan, Clerodendrum viscosum, Colebrookea oppositifolia, Cuscuta reflexa, Evolvulus nummularius, Leonotis nepetifolia, Tridax procumbens, Boerhavia diffusa, Curcuma longa, Bombax ceiba, Curculigo orchioides, Elephantopus scaber,* etc.

Plants used in hydrocele : *Holoptelea integrifolia, Mimosa pudica,* etc.

Plants used in jaundice : *Bacopa monnieri, Phyllanthus fraternus, P. virgatus, Aegle marmelos, Ceriscoides turgida, Boerhavia diffusa, Curculigo orchioides, Hygrophila auriculta, Cuscuta reflexa, Litsea glutinosa, Eclipta prostrata, Oledenlandia corymbosa,* etc.

Plants used in fevers : *Costus speciosus, Hemidesmus indicus, Gmelina arborea, Oxalis corniculata, Helicteres isora, Andrographis paniculata, Tinospora cordifolia, Eclipta prostrata, Croton roxburghii, Canscora diffusa,* etc.

Plants used in rheumatism and gout : *Celastrus paniculatus, Cocculus hirsutus, Achyranthus aspera, Urena lobata, Boerhavia diffusa, Alangium salvifolium, Leucas aspera, Strychnos nuxvomica, Gloriosa suberba,* etc.

Plants used in stomachaches : *Elephantopus scaber, Murraya koenigii, Grewia serrulata, Cassia fistula, Careya arborea,* etc.

Plants used as laxatives : *Aegles marmelos, Boerhavia diffusa, Cassia fistula, C. tora, Chenopodium album,*

Colocasia esculenta, Justicia procumbens, Trichosanthes cucumerina, Amaranthus spinosus, Alangium salvifolium, etc.

Plants used in leprosy : *Adiantum philippense, Calotropis gigantean, Centella asiatica, Dalbergia sissoo, Albizia procera, A. lebbeck, Ficus racemosa, Lawsonia inermis, Mallotus philippensis, Wrightia tinctoria,* etc.

Plants used in piles : *Achyranthes aspera, Boerhavia diffusa, Chenopodium album, Momordica dioica, Tagetes eracta, Vernoia cinerea, Curculigo orchioides, Indigofera cassioides, Gloriosa superba, Plumbago zeylanica,* etc.

Plants used in rheumatism : *Aphanamixis polystachya, Boerhavia diffusa, Callicarpa macrophylla, Calotropis gigantea, Cassia fistula, Centella asiatica, Conyza banariensis, Corchorus capsularis, Hemidesmus indicus, Lantana camara, Lygodium flexuosum, Momordica cochinchinensis, Cocculus hirsutus, Celastrus paniculatus, Strychnos nux-vomica,* etc.

Plants used in skin diseases : *Ageratum conyzoides, Ammannia baccifera, Cassia occidentalis, Cuscuta reflexa, Dendrophthoe falcata, Hemidesmus indicus, Hyptis suaveolens,* etc.

Plants used in toothache and gum affections : *Ichnocarpus frutescens, Leucas cephalotes, Madhuca longifolia* var. *latifolia, Pentanema indicum, Rivea hypocrateriformis, Solanum anguivi, Acaica catechu, Spilanthes calva, Tabernaemontana divaricata,* etc.

Plants used in tuberculosis : *Centella asiatica, Butea monosperma, Celastrus paniculatus, Asparagus racemosus, Bauhinia variegata, Triumfetta rhomboidea, Tinospora cordifolia, Abrus precatorius, Melia azadirach,* etc.

Plants used in ophthalmic infections : *Ichnocarpus frutescens, Leucas cephalotes, Madhuca longifolia* var. *latifolia, Pentanema indicum, Rivea hypocrateriformis, Solanum anguivi, Acaica catechu, Spilanths calva, Tabernaemontana divaricata,* etc.

Plants used as purgatives : *Cassia fistula, Alangium salvifolium, Terminalia chebula, Ricinus communis, Achyranthus aspera, Cassia occidentalis, Costus speciosus, Momordica charantia, Physalis minima,* etc.

Common ethno-medicinal plants used in Tiger Reserve

The aboriginal Tharus inhabiting the tarai region of the reserve have intense knowledge of useful plants, which are used by them in their daily life. In addition to the plant species used for food, fodder, fuel, fibre, shelter, etc. they use a number of wild plants for treating their ailments. Some of the commonly used plants by them are *Parthenium hysterophorus* (for Diabetes, *Ricinus communis* (Purgative, Boils and Blisters), *Psidium guajava* (Stomach ache), *Achyranthes aspera* (Piles), *Evolvulus alsinoides* (Jaundice), *Asparagus racemosus* (Tonic for women), *Chlorophytum tuberosum* (Aphrodisiac), *Eclipta prostrata* (Hair tonic and Jaundice), *Datura metal* (Abscess), *Syzygium cumini* (Diabetes and Stomachache), *Ficus benghalensis* (Eye problems), *Rauvolfia serpentina* (Insanity and Blood pressure), *Halarrhena pubescens* (Dysentry), *Andrographis paniculata* (Fever and Malaria), *Bacopa monnieri* (Asthma), *Aegle marmelos* (Purgative, Cooling and Stomach disorders), *Azadirachta indica* (Eye problems, Small pox and Skin Diseases), *Piper longum* (Cough and Cold), *Terminalia bellirica* (Purgative, Laxative and Stomach disorders), *T. chebulas (*Purgative, Laxative and Stomach disorders*), Acacia nilotica* (GumTonic for women), *Dendrocalamus strictus* and other Bamboos (Hairs on nodes of culmsused stop bleeding), *Tridax procumbens* (Cuts and Wounds), *Cassia fistula* (Snake bite), *Coccinia grandis* (Diabetes), *Curcuma zeodaria* (Burning sensation of feet), *Curcuma longa* (Antiseptic, Tonic and Blood purifier), *Cyperus rotundus* (Anthelmintic), *Scoparia dulcis* (Toothaches), *Tagetes erecta* (Ear-pain), *Aerva lanata* (Diabetes), *A. sanguinolenta* (Dysentry), *Piper peepuliodes* (Leprosy), *Stephania japonica* (Urinary disorders), *Tiliacora acuminata* (Snake bite),

Plumbago zeylanica (Piles and Diarrhoea), *Polycarpaea corymbosa* (Jaundice), etc.

Factors affecting the vegetation :

The vegetation has been degradd into scrub jungles as well as to grasslands in some places in this Reserve. A number of biotic and abiotic factors have been found to influence the vegetation and floristic composition of the forests. Some of the common cause for the degradation of the natural vegetation in the reserve are as follows

1. **Browsing and grazing :** Grazing by domestic animals cause much injury to the ground flora. Some of the forest areas have been changed into grasslands due to grazing and browsing by domestic animals. Further, trampling of the forest floor by the cattle has adverse effects on seedlings. Lopping of forest trees and shrubs for fodder and fuel has also affected the vegetation. Domestic cattle like cow, ox, buffalo, goat, etc. freely graze in the forests and on the hill slopes. By continuous trampling the soil become compact and hard. In order to protect the natural cover from degradation grazing should be totally stopped in the core area and rotational grazing may be preferred in buffer or outer zone.

2. **Floods :** Floods cause severe damage to the vegetation. The river Gandak and other small rivers are over flooded during and sometimes after the rains, which inundate a major portion of the forest areas and cause considerable damage to the forests. The mud and soil deposited by flood destroy the herbaceous and shrubby species. The perennial flow of the river Gandak has resulted in the erosion of nearly 1000 metres (length-wise) of forestlands. Apart from this, water flow from Nepal cause considerable damage to the forest of this reserve.

3. **Fire hazards :** Fire cause severe damage to the herbaceous flora and young saplings of various forest trees. In many cases fires that occur are incendiary, mainly caused by grazers interested in getting fresh clumps of grasses for the cattle, fire for hunting, for clearing lands, for making lands passable, etc. Fire may also be caused by lighting strike, by rock fall or by friction between Bamboo culms. The evil effects of fire upon forests are:

(a) The soil nutrients remain partly unrecouped and are not replenished due to the burning of the humus and leaf litter. As a result the soil becomes deficient in nutrients, which is not supportive for plant growth.

(b) The useful soil microorganisms like VAM, earthworms, insects and useful bacteria are killed which help in enriching the soil.

(c) The seedlings are sometimes totally destroyed or severely damaged or badly injured during such fires. Certain species like *Desmodium pulchellum* and *D. triflorum* are fire indicator species. The recurrence of fire destroys the plants cover and the water washes away the topsoil of the forestlands.

(d) It has been observed that burning prevents invasion of woody species in the grasslands and also the forage produce in the burnt land is more palatable (for which reason villagers burn the grasses regularly).

4. **Population pressure :** Rapid increase of population has an important role in changing the vegetation pattern. Villagers generally depend on forests for edible items, fuel wood, fodder, etc. Due to population pressure, some of the forest areas have been converted into cultivated lands.

5. **Soil erosion :** Erosion due to heavy grazing is seen along the hill slopes and sheet erosion is commonly seen where grazing pressure is very high. Soil erosion is also seen in mixed forest areas, where recurring forest fire has depleted the plant cover and in "Sal" areas, where felling has been done.

6. **Weeds and pests :** Due to destruction of original forest by the inhabitants, obnoxious weedy elements have invaded the Reserve, e.g. *Ageratum conyzoides, Argemone mexiana, Cassia occidentalis, Ipomoea* spp., *Lantana* spp., *Malvastrum*

coromandelianum, Parthenium hysterophorus, Tridax procumbens, Urena lobata, Synedrella nodiflora, etc. which suppress the growth of native plants. Many of these climbers reach almost to the top of the forest to the top of the forest canopy and hamper proper growth of young trees and shrubs. The parasitic plants like *Dendropthoe falcate* and *Cuscuta reflexa* are found on a wide range of host trees like *Haldina cordifolia, Bombax ceiba,* and *Ziziphus mauritiana,* which also causes considerable damage to the forests. Besides, a large number of parasitic fungi and insects also entail severe damage to Sal and other economic plants of the forests.

7. **Illegal felling and over-exploitation** : Forest mafias and villagers fell timber wood trees in large numbers. Similarly Cane forests in some areas have been totally destroyed by illegal cutting. The over-ex;oitation of medicinal plants by local people also destroys the natural plant wealth of the reserve. Some of the over-exploited medicinal plants are *Rauvolfia serpentina* (for roots), *Curculigo orchioides* (for tubers), *Asparagus racemosus* (for tubers), *Chlorophytum tuberosum* (for tubers) and *C. arundinaceum* (for tubers). Generally local people uproot whole plants thus destroying their natural population.

Exotic species naturalized in the Reserve

The plants mentioned in weeds and aliens of Tiger Reserve are mostly exotic but in due course of time they have become naturalized. These naturalized exotic elements have been grouped into 4 categories, viz. Neotropical, North temperate, North African and Austro-Asian. Out of these nearly 50% are of American origin, some are of African, Australian, European origin and rest are introduced from countries like China, Japan, Malaysia, West Indies, etc.

Some species common with Malesian region : *Oxalis corniculata, Hybanthus enneaspermus, Hypercum japonicum, Pavonia rependa, Porana paniculata, Celosia argentea,* etc.

Some species common with Tropical Africa : *Cocculus hirsutus, Plycarpon prostratum, Urena lobata, Grewia serrulata, Plumbago zeylanica, Indigofera linnaei,* etc.

Some species common with Tropical America : *Argemone mexicana, Cassia tora, C. occidentalis, Ruellia tuberosa, Heliotropium indicum, Gomphrena celosoides, Nicotiana plumbaginifolia, Malachra capitata, Datura metal, Synedrella nodiflora, Physalis minima, Parthenium hysterophorus, Conyza bonriensis, Eichhornia crassipes,*etc.

Some species common with Europe : *Anagallis arvensis, Medicago lupulina, Portulaca oleracea, Convolvulus arvensis, Fumaria indica, Spergula arvensis, Stellaria media, Vicia hirsute, V. sativa, Sonchus oleraceus, Melilotus alba, M. indica,* etc.

Conservation Strategies :

Valmiki Tiger Reserve is rich in floristic/species diversity but this diversity is continuously declining due to various natural and man made activities such as developmental activities, floods and erosion, illegal felling, forest fire, illegal grazing and browsing, etc. Expansion of agricultural lands, and other socio-economic factors also lead to the depletion of natural habitats. Measures required to conserve the plant diversity of the Tiger reserve are

- Establishment of commercial farms for medicinal plant cultivation near village areas to prevent over-exploitation and also encouragement for cultivation of well known and less-known economically potential plants to check their exploitation from natural habitats.
- Appropriate legislative mechanism for sustenance of rare and endemic species.
- Involvement and encouragement of local people in forest management and imparting environmental awareness training for integrated development of flora vis-à-vis local populace.

- It has been observed that human population inhabiting the core area of the valmiki Tiger Reserve adversely affects population of wild animals and plant. Therefore to improve the ecosystem, removal of adverse human factors from the core area of the Reserve is essential as per Action Plan proposed under the Project Tiger.
- Appropriate steps should be taken in Action Plan of Tiger Reserve for flood control, fire control and grazing and browsing by domestic animals.

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Map of Valmiki Tiger Reserve, Bihar

Lantana camara : weed invaded most of the forest area

SALIENT FEATURES

Area

Core	:	335.64 sq km
Buffer	:	358 sq km
Total	:	840.26 sq km
Longitude	:	83°0' East to 84°41' East
Latitude	:	27°3' North to 27° 10' North
Altitude	:	125 m to 880 m above M.S.L.
Rainfall	:	1461.2 mm to 2053.3mm

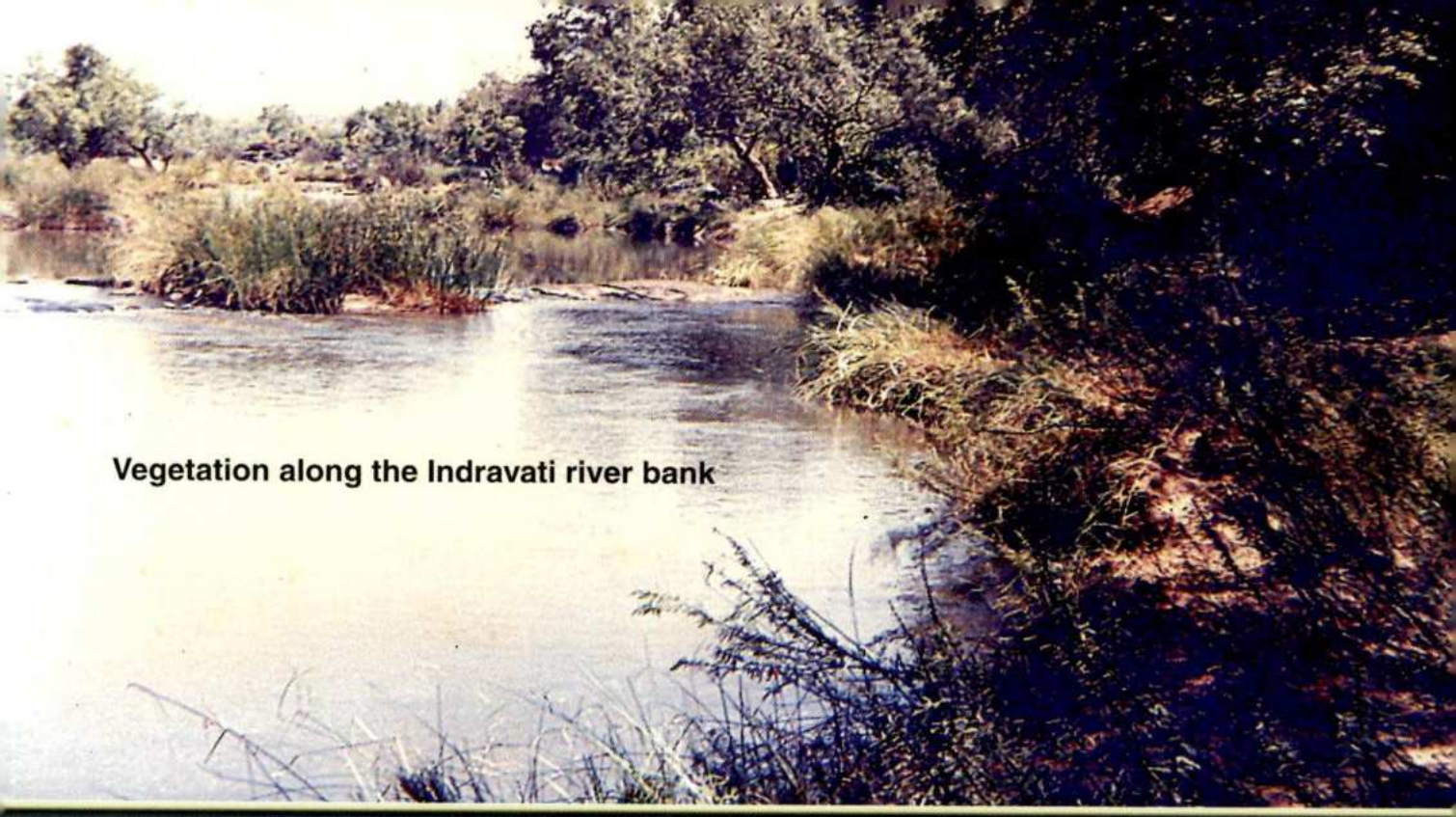
Temperature

Minimum	:	8°C
Maximum	:	36°C

Seasons

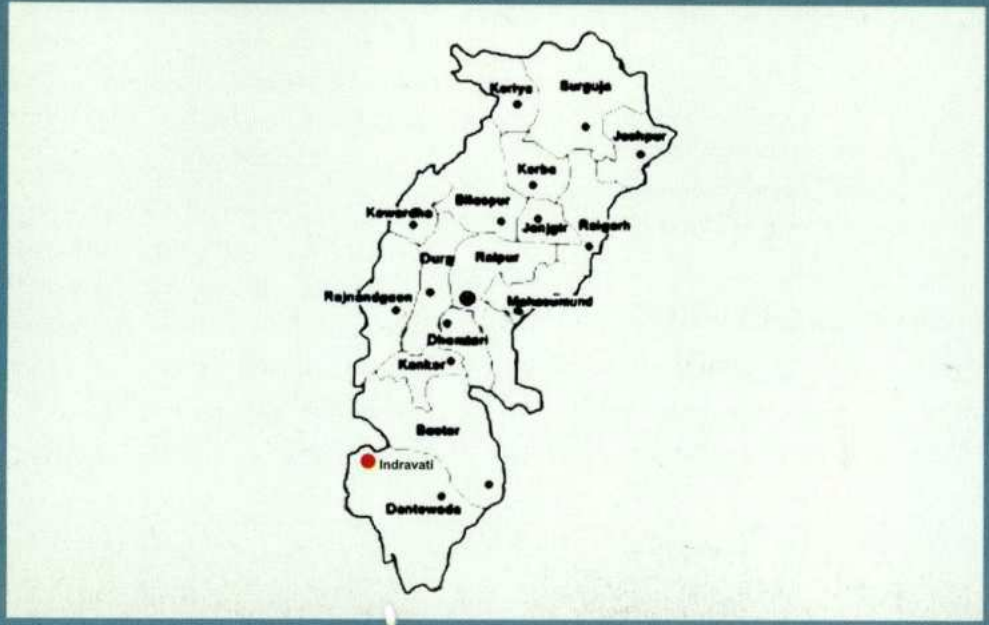
Winter	:	November to February
Summer	:	March to June
Rainy	:	July to September

CHHATTISGARH



Vegetation along the Indravati river bank

Indravati Tiger Reserve



Indravati Tiger Reserve

Anand Kumar & KP Singh
Botanical Survey of India, Central Circle, Allahabad

The Indravati Tiger Reserve established in 1982-83 lies between 18°51′-19°24′ N latitude and 80°16′-80°44′ E longitude in Bijapur tehsil of Dantewada district (Chhattisgarh). The total area of the tiger reserve is 2,799 sq km, which include 1,258 sq km of core area and 1,541 sq km of buffer zone. The tiger reserve derives its name from the river Indravati which forms its northern and western boundary.

Topography of the reserve is not very variable. A large portion of the reserve is usually flat with hills distributed throughout. Altitude of some important places of the reserve is as follows: Pengunda (192m), Karkawada (225 m) Kerpe (250 m), Dudepalli (252 m), Kutru (286.4 m), Pharsegarh (295.6 m) and Bijapur (463.2 m). The average annaul rainfall is estimated to be 182 cm in Bhopalpatnam and 178.8 cm in Bijapur. Climate of the reserve has three distinct seasons, viz., winter, summer and rainy. The soil is generally deep, loamy and well drained with alluvial deposits at the foot hills, streams and river banks.

VEGETATION

A wide variety of vegetation patterns from grasslands to southern tropical dry deciduous and southern tropical moist deciduous forests are found. These are briefly dealt as follows:

Southern tropical moist deciduous forests

These forests are confined to lower hills slopes and are dense. Common tree species present in the top canopy are *Dillenia pentagyna* Roxb., *Gmelina arborea* Roxb., *Haldina cordifolia* (Roxb.) Ridsdale, *Lannea coromandelica* (Houtt.) Merr., *Pterocarpus marsupium* Roxb., *Schleichera oleosa* (Lour.) Oken, *Terminalia alata* Heyne ex Roth and *T. bellirica* (Gaertn.) Roxb. In second storey mainly *Antidesma acidum* Retz., *Bridelia hemiltoniana* Wall. ex Muell. Arg., *Bauhinia semla* Wunderlin, *Cassia fistula* L., *Dendrocalamus strictus* (Roxb.) Nees, *Embelia basaal* (Roem. & Schult.) A. DC., *Emblica officinalis* Gaertn., *Gardenia latifolia* Ait., *Grewia tiliifolia* Vahl, *Holarrhena pubescens* (Buch.-Ham.) Wall. ex G. Don, *Heterophragma quadriloculare* (Roxb.) K. Schum., *Kydia calycina* Roxb., *Mallotus philippensis* (Lam.) Muell. Arg., *Morinda pubescens* Sm., *Nyctanthes arbor-tristis* L. and *Syzygium cumini* (L.) Skeels are met. Common shrubs in these forests are represented by *Flemingia bracteata* (Roxb.) Wight, *Grewia hirsuta* Vahl, *G. rothii* DC., *Petalidium barlerioides* (Roth) Nees, *Rhinacanthus nasuta* (L.) Kurz etc. *Bauhinia vahlii* Wight & Arn. *Cansjera rheedii* Gmel., *Calycopteris floribunda* Lam., *Cissampelos pareira* L., *Dioscorea bulbifera* L., *D. glabra* Roxb., *Erycibe paniculata* Roxb., *Merremia umbellata* (L.) Hall. f., *Naravelia zeylanica* (L.) DC., *Symphorema polyandrum* Wight and *Smilax zeylanica* L. are usually occurring species of climbers and lianas in these forests. The ground flora comprises various herbaceous species like *Andrographis paniculata* (Burm. f.) Wall. ex Nees, *Arthraxon lancifolius* (Trin.) Hochst., *Cassia absus* L., *Cyperus niveus* Retz., *Desmodium gangeticum* (L.) DC., *Dipteracanthus prostratus* (Poir.) Nees, *Eranthemum purpurascens*

Wight ex Nees, *Mnesithea laevis* (Retz.) Kunth, *Oplismenus burmannii* (Retz.) P. Beauv., *O. compositus* (L.) P. Beauv., *Osbeckia muralis* Naud., *Rottboellia exaltata* L., f., *Orthosiphon rubicundus* (D. Don) Benth., *Sesamum indicum* L., *Sida cordata* (Burm. f.) Borss., *S. cordifolia* L. etc.

Southern tropical dry decidous forests

These forests are spread on upper hill slopes and plains. The number of species is less as compared to moist deciduous forests. Trees' height is of moderate size. *Dendrocalamus strictus* (Roxb.) Nees (bamboo) is often frequent. Climbers and lianas are comparatively few. These forests can be categorized into following two groups:

I. Mixed forests without teak

These forests occur in most parts of the reserve, viz., Kerpe, Pasewada, Dudepalli, Bhopalpatnam, Pengunda, Netikakler, Karkeli etc. Dense growth of *Dendrocalamus strictus* (Roxb.) Nees is present in Kerpe valley, Kandlaparti and Pharsegarh. In Netikakler, thick growth of tall grasses is seen as undergrowth. Species diversity is comparatively high. Common trees found in these forests are *Anogeissus latifolia* (Roxb. ex DC.) Wall. ex Guill. & Perr., *Alangium salvifolium* (L.f.) Wang., *Boswellia serrata* Roxb. ex Colebr., *Butea monosperma* (Lam.) Taub., *Buchnania lanzan* Spreng., *Careya arborea* Roxb., *Cleistanthus collinus* (Roxb.) Benth. ex Hook. f., *Cassia fistula* L., *Casearia graveolens* Dalz., *Cochlospermum religiosum* (L.) Alston, *Dendrocalamus strictus* (Roxb.) Nees, *Diospyros melanoxylon* Roxb., *Dolichandrone falcata* (Wall. ex DC.) Seem., *Eriolaena hookeriana* Wight & Arn., *Flacourtia indica* (Burm. f.) Merr., *Garuga pinnata* Roxb., *Hardwickia binata* Roxb., *Holarrhena pubescens* (Buch.-Ham.) Wall. ex G. Don, *Hymenodictyon orixense* (Roxb.) Mabberley, *Lagerstroemia parviflora* Roxb., *Mitragyna parvifolia* (Roxb.) Korth., *Oroxylum indicum* (L.) Venten., *Pterocarpus marsupium* Roxb., *Semecarpus anacardium* L. f., *Streblus asper* Lour., *Terminalia bellirica* (Gaertn.) Roxb. and *Wrightia tinctoria* R. Br. Shrubby species in these forests are represented by *Desmodium motorium* (Houtt.) Merr., *Indigofera cassioides* Rottler ex DC., *Flemingia semialata* Roxb. ex Ait. f., *Ixora pavetta* Andr., *Waltheria indica* L., *Woodfordia fruticosa* (L.) Kurz etc. These forests are also infested with various climbers and lianas, viz., *Bauhinia vahlii* Wight & Arn., *Butea superba* Roxb. ex Willd., *Combretum albidum* G. Don, *C. roxburghii* Spreng., *Cissus repanda* Vahl, *Cryptolepis buchanani* Roem. & Schult., *Erycibe paniculata* Roxb., *Hemidesmus indicus* (L.) R. Br., *Ichnocarpus frutescens* (L.) R. Br., *Mucuna prureins* (L.) DC., *Olax scandens* Roxb. and *Ventilago denticulata* Willd. Among herbs and grasses *Allmania nodiflora* (L.) R. Br. ex Wight, *Andrographis paniculata* (Burm. f.) Wall. ex Nees, *Bothriochloa pertusa* (L.) A. Camus, *Blepharis maderspatensis* (L.) Heyne ex Roth, *Blumea fistulosa* (Roxb.) Kurz, *Chrysopogon fulvus* (Spreng.) Chiov., *Chionachne koenigii* (Spreng.) Thwaites, *Dichanthium annulatum* (Forssk.) Stapf, *Hackelochloa granularis* (L.) Kuntze, *Heteropogon contortus* (L.) P. Beauv. ex Roem. & Schult., *Hemigraphis latebrosa* (Heyne ex Roth) Nees, *Iseilema laxum* Hack., *Pentanema indicum* (L.) Ling, *Plectranthus mollis* (Ait.) Spreng., *Rungia pectinata* (L.) Nees, *Themeda laxa* (Andersson.) A. Camus and *Urena lobata* L. are commonly found.

II. Mixed forests with teak

These forests are found only in some parts of the tiger reserve such as Bhopalpatnam, Kandlaparti, Itpal, Kodepal etc. *Tectona* L. f. (teak) is a common tree species here. Common associates of teak are *Anogeissus latifolia* (Roxb. ex DC.) Wall. ex Guill. & Perr., *Haldina cordifolia* (Roxb.) Ridsdale and *Mitragyna parvifolia* (Roxb.) Korth. Other tree species present in these forests are *Albizia odoratissima* (L. f.) Benth., *Bauhinia racemosa* Lam., *Boswellia serrata* Roxb. ex Colebr., *Cassia fistula* L., *Careya arborea* Roxb., *Chloroxylon swietenia* DC., *Dalbergia lanceolaria* L. f. subsp. *paniculata* (Roxb.) Thoth., *Emblica officinalis* Gaertn., *Flacourtia indica* (Burm.

f.) Merr., *Ziziphus mauritiana* Lam. and *Z. xylopyra* (Retz.) Willd. Shrubby vegetation is represented by *Euphorbia nivulia* Buch.-Ham., *Grewia hirsuta* Vahl, *Helicterers isora* L., *Indigofera cassioides* Rottler ex DC., *Phoenix acaulis* Buch. Ham. ex Roxb., *Petalidium barlerioides* (Roth) Nees, *Urena lobata* L. etc. These forests have only a few species of climbers and lianas like *Acacia pennata* (L.) Willd., *Bauhinia vahlii* Wight & Arn., *Butea superba* Roxb. ex Willd., *Ipomoea pes-tigridis* L., *Merremia hederacea* (Burm. f.) Hall. f., *Millettia extensa* (Benth.) Benth. ex Baker and *Smilax zeylanica* L. Undergrowth is such forests is poor and mainly comprises *Alloteropsis cimicina* (L.) Stapf, *Arthraxon lancifolius* (Trin.) Hochst., *Blepharis maderaspatenis* (L.) Heyne ex Roth, *Bothriochloa pertusa* (L.) A. Camus, *Chloris dolichostachya* Lag., *Flemingia nana* Roxb., *F. semialata* Roxb. ex Ait. f., *Hemigraphis latebrosa* (Heyne ex Roth) Nees, *Oplismenus burmannii* (Retz.) P. Beauv., *Perotis indica* (L.) Kuntze, etc.

Dry evergreen forests

These forests are confined along the banks of river and perennial streams in some parts of the tiger reserve, viz., Kandlaparti, Pharsegarh and Bijapur Ghati. The forests here are intermixed with dry deciduous type of forests. Floristic diversity is poor here and some noticeable species are *Diospyros malabarica* (Desr.) Kostel., *Ficus racemosa* L., *Manilkara hexandra* (Roxb.) Dubard, *Memecylon umbellatum* Burm. f., *Syzygium heyneanum* Wall. ex Wight & Arn. and *Vitex leucoxylon* L. f.

Grasslands

Many grasslands are found scattered in the tiger reserve. Luxuriant undergrowth of grasses is also met in dry deciduous forests at Netikakler and Pillure where tree canopy is not dense. In Pillure, vast stretch of grassland is present. Dominant species found in the grasslands are *Apluda mutica* L., *Aristida setacea* Retz., *Bothriochloa intermedia* (R. Br.) A. Camus, *B. pertusa* (L.) A. Camus, *Chionachne koenigii* (Spreng.) Thwaites, *Chrysopogon fulvus* (Spreng.) Chiov., *Digitaria ciliaris* (Retz.) Keeler, *Heteropogon contortus* (L.) P. Beauv. ex Roem. & Schult., *Imperata cylindrica* (L.) P. Beauv., *Iseilema anthephoroides* Hack., *I. laxum* Hack., *Mnesithea laevis* (Retz.) Kunth, *Pennisetum pedicellatum* Trin., *Setaria intermedia* Roem. & Schult., *S. pumila* (Poir.) Roem. & Schult., *Sorghum halepense* (L.) Pers., *Themeda laxa* (Andersson) A. Camus, *T. quadrivalvis* (L.) Kuntze and *Vetiveria zizanioides* (L.) Nash. Grasslands are also inhabited by some common herbs, they are *Ageratum conyzoides* L., *Alyscicarpus hamosus* Edgew., *A. vaginalis* (L.) DC., *Crotalaria albida* Heyne ex Roth, *C. linifolia* L. f., *Cassia occidentalis* L., *Desmodium laxiflorum* DC., *Polygala arvensis* Willd., *Pentanema indicum* (L.) Ling, *Scoparia dulcis* L., *Tridax procumbens* L. and *Vernonia cinerea* (L.) Less.

Aquatic vegetation

Due to presence of number of ponds, tanks, rivers, streams and puddles a large number of aquatic and marshy plants are found in the tiger reserve. Some of these plants are *Ammannia baccifera* L., *A. multiflora* Roxb., *Aeschynomene indica* L., *Aponogeton natans* (L.) Engl. & K. Karause, *Bergia ammannioides* Roxb. ex Roth, *Coix gigantea* Koenig ex Roxb., *Ceratophyllum demersum* L., *Cyperus brevifolius* (Rottb.) Hassk., *C. alulatus* Kern, *C. cyperoides* (L.), Kuntze, *C. exaltatus* Retz., *C. iria* L., *C. halpan* L., *C. pangorei* Rottb., *C. procerus* Rottb., *Echinochloa stagnina* (Retz.) P. Beauv., *Fimbristylis ferruginea* (L.) Vahl, *F. miliacea* (L.) Vahl, *F. schoenoides* (Retz.) Vahl, *Fuirena ciliaris* (L.) Roxb., *Hydrolea zeylanica* (L.) Vahl, *Hydrilla verticillata* (L. f.) Royle, *Hygrophila balsamica* (L.f.) Raf., *Ipomoea aquatica* Forssk., *Isachne globosa* (Thunb.) Kuntze, *Ludwigia adscendens* (L.) Hara, *Limnophila indica* (L.) Druce, *Lobelia alsinoides* Lam., *Monochoria vaginalis* (Burm. f.) K. Presl, *Najas indica* (Willd.) Cham., *Nymphoides*

hydrophylla (Lour.) Kuntze, *N. indica* (L.) Kuntze, *Nelumbo nucifera* Gaertn., *Nymphaea nouchali* Burm. f., *Oryza rufipogon* Griff., *Pistia stratiotes* L., *Polygonum glabrum* Willd., *P. barbatum* L., *Rotula aquatica* Lour., *Rotala densiflora* (Roth ex Roem. & Schult.) Koehne, *R. indica* (Willd.) Koehne, *Sacciolepis interrupta* (Willd.) Stapf, *Scirpus articulatus* L., *S. lateriflorus* J.F. Gmelin, *Sesbania bispinosa* (Jacq.) W.F. Wight; *Butomopsis latifolia* (D. Don) Kunth, *Tonningia axillaris* (L.) Kuntze, *Utricularia exoleta* R. Br. and *Vallisneria natans* (Lour.) Hara.

FLORISTIC DIVERSITY

Angiospermic diversity in the Indiravati Tiger Reserve area comprises 561 species distributed in 355 genera and 101 families following Kumar (2003). Out of these 393 species in 265 genera and 81 families belong to dicotyledons and 168 species in 90 genera and 20 families to moncotyledons (Table I).

A conspectus of different families representing number of genera and species in the tiger reserve has also been provided in Table II; the families have been arranged according to the Bentham and Hooker's System of Classification (1862-1883).

In Table III ten dominant families in respect of number of species and in Table IV ten dominant genera along with their number of species have been shown.

Following families of angiosperms are represented by single genus with single species: Ranunculaceae, Dilleniaceae, Papaveraceae, Violaceae, Polygalaceae, Caryophyllaceae, Portulacaceae, Tamaricaceae, Elatinaceae, Bombacaceae, Simaroubaceae Ochnaceae, Olacaceae, Leeaceae, Sapindaceae, Moringaceae, Apiaceae, Alangiaceae, Myrsinaceae, Hydrophyllaceae, Orobanchaceae, Pedaliaceae, Lauraceae, Urticaceae, Ulmaceae, Hydrocharitaceae, Costaceae, Hypoxidaceae, Taccaceae, Smilacaceae, Pontederiaceae, Butomaceae and Najadaceae.

Table I: Status of different groups of angiosperms

Group	Family	Genera	Species
Angiosperms	101	355	561
Dicotyledons	81	265	393
Monocotyledons	20	90	168

Table II: A conspectus of families representing number of genera and species

Family	No. of genera	No. of species
Ranunculaceae	1	1
Dilleniaceae	1	1
Annonaceae	1	2
Menispermaceae	2	2
Nymphaeaceae	2	2
Papaveraceae	1	1
Capparaceae	2	2
Violaceae	1	1
Cochlospermaceae	1	1
Flacourtiaceae	2	2
Polygalaceae	1	1
Caryophyllaceae	1	1
Portulacaceae	1	1
Tamaricaceae	1	1
Elatinaceae	1	1
Malvaceae	6	9
Bombacaceae	1	1
Sterculiaceae	6	6
Tiliaceae	3	9
Oxalidaceae	2	3
Rutaceae	2	2
Simaroubaceae	1	1
Ochnaceae	1	1
Burseraceae	2	2
Meliaceae	2	2
Olacaceae	1	1

Family	No. of genera	No. of species
Opiliaceae	2	2
Celastraceae	2	2
Rhamnaceae	2	3
Vitaceae	2	2
Leeaceae	1	1
Sapindaceae	1	1
Anacardiaceae	5	5
Moringaceae	1	1
Fabaceae	22	46
Caesalpiniaceae	5	15
Mimosaceae	4	9
Droseraceae	1	2
Combretaceae	5	12
Myrtaceae	3	4
Lecythidaceae	2	2
Melastomataceae	3	4
Lythraceae	5	7
Onagraceae	1	4
Cucurbitaceae	3	5
Molluginaceae	2	3
Apiaceae	1	1
Alangiaceae	1	1
Rubiaceae	14	18
Asteraceae	18	21
Campanulaceae	2	3
Myrsinaceae	1	1
Sapotaceae	2	2
Ebenaceae	1	4
Oleaceae	2	2
Apocynaceae	3	3
Asclepidaceae	4	4
Loganiaceae	2	2
Gentianaceae	2	6
Hydrophyllaceae	1	1

Family	No. of genera	No. of species
Boraginaceae	5	5
Convolvulaceae	5	11
Solanaceae	2	3
Scrophulariaceae	9	14
Orobanchaceae	1	1
Lentibulariaceae	1	2
Bignoniaceae	4	4
Pedaliaceae	1	1
Acanthaceae	19	26
Verbenaceae	7	7
Lamiaceae	9	12
Nyctaginaceae	3	3
Amaranthaceae	9	11
Polygonaceae	1	4
Lauraceae	1	1
Loranthaceae	2	3
Euphorbiaceae	11	21
Urticaceae	1	1
Ulmaceae	1	1
Moraceae	2	7
Ceratophyllaceae	1	1
Hydrocharitaceae	3	3
Orchidaceae	4	5
Zingiberaceae	3	4
Costaceae	1	1
Amaryllidaceae	2	2
Hypoxidaceae	1	1
Taccaceae	1	1
Dioscoreaceae	1	2
Liliaceae	5	7
Smilacaceae	1	1
Pontederiaceae	1	1
Commelinaceae	4	10
Arecaceae	2	3

Family	No. of genera	No. of species
Araceae	4	4
Butomaceae	1	1
Najadaceae	1	1
Aponogetonaceae	1	1
Eriocaulaceae	1	2
Cyperaceae	9	42
Poaceae	43	75

Table III: Ten dominant families

Family	No. of species	% of total species
Poaceae	75	13.37
Fabaceae	46	8.20
Cyperaceae	42	7.49
Acanthaceae	26	4.63
Euphorbiaceae	21	3.74
Asteraceae	21	3.74
Rubiaceae	18	3.21
Caesalpiniaceae	15	2.67
Scrophulariaceae	14	2.49
Combretaceae	12	2.14

Table IV: Ten dominant genera

Genus	Family	No. of species
Cyperus	Cyperaceae	22
Fimbristylis	Cyperaceae	9
Eragrostis	Poaceae	9
Desmodium	Fabaceae	8
Cassia	Caesalpiniaceae	8
Crotalaria	Fabaceae	6
Ficus	Moraceae	6
Indigofera	Fabaceae	5
Acacia	Mimosaceae	5
Ipomoea	Convolvulaceae	5

PHYTOGEOGRAPHY

The Indravati Tiger Reserve is sandwiched between Central India and Peninsular India. The vegetational analysis and floristic account reveal that the plants represented in the reserve have affinities with the plants of adjoining areas, viz., Central India and Peninsular India.

Plants common with Central India

Cissampelos pareira L. var. *hirsuta* (Buch.-Ham. ex DC.) Forman, *Cocculus hirsutus* (L.) Diels, *Hybanthus enneaspermus* (L.) F. Muell., *Cochlospermum religiosum* (L.) Alston, *Casearia graveolens* Dalz., *Flacourtia indica* (Burm. f.) Merr., *Bergia ammannioides* Roxb. ex Roth, *Kydia calycina* Roxb., *Urena lobata* L., *Bombax ceiba* L., *Helicteres isora* L., *Sterculia urens* Roxb., *Grewia abutilifolia* Vent. ex Juss., *G. hirsuta* Vahl, *Chloroxylon swietenia* DC., *Boswellia serrata* Roxb. ex Colebr., *Soymida febrifuga* (Roxb.) A. Juss., *Olax scandens* Roxb., *Cassine glauca* (Rottb.) Kuntze, *Ampelocissus latifolia* (Roxb.) Planch., *Buchnania lanzan* Spreng., *Lannea coromandelica* (Houtt.) Merr., *Semecarpus anacardium* L. f., *Abrus precatorius* L., *Butea monosperma* (Lam.) Taub., *Dalbergia latifolia* Roxb., *Desmodium pulchellum* (L.) Benth., *Ougeinia oojeinensis* (Roxb.) Hochr., *Uraria picta* (Jacq.) Desv. ex DC., *Bauhinia vahlii* Wight & Arn., *Cassia absus* L., *Anogeissus latifolia* (Roxb. ex DC.) Wall. ex Guill. & Perr., *Terminalia alata* Heyne ex Roth, *Careya arborea* Roxb., *Lagerstroemia parviflora* Roxb., *Woodfordia fruticosa* (L.) Kurz, *Melothria maderaspatana* (L.) Cogn., *Gardenia latifolia* Ait., *Haldina cordifolia* (Roxb.) Ridsdale, *Mitragyna parvifolia* (Roxb.) Korth., *Knoxia sumatrensis* (Retz.) DC., *Blumeopsis flava* (DC.) Gagnep., *Pentanema indicum* (L.) Ling, *Madhuca longifolia* (J. Koenig) Macbr. var. *latifolia* (Roxb.) Chevalier, *Diospyros melanoxylon* Roxb., *Holarrhena pubescens* (Buch.-Ham.)Wall. ex G. Don, *Wrightia tinctoria* R. Br., *Canscora decurrens* Dalz., *Cynoglossum lanceolatum*

Forssk., *Limnophila indica* (L.) Druce, *Oroxylum indicum* (L.) Venten., *Stereospermum chelonoides* (L. f.) DC., *Barleria cristata* L., *Nelsonia canescens* (Lam.) Spreng., *Andrographis paniculata* (Burm. f.) Wall. ex Nees, *Petalidium barlerioides* (Roth) Nees, *Gmelina arborea* Roxb., *Leucas biflora* (Vahl) R. Br., *Plectranthus mollis* (Aiton) Spreng., *Celosia argentea* L., *Polygonum glabrum* Willd., *Dendrophthoe falcata* (L.f.) Eitting., *Bridelia retusa* (L.) Spreng., *Cleistanthus collinus* (Roxb.) Benth. ex Hook f., *Mallotus philippensis* (Lam.) Muell. Arg., *Sebastiania chamaelea* (L.) Muell. Arg., *Ficus hispida* L.f., *Vanda tessellata* (Roxb.) Hook. ex G. Don, *Curcuma pseudomontana* J. Graham, *Curculigo orchioides* Gaertn., *Chlorophytum laxum* R. Br., *Smilax zeylanica* L., *Cyperus cyperoides* (L.) Kuntze, *Chionachne koenigii* (Spreng.) Thwaites, *Chrysopogon fulvus* (Spreng.) Chiov. etc.

Plants common with Peninsular India

Naravelia zeylanica (L.) DC., *Dillenia pentagyna* Roxb., *Byttneria herbacea* Roxb., *Eriolaena hookeriana* Wight & Arn., *Melochia corchorifolia* L., *Waltheria indica* L., *Grewia tiliifolia* Vahl, *Ochna gamblei* King ex Brandis, *Garuga pinnata* Roxb., *Cansjera reheedii* Gmel., *Opilia amentacea* Roxb., *Cissus repanda* Vahl, *Leea asiatica* (L.) Ridsdale, *Crotalaria prostrata* Rottl., *C. spectabilis* Roth, *Dalbergia lanceolaria* L. f. subsp. *paniculata* (Roxb.) Thoth., *Desmodium triquetrum* (L.) DC., *Galactia tenuiflora* (Klein ex Willd.)Wight & Arn., *Pseudarthria viscida* (L.) Wight & Arn., *Pterocarpus marsupium* Roxb., *Cassia pumila* Lam., *Mimosa himalayana* Gamble, *Anogeissus sericea* Brandis, *Calycopteris floribunda* Lam., *Memecylon umbellatum* Burm. f., *Osbeckia muralis* Naud., *Nesaea brevipes* Koehne, *Rotala densiflora* (Roth ex Roem. & Schult.) Koehne, *Cucumis callosus* (Rottler) Cogn., *Pimpinella wallichiana* (Hoenck.) Gandhi, *Hymenodictyon orixense* (Roxb.) Mabberley, *Morinda pubescens* Sm., *Embelia basaal* (Roem. & Schult.) A. DC., *Diospyros sylvatica* Roxb., *Canscora heteroclita* (L.) Gilg, *Erycibe paniculata* Roxb., *Merremia umbellata* (L.) Hall. f., *Centranthera tranquebarica* (Spreng.) Merr., *Aegenetia indica* L. *Dolichandrone falcata* (Wall. ex D.C.) Seem., *Heterophragma quadrioculare* (Roxb.) K. Schum., *Barleria strigosa* Willd., *Hygrophila balsamica* (L.f.) Raf., *Justicia betonica* L., *Staurogyne glauca* (Nees) Kuntze, *Symphorema polyandrum* Wight, *Vitex leucoxylon* L.f., *Lippia javanica* (Burm. f.) Spreng., *Anisochilus carnosus* (L.f.) Wall. ex Benth., *Leucas stricta* Heyne ex Benth., *Allmania nodiflora* (L.) R. Br. ex Wight, *Polygonum pulchrum* Blume, *Viscum orientale* Willd., *Antidesma acidum* Retz., *A. ghaesembilla* Gaertn., *Bridelia hamiltoniana* Wall. ex Muell. Arg., *Elatostema cuneatum* Wight, *Streblus asper* Lour., *Ficus amplissima* Sm., *Eulophia explanata* Lindl., *Curuma aromatica* Salisb., *Zingiber capitatum* Roxb., *Chlorophytum arundinaceum* Baker, *Murdannia edulis* (Stokes) Faden, *Amorphophallus sylvaticus* (Roxb.) Kunth, *Cyperus proceus* Rottb., *Fimbristylis ferruginea* (L.) Vahl, *Lipocarpha chinensis* (Osbeck.) Kern, *Rhynchospora longisetis* R. Br., *Isachne globosa* (Thunb.) Kuntze, *Mnesithea laevis* (Retz.) Kunth, etc.

UTILITARIAN ASPECT OF THE FLORA

A large variety of plant species found in the tiger reserve are useful for various purposes. These economically important plants along with their uses are presented in Table V.

Besides economic plants, various wild relatives of cultivated crops are also found in the tiger reserve, viz., *Chionachne koenigii* (Spreng.) Thwaites, *Coix gigantea* Koenig ex Roxb., *Eleusine indica* (L.) Gaertn. *Oryza rufipogon* Griff., *Setaria pumila* (Poir.) Roem. & Schult. and *S. intermedia* Roem. & Schult., among cereals and millets; *Cajanus scarabaeoides* (L.) Petit-Thou., *Mucuna pruriens* (L.) DC. and *Vigna umbellata* (Thunb.) Ohwi & Ohashi among legumes;

Table V : Useful plants

Botanical name	Timber	Tannin	Gum	Fibre	Paper	Dye	Oil	Edible	Fodder	Medicinal
Abelmoschus moschatus Medik.	-	-	-	+	-	-	+	+	-	+
Abrus precatorius L.	-	-	-	-	-	-	-	+	-	+
Acacia catechu (L. f.) Willd.	+	-	+	-	-	+	-	-	-	+
A. leucophloea (Roxb.) Willd.	-	+	-	+	-	-	-	+	+	+
A. nilotica (L.) Delile subsp. *indica* (Benth.) Brenan	+	+	+	-	-	-	+	+	+	+
A. pennata (L.) Willd.	-	+	-	-	-	-	-	-	-	-
Achyranthes aspera L.	-	-	-	-	-	-	-	+	-	+
Adhatoda zeylanica Medik.	-	-	-	-	-	-	+	-	-	+
Aegle marmelos (L.) Correa	-	-	+	-	-	-	+	+	-	+
Ageratum conyzoides L.	-	-	-	-	-	-	+	-	-	+
Ailanthus excelsa Roxb.	-	-	+	-	-	-	-	-	+	+
Alangium salvifolium (L. f.) Wang	+	-	-	-	-	-	+	-	-	+
Albizia lebbeck (L.) Benth.	+	+	+	-	-	-	-	-	-	+
A. odoratissima (L. f.) Benth.	+	-	+	-	-	-	-	-	+	+
Alternanthera sessilis (L.) R. Br. ex DC.	-	-	-	-	-	-	-	+	-	+
Amaranthus spinosus L.	-	-	-	-	-	-	-	+	-	+
Ammannia balccifera L.	-	-	-	-	-	-	-	-	-	+
Amorphophallus sylvaticus (Roxb.) Kunth	-	-	-	-	-	-	-	-	-	+
Andrographis paniculata (Burm. f.) Wall. ex Nees	-	-	-	-	-	-	-	-	-	+
Anisochilus carnosus (L.f.) Wall. ex Benth.	-	-	-	-	-	-	+	+	-	+
Anogeissus latifolia (Roxb. ex DC.) Wall. ex Guill. & Perr.	+	-	+	-	-	-	-	-	-	-
A. pendula Edgew.	+	-	-	-	-	-	-	-	-	-
Antidesma acidum Retz.	-	-	-	-	-	-	+	+	-	-
Argemone mexicana L.	-	-	-	-	-	-	+	-	-	+
Aristida setacea Retz.	-	-	-	-	+	-	-	-	-	-
Asparagus racemosus Willd.	-	-	-	-	-	-	-	-	-	+
Azadirachata indica A. Juss.	+	-	-	-	-	-	+	-	-	+
Barringtonia acutangula (L.) Gaertn.	-	+	-	-	-	-	-	-	+	+
Bauhinia purpurea L.	-	-	-	+	-	-	-	+	+	+
B. racemosa Lam.	-	-	-	+	-	-	-	-	-	+
B. semla Wunderlin	-	-	+	-	-	-	-	-	-	-
B. vahlii Wight & Arn.	-	+	-	+	-	-	-	+	-	-
Blumea lacera (Burm. f.) DC.	-	-	-	-	-	-	+	-	-	+
Bombax ceiba L.	-	-	+	+	-	-	+	-	+	+
Boswellia serrata Roxb. ex Colebr.	+	-	+	-	+	-	-	+	-	+
Bothriochloa intermedia (R. Br.) A. Camus	-	-	-	-	-	-	-	-	+	+
Brachiaria reptans (L.) Gard. & Hubb.	-	-	-	-	-	-	-	+	+	-
Breynia vitis-idaea (Burm. f.) C. E. C. Fischer	-	-	-	-	-	-	-	+	-	+
Bridelia retusa (L.) Spreng.	-	+	-	-	-	-	-	+	+	+
Buchanania lanzan Spreng.	+	+	+	-	-	-	+	+	+	+
Butea monosperma (Lam.) Taub.	-	-	+	+	+	+	+	-	+	+
B. superba Roxb. ex Willd.	-	-	+	-	-	-	+	-	+	+
Caesalpinia bonduc (L.) Roxb.	-	-	-	-	-	-	+	-	-	+
Calotropis gigantea (L.) R. Br.	-	-	-	+	-	-	+	-	-	+
Calycopteris floribunda Lam.	-	-	-	-	-	-	-	-	-	+
Capparis zeylanica L.	-	-	-	-	-	-	-	+	-	+
Careya arborea Roxb.	+	-	-	-	+	-	-	-	-	-

Botanical name	Timber	Tannin	Gum	Fibre	Paper	Dye	Oil	Edible	Fodder	Medicinal
Casearia graveolens Dalz.	-	+	-	-	-	-	-	-	-	+
Cassia fistula L.	-	+	-	-	-	-	-	-	-	+
C. occidentalis L.	-	-	-	-	-	-	+	-	-	+
C. siamea Lam.	+	-	-	-	-	-	-	+	+	-
Cassine glauca (Rottb.) Kuntze	-	+	+	-	-	-	-	-	-	+
Catunaregam spinosa (Thunb.) Tirvengadum	-	-	-	-	-	+	+	+	+	+
Celastrus paniculatus Willd.	-	-	-	-	-	-	+	-	-	+
Celosia argentea L.	-	-	-	-	-	-	-	+	-	+
Chloris virgata Sw.	-	-	-	-	-	-	-	-	+	+
Chlorophytum arundinaceum Baker	-	-	-	-	-	-	-	-	-	+
C. tuberosum (Roxb.) Baker	-	-	-	-	-	-	-	+	-	-
Chloroxylon swietenia DC.	+	-	+	-	-	+	+	-	-	+
Cissampelos pariera L.	-	-	-	+	-	-	-	-	-	+
Cleistanthus collinus (Roxb.) Benth. ex Hook. f.	-	-	-	-	-	-	-	-	-	+
Cleome viscosa L.	-	-	-	-	-	-	-	+	-	+
Clerodendrum serratum (L.) Moon	-	-	-	-	-	-	-	-	-	+
Cocculus hirsultus (L.) Diels	-	-	-	-	-	-	-	-	-	+
Cochlospermum religiosum (L.) Alston	-	-	+	+	-	-	+	-	-	-
Caoldenia procumbens L.	-	-	-	-	-	-	-	-	-	+
Colocasia esculenta (L.) Schott.	-	-	-	-	-	-	-	+	-	+
Commelina benghalensis L.	-	-	-	-	-	-	-	+	-	+
Corchorus capsularis L.	-	-	-	+	-	-	-	-	-	+
C. olitorius L.	-	-	-	+	-	-	-	+	-	+
Cordia obliqua Willd.	-	-	-	-	-	-	-	+	-	+
Costus speciosus (J. Koenig) Sm.	-	-	-	-	-	-	-	+	-	+
Crinum defixum Ker-Gawl.	-	-	-	-	-	-	-	-	-	+
Crotalaria juncea L.	-	-	-	+	-	-	-	-	-	-
C. spectabilis Roth	-	-	-	+	-	-	-	-	-	+
Cryptolepis buchanani Roem. & Schult.	-	-	-	+	-	-	-	-	-	-
Curculigo orchioides Gaertn.	-	-	-	-	-	-	-	-	-	+
Curcuma aromatica Salisb.	-	-	-	-	-	-	-	-	-	+
Cymbopogon martinii (Roxb.) Wats.	-	-	-	-	-	-	+	-	-	+
Cynodon dactylon (L.) Pers.	-	-	-	-	-	-	-	-	+	+
Cyperus brevifolius (Rottb.) Hassk.	-	-	-	-	-	-	-	-	+	+
C. exaltatus Retz.	-	-	-	-	+	-	-	-	-	-
C. iria L.	-	-	-	-	-	-	-	-	+	+
C. rotundus L.	-	-	-	-	-	-	+	-	-	+
Dactyloctenium aegyptium (L.) P. Beauv.	-	-	-	-	-	-	-	+	+	-
Dalbergia latifolia Roxb.	+	+	-	-	-	-	-	-	+	+
Dendrocalamus strictus (Roxb.) Nees	+	-	-	-	+	-	-	+	+	+
Dendrophthoe falcata (L. f.) Etting.	-	+	-	-	-	-	-	-	-	+
Desmodium gangeticum (L.) DC.	-	-	-	-	+	-	-	-	-	+
D. motorium (Houtt.) Merr.	-	-	-	-	-	-	-	-	+	-
Digitaria ciliaris (Retz.) Keeler	-	-	-	-	-	-	-	-	+	-
Dillenia pentagyna Roxb.	-	+	-	+	-	-	-	+	-	-
Dioscorea bulbifera L.	-	-	-	-	-	-	-	+	-	+
Diospyros malabarica (Desr.) Kostel.	+	+	-	-	-	-	-	-	-	+
D. melanoxylon Roxb.	+	-	-	-	-	-	-	+	-	+
Dolichandrone falcata (Wall. ex DC.) Seem	+	-	-	+	-	-	-	-	-	-
Drimia indica (Roxb.) Jessop	-	-	-	-	-	-	-	-	-	+
Echinochloa colonum (L.) Link	-	-	-	-	-	-	-	+	+	-
E. stagnina (Retz.) P. Beauv.	-	-	-	-	-	-	-	+	+	+
Eclipta prostrata (L.) L.	-	-	-	-	-	-	-	-	-	+
Elephantopus scaber L.	-	-	-	-	-	-	-	-	+	+

Botanical name	Timber	Tannin	Gum	Fibre	Paper	Dye	Oil	Edible	Fodder	Medicinal
Eleusine indica (L.) Gaertn.	-	-	-	-	-	-	-	+	+	-
Embelia basaal (Roem. & Schult.) A. DC.	-	-	-	-	-	-	-	+	-	+
Emblica officinalis Gaerth.	+	+	-	-	-	-	+	-	-	+
Emilia sonchifolia (L.) DC.	-	-	-	-	-	-	-	+	-	+
Eragrostis tenella (L.) P. Beauv. ex Roem. & Schult.	-	-	-	-	-	-	-	+	+	-
E. unioloides (Retz.) Nees ex Steud.	-	-	-	-	-	-	-	-	+	-
Erycibe paniculata Roxb.	-	-	-	-	-	-	-	+	-	+
Euphorbia hirta L.	-	-	-	-	-	-	-	+	-	+
E. thymifolia L.	-	-	-	-	-	-	-	-	-	+
Evolvulus alsinoides (L.) L.	-	-	-	-	-	-	-	-	-	+
Ficus benghalensis L.	+	-	-	+	+	-	-	+	+	+
F. hispida L. f.	-	+	-	+	-	-	-	+	-	+
F. racemosa L.	+	+	-	-	-	-	-	+	+	+
F. religiosa L.	-	+	-	+	+	-	-	+	+	+
Flacourtia indica (Brum. f.) Merr.	-	+	-	-	-	-	-	+	+	+
Flemingia nana Roxb.	-	-	-	-	-	-	-	-	-	+
Gardenia latifolia Ait.	+	-	-	-	-	-	-	-	-	-
G. resinifera Roth	+	-	+	-	-	-	-	-	-	+
Garuga pinnata Roxb.	+	+	-	-	+	-	-	-	+	+
Glinus lotoides L.	-	-	-	-	-	-	-	+	-	+
G. oppositifolius (L.) A. DC.	-	-	-	-	-	-	-	-	-	+
Gloriosa superba L.	-	-	-	-	-	-	-	-	-	+
Gmelina arborea Roxb.	+	-	-	-	+	-	-	-	-	+
Gnaphalium polycaulon Pers.	-	-	-	-	-	-	-	+	-	-
Grangea maderaspatensis (L.) Poir.	-	-	-	-	-	-	-	-	-	+
Grewia hirsuta Vahl	-	-	-	-	-	-	-	+	-	+
G. tiliifolia Vahl	+	-	-	+	-	-	-	+	-	+
Hackelochloa granularis (L.) Kuntze	-	-	-	-	-	-	-	-	+	+
Haldina cordifolia (Roxb.) Ridsdale	+	+	-	-	+	-	-	-	+	+
Hardwickia binata Roxb.	+	-	-	+	-	-	-	-	+	-
Helicteres isora L.	-	-	-	+	-	-	-	-	+	+
Hemidesmus indicus (L.) R. Br.	-	-	-	-	-	-	-	-	-	+
Hetrophragma quadriloculare (Roxb.) K. Schum	+	-	-	-	-	-	-	-	-	+
Holarrhena pubescens (Buch.-Ham.) Wall. ex G. Don	-	+	+	-	-	-	-	-	-	+
Homonoia riparia Lour.	-	-	-	-	-	-	-	+	-	+
Hybanthus enneaspermus (L.) F. v. Muell.	-	-	-	-	-	-	-	-	-	+
Hydrolea zeylanica (L.) Vahl	-	-	-	-	-	-	-	-	-	+
Ichnocarpus frutescens (L.) R. Br.	-	-	-	-	-	-	-	-	-	+
Imperata cylindrica L.	-	-	-	-	+	-	-	-	-	+
Indigofera tinctoria L.	-	-	-	-	-	+	-	-	-	+
Indoneesiella echioides (L.) Sreemadh.	-	-	-	-	-	-	-	-	-	+
Ipomoea aquatica Forssk.	-	-	-	-	-	-	-	+	-	+
I. pes-tigrides L.	-	-	-	-	-	-	-	-	+	+
Ischaemum rugosum Salisb.	-	-	-	-	-	-	-	+	+	-
Iseilema anthephoroides Hack.	-	-	-	-	-	-	-	-	-	+
I. laxum Hack.	-	-	-	-	-	-	-	-	-	+
Ixora pavetta Andr.	-	-	-	-	-	-	-	+	+	+
Kydia calycina Roxb.	+	-	-	+	+	-	-	-	+	-
Lagerstroemia parviflora Roxb.	+	+	+	-	-	-	-	-	+	-
Lannea coromandelica (Houtt.) Merr.	+	-	+	-	+	-	-	-	-	-
Leea asiatica (L.) Ridsdale	-	-	-	-	-	-	-	+	-	+
Leucas mollissima Wall. ex Benth.	-	-	-	-	-	-	-	+	-	-
Limnophila indica (L.) Druce	-	-	-	-	-	-	-	-	-	+
Lobelia alsinoides Lam.	-	-	-	-	-	-	-	+	-	-

Botanical name	Timber	Tannin	Gum	Fibre	Paper	Dye	Oil	Edible	Fodder	Medicinal
Madhuca longifolia (J. Koenig) Macbr. var. *latifolia* (Roxb.) Chevalier	+	-	-	-	-	-	+	+	+	+
Mangifera indica L.	+	-	-	-	-	-	-	+	-	+
Manilkara hexandra (Roxb.) Dubard	+	+	-	-	-	-	+	+	-	+
Melochia corchorifolia L.	-	-	-	+	-	-	-	+	-	+
Merremia umbellata (L.) Hall. f.	-	-	-	-	-	-	+	+	-	+
Millettia extensa (Benth.) Benth. ex Baker	-	-	-	+	-	-	-	-	+	+
Mitragyna parvifolia (Roxb.) Korth.	+	+	-	+	-	-	-	-	+	+
Mollugo pentaphylla L.	-	-	-	-	-	-	-	+	-	+
Moringa oleifera Lam.	-	-	+	-	-	-	+	+	+	+
Mucuna pruriens (L.) DC.	-	-	-	-	-	-	-	+	-	+
Nelumbo nucifera Gaertn.	-	-	-	-	-	-	+	+	+	+
Nyctanthes arbor-tristis L.	-	+	-	-	-	+	+	-	-	+
Nymphaea nouchali Burm. f.	-	-	-	-	-	-	-	+	-	+
Ocimum canum Sims.	-	-	-	-	-	-	+	+	+	+
Olax scandens Roxb.	-	-	-	-	-	-	-	+	-	+
Oroxylum indicum (L.) Ven.	+	-	-	-	-	-	+	+	+	+
Orthosiphon rubicundus (D. Don) Benth.	-	-	-	-	-	-	-	+	-	+
Oryza rufipogon Griff.	-	-	-	-	-	-	-	+	-	-
Ougeinia oojeinensis (Roxb.) Hochr.	+	+	-	+	-	-	-	-	+	+
Oxalis corniculata L.	-	-	-	-	-	-	-	+	+	+
Paspalidium flavidum (Retz.) A. Camus	-	-	-	-	-	-	-	+	+	-
Pergularia daemia (Forssk.) Chiov.	-	-	-	-	-	-	-	+	+	+
Phoenix acaulis Buch.-Ham. ex Roxb.	-	-	-	-	-	-	-	+	-	+
Phragmites karka (Retz.) Trin. ex Steud.	-	-	-	+	+	-	-	-	-	+
Phyllanthus amarus Schumach. & Thonn.	-	-	-	-	-	-	-	-	-	+
Physalis minima L.	-	-	-	-	-	-	-	+	-	+
Pistia stratiotes L.	-	-	-	-	-	-	-	+	-	+
Plectranthus mollis (Ait.) Spreng.	-	-	-	-	-	-	+	-	-	+
Polygonum barbatum L.	-	-	-	-	-	-	-	-	+	+
P. glabrum Willd.	-	-	-	-	-	-	-	+	-	+
P. plebeium R. Br.	-	-	-	-	-	-	-	+	-	+
Portulaca oleracea L.	-	-	-	-	-	-	-	+	-	+
Pterocarpus marsupium Roxb.	+	-	+	-	+	+	-	-	+	+
Ricinus communis L.	-	-	-	-	-	+	-	+	+	+
Rungia pectinata (L.) Nees	-	-	-	-	-	-	-	-	+	+
Schleichera oleosa (Lour.) Oken.	+	+	-	-	-	-	+	+	+	+
Schrebera swietenioides Roxb.	+	-	+	-	-	-	-	+	+	+
Scoparia dulcis L.	-	-	-	-	-	-	-	-	+	+
Semecarpus anacardium L.f.	+	-	+	-	-	-	-	+	-	+
Sesbania bispinosa (Jacq.) W.F. Wight	-	-	-	+	-	-	-	-	+	-
Setaria glauca (L.) P. Beauv.	-	-	-	-	-	-	-	+	-	+
Sida acuta Burm. f.	-	-	-	+	-	-	-	-	-	+
S. cordifolia L.	-	-	-	+	-	-	-	-	+	+
S. rhombifolia L.	-	-	-	+	-	-	-	-	-	+
Smilax zeylanica L.	-	-	-	-	-	-	-	+	-	+
Smithia conferta Sm.	-	-	-	-	-	-	-	+	-	+
Solanum virginianum L.	-	-	-	-	-	-	-	+	-	+
Sorghum halepense (L.) Pers.	-	-	-	-	-	-	-	+	+	+
Soymida febrifuga (Roxb.) A. Juss.	+	+	+	+	-	-	-	-	-	+
Sphaeranthus indica L.	-	-	-	-	-	-	+	+	-	+
Sterculia urens Roxb.	-	-	+	+	+	-	+	+	+	+
Stereospermum chelonoides (L.f.) DC.	+	-	-	-	-	-	-	-	+	+
Streblus asper Lour.	-	-	-	+	+	-	-	+	+	+
Syzygium cumini (L.) Skeels	+	+	-	-	-	+	-	+	+	+
S. heyneanum Wall. ex Wight & Arn.	+	+	-	-	-	-	-	+	-	+

Botanical name	Timber	Tannin	Gum	Fibre	Paper	Dye	Oil	Edible	Fodder	Medicinal
Tacca leontopetaloides (L.) Kuntze	-	-	-	-	-	-	-	+	-	+
Tamarindus indica L.	+	+	-	+	-	-	+	+	+	+
Tamarix ericoides Rottler & Willd.	-	-	-	-	-	-	-	+	-	+
Tectona grandis L. f.	+	+	-	-	-	+	-	-	-	+
Tephrosia purpurea (L.) Pers.	-	-	-	-	-	-	+	-	-	+
Terminalia alata Heyne ex Roth	+	+	+	-	+	+	-	-	-	+
T. arjuna (Roxb. ex DC.) Wigth & Arn.	+	+	-	-	-	-	-	-	-	+
T. bellirica (Gaertn.) Roxb.	+	+	+	-	-	-	+	-	-	+
T. chebula Retz.	+	+	+	-	-	-	+	-	-	+
Themeda quadrivalvis (L.) Kuntze	-	-	-	-	+	-	-	-	+	-
Thespesia lampas (Cav.) Dalz. & Gibs.	-	-	-	+	-	+	+	-	-	+
Trema orientalis (L.) Blume	-	+	-	+	+	-	-	+	+	+
Tridax procumbens L.	-	-	-	-	-	-	-	-	-	+
Triumfetta rhomboidea Jacq.	-	-	-	+	-	-	-	+	-	+
Uraria picta (Jacq.) Desv. ex DC.	-	-	-	-	-	-	-	-	-	+
Urena lobata L.	-	-	-	+	+	-	-	-	-	+
Vallisneria natans (Lour.) Hara	-	-	-	-	-	-	-	+	-	+
Vanda tessellata (Roxb.) Hook ex G. Don	-	-	-	-	-	-	-	-	-	+
Ventilago denticulata Willd.	-	-	-	+	-	-	+	-	-	+
Vetiveria zizaniodes (L.) Nash	-	-	-	-	+	-	+	-	-	+
Vigna umbellata (Thunb.) Ohwi & Ohashi	-	-	-	-	-	-	-	-	+	+
Viscum orientale Willd.	-	-	-	-	-	-	-	-	-	+
Woodfordia fruticosa (L.) Kurz	-	+	+	-	-	+	-	-	-	+
Wrightia tinctoria R. Br.	-	-	-	-	-	+	+	+	-	+
Xylia xylocarpa (Roxb.) Taub.	+	-	-	-	+	-	+	-	-	+
Ziziphus oenoplia (L.) Mill.	-	+	-	-	-	-	-	+	-	+
Z. xylopyra (Retz.) Willd.	-	+	-	+	-	-	+	-	-	-
Zornia gibbosa Span.	-	-	-	-	-	-	-	-	+	+

Dry deciduous forest

Aegle marmelos (L.) Correa, *Diospyros malabarica* (Desr.) Kostel., *D. melanoxylon* Roxb., *D. montana* Roxb., *D. sylvatica* Roxb., *Emblica officinalis* Gaertn., *Manilkara hexandra* (Roxb.) Dubard, *Syzygium cumini* (L.) Skeels, *S. heyneanum* Wall. ex Wight & Arn., *Ziziphus oenoplia* (L.) Mill. and *Z. xylopyra* (Retz.) Willd. among fruits; *Abelmoschus moschatus* Medik. and *Solanum incanum* L. among vegetables; *Sesamum orientale* L. among oilseeds; *Corchorus capsularis* L. and *Urena lobata* L. among fibre types.

RARE PLANTS

In the Indravati Tiger Reserve many rare species of angiosperms especially with reference to Chhattisgarh are found such as *Hygrophila balsamica* (L.f.) Raf., *Rhinacanthus nasuta* (L.) Kurz, *Staurogyne glauca* (Nees) Kuntze, *Amorphophallus sylvaticus* (Roxb.) Kunth, *Heterophragma quadriloculare* (Roxb.) K. Schum., *Calycopteris floribunda* Lam., *Cyperus platystylis* R. Br., *C. procerus* Rottb., *Fimbristylis argentea* (Rottb.) Vahl, *Scleria annularis* Nees ex Steud., *Drosera burmanni* Vahl, *D. india* L., *Indigofera nummularifolia* (L.) Livera ex Alston, *Canscora heteroclita* (L.) Glig., *Leucas stricta* Heyne ex Benth., *Osbeckia muralis* Naud., *Cansjera rheedii* Gmel., *Opilia amentacea* Roxb., *Eulophia explanata* Lindl., *Naravelia zeylanica* (L.) DC. and *Elatostema cuneatum* Wight.

CONSERVATION STRATEGIES

It has been observed that human population inhabiting the core area of the tiger reserve adversely affects its biodiversity. Therefore, to improve the ecosystem removal of adverse biotic factors from the core area is essential as per Action Plan proposed under the Project Tiger. To facilitate rehabilitation of the tribals cottage industries based on useful forest plants should be established.

Due emphasis should be given upon ecodevelopment of buffer zone in order to increase its biomass productivity, so as to ensure the availability of adequate firewood and fodder to meet requirement of the people displaced from the core area.

ENUMERATION

RANUNCULACEAE

Naravelia zeylanica (L.) DC.

DILLENIACEAE

Dillenia pentagyna Roxb.

ANNONACEAE

Annona reticulata L.
A. squamosa L.

MENISPERMACEAE

Cissampelos pareira L.
var. **hirsuta** (Buch.-Ham. ex DC.) Forman
Cocculus hirsutus (L.) Diels

NYMPHAEACEAE

Nelumbo nucifera Gaertn.
Nymphaea nouchali Burm. f.

PAPAVERACEAE

Argemone mexicana L.

CAPPARACEAE

Capparis zeylanica L.
Cleome viscosa L.

VIOLACEAE

Hybanthus enneaspermus (L.) F. Muell.

COCHLOSPERMACEAE

Cochlospermum religiosum (L.) Alston

FLACOURTIACEAE

Casearia elliptica Willd.
C. graveolens Dalz.
Flacourtia indica (Burm. f.) Merr.

POLYGALACEAE

Polygala arvensis Willd.

CARYOPHYLLACEAE

Polycarpon prostratum (Forssk.)
Aschers. & Schweinf.

PORTULACACEAE

Portulaca oleracea L.

TAMARICACEAE

Tamarix ericoides Rott. & Willd.

ELATINACEAE

Bergia ammannioides Roxb. ex Roth

MALVACEAE

Abelmoschus moschatus Medik.
Abutilon indicum (L.) Sw.
Kydia calycina Roxb.
Sida acuta Burm. f.
S. cordata (Burm. f.) Borss. - Walk.
S. cordifolia L.
S. rhombifolia L.
Thespesia lampas (Cav.) Dalz. & Gibs.
Urena lobata L.

BOMBACACEAE

Bombax ceiba L.

STERCULIACEAE

Byttneria herbacea Roxb.
Eriolaena hookeriana Wight & Arn.
Helicteres isora L.
Melochia corchorifolia L.
Sterculia urens Roxb.
Waltheria indica L.

TILIACEAE

Corchorus aestuans L.
C. capsularis L.
C. olitorius L.
Grewia abutilifolia Vent. ex A.L. Juss.
G. hirsuta Vahl
G. rothii DC.
G. tiliifolia Vahl
Triumfetta pentandra A. Rich.
T. rhomboidea Jacq.

OXALIDACEAE

Biophytum reinwardtii (Zucc.) Klotzs.
B. sensitivum (L.) DC.
Oxalis corniculata L.

RUTACEAE

Aegle marmelos (L.) Corrêa
Chloroxylon swietenia DC.

SIMAROUBACEAE

Ailanthus excelsa Roxb.

BALANITACEAE

Balanites roxburghii Planch.

OCHNACEAE

Ochna gamblei King ex Brandis

BURSERACEAE

Boswellia serrata Roxb. ex Colebr.
Garuga pinnata Roxb.

MELIACEAE

Azadirachta indica A. Juss.
Soymida febrifuga (Roxb.) A. Juss.

OLACACEAE

Olax scandens Roxb.

OPILIACEAE

Cansjera rheedii J.F. Gmelin
Opilia amentacea Roxb.

CELASTRACEAE

Cassine glauca (Rottb.) Kuntze
Celastrus paniculatus Willd.

RHAMNACEAE

Ventilago denticulata Willd.
Ziziphus oenoplia (L.) Mill.
Z. xylopyra (Retz.) Willd.

VITACEAE

Ampelocissus latifolia (Roxb.) Planch.
Cissus repanda Vahl

LEEACEAE

Leea asiatica (L.) Ridsdale

SAPINDACEAE

Schleichera oleosa (Lour.) Oken.

ANACARDIACEAE

Anacardium occidentale L.
Buchanania lanzan Spreng.
Lannea coromandelica (Houtt.) Merr.
Mangifera indica L.
Semecarpus anacardium L. f.

MORINGACEAE

Moringa oleifera Lam.

LEGUMINOSEAE-PAPILIONOIDEAE

Abrus precatorius L.
Aeschynomene indica L.
Alysicarpus hamosus Edgew.
A. vaginalis (L.) DC.
Butea monosperma (Lam.) Taub.
B. superba Roxb.
Cajanus scarabaeoides (L.) du Petit-Thou.
Crotalaria albida Heyne ex Roth
C. calycina Schrank
C. juncea L.
C. linifolia L. f.
C. prostrata Rottler
C. spectabilis Roth
Dalbergia latifolia Roxb.
D. paniculata Roxb.
Desmodium gangeticum (L.) DC.
D. heterocarpon (L.) DC.
D. laxiflorum DC.
D. motorium (Houtt.) Merr.
D. pulchellum (L.) Benth.
D. triflorum (L.) DC.
D.triquetrum (L.) DC.
D. velutinum (Willd.) DC.
Flemingia bracteata (Roxb.) Wight
F. nana Roxb.
F. semialata Roxb. ex W.T. Aiton
Galactia tenuiflora (Klein ex Willd.) Wight & Arn.
Indigofera astragalina DC.
I. cassioides Rottler ex DC.
I. linifolia (L. f.) Retz.
I. nummularifolia (L.) Livera ex Alston
I. tinctoria L.
Millettia extensa (Benth.) Benth. ex Baker
Mucuna pruriens (L.) DC.
Ougeinia oojeinensis (Roxb.) Hochr.
Pseudarthria viscida (L.) Wight & Arn.
Pterocarpus marsupium Roxb.

Dense growth of bamboo in dry deciduous forest

Sesbania bispinosa (Jacq.) W.F. Wight
Smithia conferta Sm.
Tephrosia pumila (Lam.) Pers.
T. purpurea (L.) Pers.
Uraria picta (Jacq.) Desv.
U. rufescens (DC.) Schindl.
Vigna umbellata (Thunb.) Ohwi & Ohashi
V. vexillata (L.) A. Rich.
Zornia gibbosa Span.

LEGUMINOSAE-CAESALPINIOIDEAE

Bauhinia purpurea L.
B. racemosa Lam.
B. semla Wund.
B. vahlii Wight & Arn.
Caesalpinia bonduc (L.) Roxb.
Cassia absus L.
C. fistula L.
C. mimosoides L.
C. obtusifolia L.
C. occidentalis L.
C. pumila Lam.
C. siamea Lam.
C. tora L.
Delonix regia (Bojer ex Hook.) Rafin.
Hardwickia binata Roxb.
Peltophorum pterocarpum (DC.) Backer ex K. Heyne
Tamarindus indica L.

LEGUMINOSAE-MIMOSOIDEAE

Acacia catechu (L. f.) Willd.
A. leucophloea (Roxb.) Willd.
A. nilotica (L.) Willd. ex Delile subsp. **indica** (Benth.) Brenan
A. pennata (L.) Willd.
A. suma (Roxb.) Kurz
Albizia lebbeck (L.) Benth.
A. odoratissima (L. f.) Benth.
Mimosa himalayana Gamble
Xylia xylocarpa (Roxb.) Taub.

DROSERACEAE

Drosera burmanni Vahl
D. indica L.

COMBRETACEAE

Anogeissus latifolia (Roxb. ex DC.) Wall. ex Guill. & Perr.
A. pendula Edgew.
A. sericea Brandis
Calycopteris floribunda Lam.
Combretum albidum G. Don
C. nanum Buch.-Ham. ex D. Don
C. roxburghii Spreng.
Quisqualis indica L.
Terminalia alata Heyne ex Roth
T. arjuna (Roxb. ex DC.) Wight & Arn.
T. bellirica (Gaertn.) Roxb.
T. chebula Retz.

MYRTACEAE

Syzygium cumini (L.) Skeels
S. heyneanum Wall. ex Wight & Arn.

LECYTHIDACEAE

Barringtonia acutangula (L.) Gaertn.
Careya arborea Roxb.

MELASTOMATACEAE

Memecylon umbellatum Burm. f.
Osbeckia muralis Naud.
O. zeylanica L. f.
Sonerila tenera Royle

LYTHRACEAE

Ammannia baccifera L.
A. multiflora Roxb.
Lagerstroemia parviflora Roxb.
Nesaea brevipes Koehne
Rotala densiflora (Roth ex Roem. & Schult.) Koehne
R. indica (Willd.) Koehne
Woodfordia fruticosa (L.) Kurz

ONAGRACEAE

Ludwigia adscendens (L.) Hara
L. octovalvis (Jacq.) Raven
L. perennis L.

CUCURBITACEAE

Cucumis callosus (Rott.) Cogn.
C. sativus L.
Diplocyclos palmatus (L.) C. Jeffrey
Melothria heterophylla (Lour.) Cogn.
M. maderaspatana (L.) Cogn.

MOLLUGINACEAE

Glinus lotoides L.
G. oppositifolius (L.) A. DC.
Mollugo pentaphylla L.

APIACEAE

Pimpinella wallichiana (Hoheni) Gandhi

ALANGIACEAE

Alangium salvifolium (L. f.) Wang

RUBIACEAE

Catunaregam spinosa (Thunb.) Tirveng.
Dentella repens (L.) J.R. Forst. & G. Forst.
Gardenia latifolia Ait.
G. resinifera Roth
Haldina cordifolia (Roxb.) Ridsdale
Hedyotis corymbosa (L.) Lam.
H. gracilis Wall.
H. herbacea L.
Hymenodictyon orixense (Roxb.) Mabb.
Ixora pavetta Andr.
Knoxia sumatrensis (Retz.) DC.
Mitragyna parvifolia (Roxb.) Korth.
Morinda pubescens Sm.
Spermacoce hispida L.
S. pusilla Wall.
Spermadictyon suaveolens Roxb.
Tamilnadia uliginosa (Retz.) Tirveng. & Sastre
Thecagonum ovatifolium (Cav.) Babu

ASTERACEAE

Acanthospermum hispidum DC.
Ageratum conyzoides L.
Blumea fistulosa (Roxb.) Kurz
Blumea lacera (Burm. f.) DC.
B. mollis (D. Don) Merr.
B. oxyodonta DC.
Blumeopsis flava (DC.) Gagnep.
Chromolaena odorata (L.) King & Robinson
Crassocephalum crepidioides (Benth.) S. Moore
Cyathocline purpurea (Buch.-Ham. ex D. Don) Kuntze
Eclipta prostrata (L.) L.
Elephantopus scaber L.
Emilia sonchifolia (L.) DC.
Gnaphalium polycaulon Pers.
Grangea maderaspatana (L.) Poir.
Pentanema indicum (L.) Ling
Sphaeranthus indicus L.
Spilanthes calva DC.
Tridax procumbens L.
Vernonia cinerea (L.) Less.
Xanthium indicum J. Koenig

CAMPANULACEAE

Campanula benthamii Wall. ex DC.
C. modesta Hook. f. & Thomson
C. pallida Wall.
Lobelia alsinoides Lam.
L. heyneana Roem. & Schult.
Wahlenbergia marginata (Thunb.) DC.

MYRSINACEAE

Embelia basaal (Roem. & Schult.) A. DC.

SAPOTACEAE

Madhuca longifolia (J. Koenig) Macbr. var. **latifolia** (Roxb.) Chevalier
Manilkara hexandra (Roxb.) Dubard

EBENACEAE

Diospyros malabarica (Desr.) Kostel.
D. melanoxylon Roxb.
D. montana Roxb.
D. sylvatica Roxb.

OLEACEAE

Nyctanthes arbor-tristis L.
Schrebera swietenioides Roxb.

Flemingia bracteata in moist deciduous forest

APOCYNACEAE

Holarrhena pubescens (Buch.-Ham.) Wall. ex G. Don
Ichnocarpus frutescens (L.) R. Br.
Wrightia tinctoria R. Br.

ASCLEPIADACEAE

Calotropis gigantea (L.) R. Br.
Cryptolepis buchanani Roem. & Schult.
Hemidesmus indicus (L.) R. Br.
Pergularia daemia (Forssk.) Chiov.

LOGANIACEAE

Mitrasacme indica Wight
Mitreola petiolata (J.F. Gmelin) Torr. & A. Gray

GENTIANACEAE

Canscora decurrens Dalz.
C. decussata (Roxb.) Roem. & Schult.
C. diffusa (Vahl) R. Br. ex Roem. & Schult.
C. heteroclita (L.) Gilg
Nymphoides hydrophylla (Lour.) Kuntze
N. indica (L.) Kuntze

HYDROPHYLLACEAE

Hydrolea zeylanica (L.) Vahl

BORAGINACEAE

Coldenia procumbens L.
Cordia obliqua Willd.
Cynoglossum lanceolatum Forssk.
Rotula aquatica Lour.
Trichodesma indicum (L.) R. Br. ex Lehm.

CONVOLVULACEAE

Argyreia involucrata C.B. Clarke
Erycibe paniculata Roxb.
Evolvulus alsinoides (L.) L.
E. nummularius (L.) L.
Ipomoea aquatica Forssk.
I. carnea Jacq.
I. hederifolia L.
I. obscura (L.) Ker-Gawl.
I. pes-tigridis L.
Merremia hederacea (Burm. f.) Hall. f.
M. umbellata (L.) Hall. f.

SOLANACEAE

Physalis minima L.

Solanum incanum L.
S. virginianum L.

SCROPHULARIACEAE

Centranthera tranquebarica (Spreng.) Merr.
Dopatrium junceum (Roxb.) Buch.-Ham. ex Benth
Limnophila indica (L.) Druce
L. repens (Benth.) Benth.
Lindernia anagallis (Burm. f.) Pennell
L. antipoda (L.) Alston
L. ciliata (Colsm.) Pennell
L. crustacea (L.) F. Muell.
L. parviflora (Roxb.) Haines
Mecardonia procumbens (Mill.) Sm.
Microcarpaea minima (J. Koenig ex Retz.) Merr.
Scoparia dulcis L.
Sopubia delphiniifolia (L.) G. Don
Striga angustifolia (D. Don) Saldanha

OROBANCHACEAE

Aeginetia indica L.

LENTIBULARIACEAE

Utricularia bifida L.
U. exoleta R. Br.

BIGNONIACEAE

Dolichandrone falcata (Wall. ex DC.) Seem.
Heterophragma quadriloculare (Roxb.) K. Schum.
Oroxylum indicum (L.) Vent.
Stereospermum chelonoides (L. f.) DC.

PEDALIACEAE

Sesamum orientale L.

ACANTHACEAE

Adhatoda zeylanica Medik.
Andrographis paniculata (Burm. f.) Wall. ex Nees
Barleria cristata L.
B. strigosa Willd.
Blepharis maderaspatensis (L.) Heyne ex Roth .
Dicliptera verticillata (Forssk.) C. Chr.
Dipteracanthus prostratus (Poir.) Nees
Dyschoriste vagans (Wight) Kuntze
Eranthemum purpurascens Wight ex Nees
Hemigraphis latebrosa (Heyne ex Roth) Nees
Hygrophila auriculata (Schumach.) Heine
H. balsamica (L. f.) Rafin.
H. polysperma (Roxb.) T. Anderson
Indoneesiella echioides (L.) Sreemadh.
Justicia betonica L.
J. diffusa Willd.
J. quinqueangularis Koenig ex Roxb.
Lepidagathis hamiltoniana Wall. ex Nees
Nelsonia canescens (Lam.) Spreng.
Peristrophe paniculata (Forssk.) Brummitt
Petalidium barlerioides (Roth) Nees
Phaulopsis dorsiflora (Retz.) Santapau
Rhinacanthus nasuta (L.) Kurz
Rungia pectinata (L.) Nees
R. repens (L.) Nees
Staurogyne glauca (Nees) Kuntze

VERBENACEAE

Clerodendrum serratum (L.) Moon
Gmelina arborea Roxb.
Lantana camara L.
Lippia javanica (Burm. f.) Spreng.
Symphorema polyandrum Wight
Tectona grandis L. f.
Vitex leucoxylon L. f.

LAMIACEAE

Acrocephalus hispidus (L.) Nicolson & Sivadasan
Anisochilus carnosus (L. f.) Wall. ex Benth.
Anisomeles indica (L.) Kuntze
Hyptis suaveolens (L.) Poit.
Leucas biflora (Vahl) R. Br.
L. indica (L.) R. Br. ex Vatke
L. mollissima Wall. ex Benth.
L. stricta Heyne ex Benth.
Ocimum canum Sims
Orthosiphon rubicundus (D. Don) Benth.
Plectranthus mollis (Aiton) Spreng.
Pogostemon parviflorus Benth.

NYCTAGINACEAE

Boerhavia diffusa L.
Bougainvillea spectabilis Willd.
Mirabilis jalapa L.

AMARANTHACEAE

Achyranthes aspera L.
Aerva lanata (L.) Juss. ex Schult.
Allmania nodiflora (L.) R. Br. ex Wight
Alternanthera sessilis (L.) R. Br. ex DC.
Amaranthus spinosus L.
A. tricolor L.
A. viridis L.
Celosia argentea L.
Gomphrena celosioides Mart.
Psilotrichum ferrugineum (Roxb.) Moq.
Trichuriella monsoniae (L. f.) Bennet

POLYGONACEAE

Polygonum barbatum L.
P. glabrum Willd.
P. plebeium R. Br.
P. pulchrum Blume

LAURACEAE

Cassytha filiformis L.

LORANTHACEAE

Dendrophthoe falcata (L. f.) Etting.
Viscum articulatum Burm. f.
V. orientale Willd.

EUPHORBIACEAE

Antidesma acidum Retz.
A. ghaesembilla Gaertn.
Breynia vitis-idaea (Burm. f.) C.E.C. Fischer
Bridelia hamiltoniana Wall. ex Muell. Arg.
B. retusa (L.) Spreng.
Chrozophora prostrata Dalz.
C. rottleri (Geiseler) Adr. Juss. ex Spreng.
Cleistanthus collinus (Roxb.) Benth. ex Hook. f.
Emblica officinalis Gaertn.
Euphorbia hirta L.
E. nivulia Buch.-Ham.
E. thymifolia L.
Homonoia retusa J. Graham ex Wight) Muell. Arg.
H. riparia Lour.
Mallotus philippensis (Lam.) Muell. Arg.
Phyllanthus airy-shawii Brunel ex Roux
P. amarus Schumach. & Thonn.
P. urinaria L.
P. virgatus G. Forst.
Ricinus communis L.
Sebastiania chamaelea (L.) Muell. Arg.

URTICACEAE

Elatostema cuneatum Wight

ULMACEAE

Trema orientalis (L.) Blume

MORACEAE

Ficus amplissima Sm.
F. benghalensis L.
F. hispida L. f.
F. racemosa L.
F. religiosa L.
F. tinctoria G. Forst.
subsp. **parasitica** (Willd.) Corner
Streblus asper Lour.

CERATOPHYLLACEAE

Ceratophyllum demersum L.

HYDROCHARITACEAE

Hydrilla verticillata (L. f.) Royle
Lagarosiphon alternifolia (Roxb.) Druce
Vallisneria natans (Lour.) Hara

ORCHIDACEAE

Eulophia explanata Lindl.
Habenaria commelinifolia (Roxb.) Wall. ex Lindl.
H. plantaginea Lindl.
Peristylus plantagineus (Lindl.) Lindl.
Vanda tessellata (Roxb.) Hook. ex G. Don

ZINGIBERACEAE

Curcuma aromatica Salisb.
C. pseudomontana J. Graham
Globba marantina L.
Zingiber capitatum Roxb.

COSTACEAE

Costus speciosus (J. Koenig) Sm.

AMARYLLIDACEAE

Crinum defixum Ker-Gawl.

HYPOXIDACEAE

Curculigo orchioides Gaertn.

TACCACEAE

Tacca leontopetaloides (L.) Kuntze

DIOSCOREACEAE

Dioscorea bulbifera L.
D. glabra Roxb.

LILIACEAE

Asparagus racemosus Willd.
Chlorophytum arundinaceum Baker
C. laxum R. Br.
C. tuberosum (Roxb.) Baker
Drimia indica (Roxb.) Jassop
Gloriosa superba L.
Iphigenia indica (L.) A. Gray

SMILACACEAE

Smilax zeylanica L.

PONTEDERIACEAE

Monochoria vaginalis (Burm. f.) K. Presl

COMMELINACEAE

Commelina benghalensis L.
C. hasskarlii C.B. Clarke
C. longifolia Lam.
C. suffruticosa Blume
Cyanotis cristata (L.) D. Don
Murdannia edulis (Stokes) Faden
M. nudiflora (L.) Brenan
M. spirata (L.) Brückn.
M. vaginata (L.) Brückn.
Tonningia axillaris (L.) Kuntze

ARECACEAE

Phoenix acaulis Buch.-Ham. ex Roxb.
P. sylvestris (L.) Roxb.

ARACEAE

Amorphophallus sylvaticus (Roxb.) Kunth
Colocasia esculenta (L.) Schott
Pistia stratiotes L.
Theriophonum minutum (Willd.) Baill.

BUTOMACEAE

Tenagocharis latifolia (D. Don) Buchen.

NAJADACEAE

Najas indica (Willd.) Cham.

APONOGETONACEAE

Aponogeton natans (L.) Engl. & K. Krause

ERIOCAULACEAE

Eriocaulon cinereum R. Br.
E. quinquangulare L.

CYPERACEAE

Bulbostylis barbata (Rottb.) C.B. Clarke
Cyperus alulatus Kern
C. brevifolius (Rottb.) Hassk.
C. compactus Retz.
C. compressus L.
C. cuspidatus Kunth
C. cyperoides (L.) Kuntze
C. difformis L.
C. distans L. f.
C. exaltatus Retz.
C. halpan L.
C. iria L.
C. niveus Retz.
C. nutans Vahl var. **eleusinoides** (Kunth) Haines
C. pangorei Rottb.
C. platystylis R. Br.
C. procerus Rottb.
C. pumilus L.
C. pygmaeus Rottb.
C. rotundus L.
C. sanguinolentus Vahl
C. tenuispica Steud.
C. triceps Endl.
Eleocharis atropurpurea (Retz.) J. Presl & K. Presl
E. retroflexa (Poir.) Urb.
Fimbristylis aestivalvis (Retz.) Vahl
F. argentea (Rottb.) Vahl
F. bisumbellata (Forssk.) Bubani
F. dichotoma (L.) Vahl
F. ferruginea (L.) Vahl
F. littoralis Gaud.
F. miliacea (L.) Vahl
F. schoenoides (Retz.) Vahl
F. tetragona R. Br.
Fuirena ciliaris (L.) Roxb.

Lipocarpha chinensis (Osbeck) Kern
Rhynchospora longisetis R. Br.
Scirpus articulatus L.
S. lateriflorus J.F. Gmelin
S. squarrosus L.
Scleria annularis Nees ex Steud.
S. biflora Roxb.

POACEAE

Alloteropsis cimicina (L.) Stapf
Apluda mutica L.
Aristida setacea Retz.
Arthraxon lancifolius (Trin.) Hochst.
Arundinella bengalensis (Spreng.) Druce
A. pumila (Hochst. ex A. Rich.) Steud.
Bothriochloa intermedia (R. Br.) A. Camus
B. kuntzeana (Hack.) Henr.
B. pertusa (L.) A. Camus
Brachiaria distachya (L.) Stapf
B. reptans (L.) Gardn. & C.E. Hubb.
Chionachne koenigii (Spreng.) Thwaites
Chloris dolichostachya Lag.
C. virgata Sw.
Chrysopogon fulvus (Spreng.) Chiov.
Coix gigantea Koenig ex Roxb.
Cymbopogon martinii (Roxb.) Wats.
Cynodon dactylon (L.) Pers.
Dactyloctenium aegyptium (L.) Willd.
Dendrocalamus strictus (Roxb.) Nees
Dichanthium annulatum (Forssk.) Stapf
Digitaria abludens (Roem. & Schult.) Veldk.
D. ciliaris (Retz.) Koel.
D. longiflora (Retz.) Pers.
D. stricta Roth ex Roem. & Schult.
Echinochloa colona (L.) Link
E. stagnina (Retz.) P. Beauv.
Eleusine indica (L.) Gaertn.
Eragrostis atrovirens (Desf.) Trin. ex Steud.
E. cilianensis (All.) Vignolo-Lutati ex F.T. Hubb.
E. ciliata (Roxb.) Nees
Eragrostis coarctata Stapf
E. diarrhena (Schult.) Steud.
E. namaquensis Schrad. var. **diplachnoides** (Steud.) W.D. Clayton
E. nutans (Retz.) Nees ex Steud.
E. tenella (L.) P. Beauv. ex Roem. & Schult.
E. unioloides (Retz.) Nees ex Steud.
Hackelochloa granularis (L.) Kuntze
Heteropogon contortus (L.) P. Beauv. ex Roem. & Schult.
Imperata cylindrica (L.) Raeuschel. var. **major** (Nees) Hubb. ex Hubb. & Vaughan
Isachne globosa (Thunb.) Kuntze
Ischaemum indicum (Houtt.) Merr.
I. rugosum Salisb.
Iseilema anthephoroides Hack.
I. laxum Hack.
I. prostratum (L.) Anderss.
Mnesithea laevis (Retz.) Kunth
Ophiuros exaltatus (L.) Kuntze
O. burmannii (Retz.) P. Beauv.
Oplismenus compositus (L.) P. Beauv.
Oryza rufipogon Griff.
O. sativa L.
Panicum curviflorum Hornem.
P. notatum Retz.
P. paludosum Roxb.
P. sumatrense Roth ex Roem. & Schult.
Paspalidium flavidum (Retz.) A. Camus
P. punctatum (Burm. f.) A. Camus
Paspalum scrobiculatum L.
Pennisetum pedicellatum Trin.
Perotis indica (L.) Kuntze
Phragmites karka (Retz.) Trin. ex Steud.
Rottboellia cochinchinensis (Lour.) W.D. Clayton
Sacciolepis indica (L.) A. Chase
S. interrupta (Willd.) Stapf
Setaria intermedia Roem. & Schult.
S. pumila (Poir.) Roem. & Schult.
S. verticillata (L.) P. Beauv.
Sorghum halepense (L.) Pers.
Sporobolus diander (Retz.) P. Beauv.
Themeda laxa (Andersson) A. Camus
T. quadrivalvis (L.) Kuntze
Vetiveria zizanioides (L.) Nash

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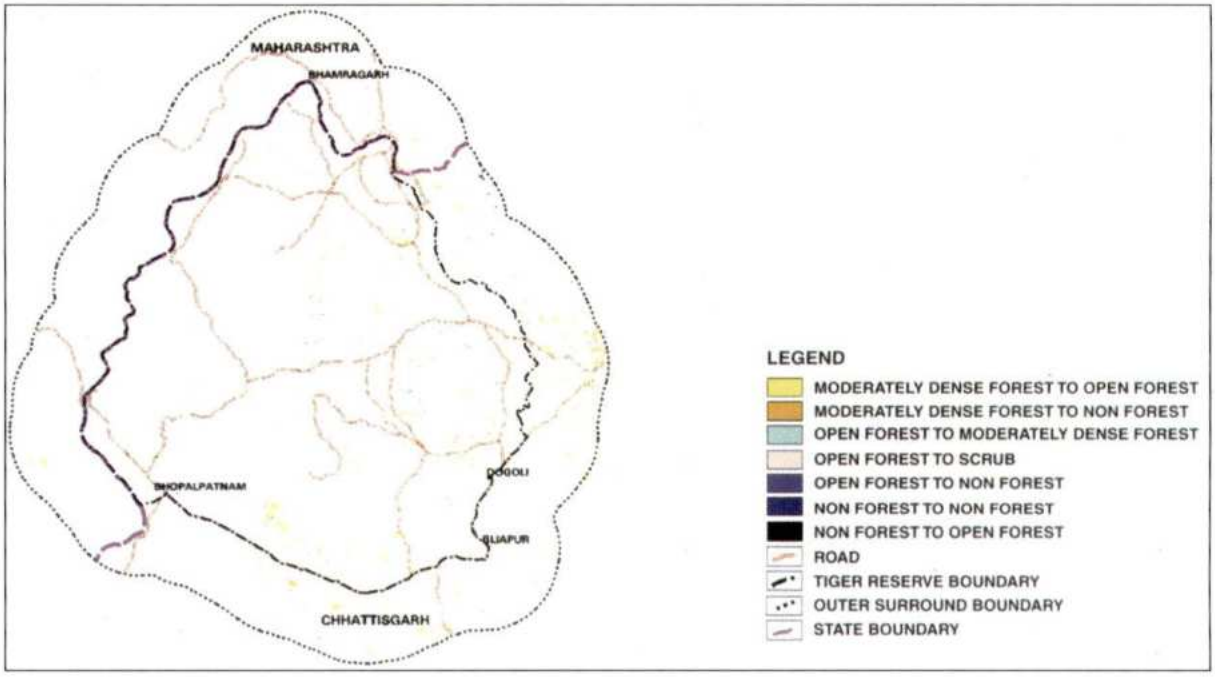


Map of Indravati Tiger Reserve

Calotropis gigantea – white form

Courtesy : P. Singh

SALIENT FEATURES

Area

Core	:	1258.372 sq km
Buffer	:	1540.714 sq km
Total	:	2799.086 sq km
Longitude	:	80°16' to 80°44' E
Latitude	:	18°51' to 19°24' N
Altitude	:	177 to 599 m above MSL
Rainfall	:	887.8 mm to 2416.3 mm

Temperature

Minimum	:	19.4°C
Maximum	:	31.3°C

Seasons

Summer	-	March to June
Monsoon	-	June to September
Winter	-	November to February

Highways

National Highway No.16 passes along the southern boundary of the Reserve but does not cause any noticeable damage.

Railway Station

JAGADALPUR 168 km

RAIPUR 496 km

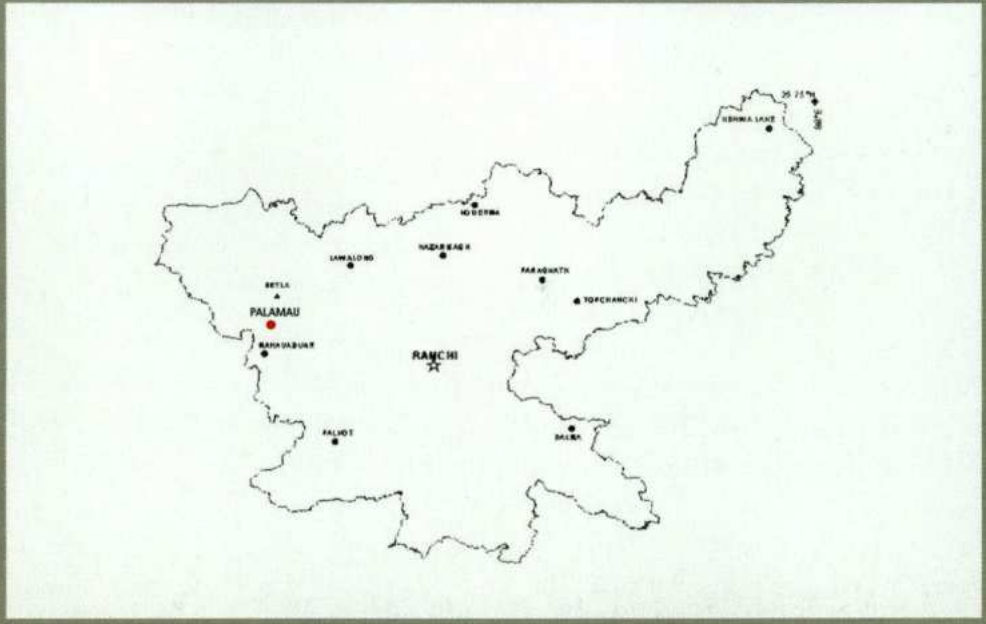
Bus Stand

BIJAPUR

JHARKHAND

Bijka hills in
Palamau Tiger Reserve

Palamau Tiger Reserve



Palamau Tiger Reserve

Sanjay Singh & HJ Chowdhery
Central National Herbarium, Botanical Survey of India, Howrah-711 103

Palamau Tiger Reserve was established in the year 1973-74. It is situated in the southern part of the district Palamau (Jharkhand) and lies between 23° 27' to 23° 51' N latitude and 82° 52' to 84° 26' E longitude. The reserve covers an area of 1026 sq km of forest stretching from the edge of Neterhat hill ranges in the south to the Auranga river in the north and from latehar Sarju road in the east to Madhya Pradesh in the west.

There are various views about the origin of the name "Palamau". According to one view, it is derived from the Hindi word "Palona" (to flee), means a place of refuge, while other view is that the name is a combination of two words i.e., "Pala" means frost and "Mu" means dead, i.e. dead from frost. Yet another view is that "Palamau" is a dravidian name, consisting of two words "Pall" meaning tooth and "amm" meaning water while "u" is a kind of genitive or possessive case meaning village, country, fortress, etc.

TOPOGRAPHY

The topography of Palamau Tiger Reserve is hilly and consists of a series of parallel ridges running east and west by the river. There are many spurs and ridges and outlying peaks. The majority of the spurs and ridges bear no definite names. Some of the important hills are Murhar, Netarhat, Huluk and Gulgul. Gulgul is the highest peak in the region and is over 1140 m above MSL. The northern hills are comparatively lower in altitude. There are some extensive grassland on the flat topped hills and along river banks.

DRAINAGE SYSTEM

The important rivers, which drain in the tiger reserve are the Koel and its tributaries, the Auranga and the Amanat. There are also a host of smaller streams, most of which are mountain torrents with rock-strewn beds. The Koel, Auranga and Amanat are similar in this respect. Their upper reaches are characterised by high banks, generally rugged and occassionally precipitous with a rapid stream dashing over boulders and shingle or gliding calmly, except in time of spate.

GEOLOGY

The geological formation of tiger reserve mainly comprises of rocks of Archean, Vindhyan and Gondwana ages. Most of the hill ranges of tiger reserve are composed of metamorphic and sub-metamorphic rocks but in the west and south-west the flat topped hills are capped by the massive sand stones and laterite. In the north-western hills biotite gneiss, a brownish amorphous-looking or slatey rock and crystalline lime-stones are frequent. The gneisses and granites are the most predominant rock of the tiger reserve.

SOIL

The soils vary in composition and texture from place to place depending upon the underlying rocks and topography. The following are the main types of soils found in the reserve :

i) **Heavy clay**

Locally known as "Kewal", it becomes very hard when dry and very sticky in wet condition.

ii) **Loam soil**

Locally known as "Dorasa", it has a typical admixture of sand and clay

iii) **Sandy soil**

Locally known as "Balasundar", it contains a considerable admixture of coarse sand.

CLIMATE

The climate of this region as a whole is dry and bracing. The year can be divided into 3 main seasons viz., the winter season from November to the early half of March; the summer season from March to May and the monsoon from June to September. The type of vegetation met within an area depends on the climate, soil and other biotic factors.

1. **Rainfall**

The average annual rainfall for the reserve area as a whole is 1335 mm. The northern parts of the district get comparatively lesser rain than southern parts. In the rainy season, the area gets 85% of the annual rainfall.

2. **Temperature**

The winter season, which starts from November, continues till about the middle of March. December and January are the coldest months. By March the temperature begins to rise steadily. In May and June the maximum temperature can be as high as 46.7°C.

3. **Humidity**

The relative humidity is generally lower in the afternoon than in the morning, except in the rainy season when there is little difference. The summer months are the driest with humidity dropping as low as 20-25% in the afternoon.

GENERAL VEGETATION

Based on the forest classification of Champion and Seth (1968), and Puri & al (1983), the forests of tiger reserve can be classified as follows:

1. **Moist tropical deciduous forest**
2. **Dry tropical deciduous forest**
   a. Dry mixed deciduous forest
   b. Dry sal forest

1. Moist tropical deciduous forest

Tropical moist deciduous forests are not found in Palamau Tiger Reserve area however, such forests do occur in small patches at Neterhat ranges, but are not common. The dominant species of this forest type are mostly deciduous, though often for brief periods. The evergreen habit is more developed in the lower storey giving the forest a more or less evergreen appearance over most of the year. Bamboo undergrowth is characteristic, although it may be absent in some places. Climbers are abundant. The main characteristic feature of the moist deciduous forest is a leafless period in the dry season.

The prominent associates in the first storey of these forests are, *Haldina cordifolia, Anogeissus latifolia, Bauhinia purpurea, B. tomentosa, B. variegata, Bombay, ceiba, Butea monosperma, Buchanania lanzan, Croton oblongifolius, Dendrocalamus strictus, Diospyros melanoxylon, Phyllanthus emblica, Madhuca longifolia, Syzygium cumini,* etc. The second storey is usually dominated by species like *Cassia fistula, Flacourtia indica, F. ramontchi, Firmiana colorata, Gardenia latifolia, Grewia tiliifolia, Hollarrhena pubescens, Nyctanthes arbor-tristis, Wendlandia heynei,* etc. and the third storey consists of *Colebrookea oppositifolia, Embelia baasal, Melastoma malabathricum, Woodfordia fruticosa,* etc. while the fourth storey is formed by the herbaceous elements like *Achyranthes aspera, A. bidentata, Aerva lanata, Bacopa monnieri, Boerhavia diffusa, Begonia picta, Commelina hasskarlii, Desmodium gangeticum, Elephantopus scaber, Heteropogon contortus, Indigofera glabra, Mazus pumilus,* etc.

Dry deciduous forest showing the hilly background

2. Dry tropical deciduous forest

Based on the composition of the forest this type can be further divided into two sub-types-

i) Dry mixed deciduous forest and

ii) Dry sal forest

2. i) Dry mixed deciduous forest

The upper canopy is this type is thin but fairly complete. Most of the trees have low spreading crowns. Trees are deciduous during the dry season. *Boswellia serrata, Cochlospermum religiosum* are the characteristic specis of such forest. Bamboos are found scattered throughout this forest type.

The main components of first storey are *Acacia catechu, Haldina cordifolia, Butea monosperma, Dalbergia sissoo, Terminalia alata, T. arjuna, T. Bellirica, T. chebula,* etc. The second storey consists of *Aegle marmelos, Bauhinia acuminata. B. purpurea, Calotropis gigantea, Careya arborea, Nyctanthes arbor-tristis, Zizyphus oenoplia, Z. xylopyrus,* etc. whereas, *Barleria prionitis, Cassia tora, Indigofera glabra, I. cassioides, Rauvolfia tetraphylla, Thespesia lampas, Woodfordia fruticosa,* etc. form the third storey. The ground cover is dominated by herbs like *Achyranthes aspera, Alternanthera sessilis, Boerhavia diffusa, Sida cordata, S. cordifolia, Tephrosia purpurea, Heteropogon controtus, Themeda triandra, Uraria picta* etc. There are few climbers e.g., *Asparagus racemosus, Bauhinia vahlii, Smilax ovalifolia,* etc.

ii) Dry sal forest

Such forests are characterized by trees of low quality and height *Shorea robusta* (Sal). The regeneration is slow and is mixed with other species. All the trees are deciduous during the dry season. Bamboos are often present but not luxuriant. Climbers, epiphytes and ferns are inconspicuous.

The chief associates of dry deciduous sal forests in the first storey are *Haldina cardifolia, Boswellia*

serrata, Madhuca longifolia etc. The common elements of the second storey are *Buchanania lanzan, Dillenia pentagyna, Phyllanthus emblica, Trema orientalis* etc. and the third storey is dominated by species like *Grewia tiliifolia, Indigofera cassiodes, Woodfordia fruticosa* etc. The ground flora mainly consists of *acyranthes aspera Cassia tora, C. sophera, Cyperus* spp., *Desmodium gangeticum, Flemingia chappar, Uraria picta, Tephrosia purpurea,* etc.

HYDROPHYTIC VEGETATION

The reserve has a number of perennial water bodies, which support aquatic vegetation. The hydrophytic vegetation of these water bodies can be categorized into 7 different categories following to Arber's (1920) classification :

a. Free floating hydrophytes

Such plants have no contact with soil. They float on the surface of water e.g. *Lemna perpusilla, Trapa natans* and *Nymphoides hydrophylla.*

b. Floating-anchored hydrophytes

These plants are fixed to the bottom of the water body with the help of roots, which are buried in the soil and their leaves, flowers, etc. float on the water surface e.g. *Nelumbo nucifera, Nymphaea, N. pubescens,* etc.

c. Submerged, non-anchored hydrophytes

They are submerged in stagnant water. Plants of this group are *Ceratophyllum demersum, Potamogeton cripus,* etc.

d. Submerged-anchored hydrophytes

Such plants remain fixed in the soil with help of roots but their plant body remains submerged in the water but their flowering parts are raised above the water level. e.g. *Hydrilla verticillata, Aponogeton undulatus, Vallisneria spiralis,* etc.

e. Emergent hydrophytes

These plants are exposed or submerged, usually with rhizomes and corms buried in water or mud. The common species are *Hygrophila auriculata, Limnophila india, Sagittaria guayanensis, Typha domingensis* etc.

f. Marshy-amphibians hydrophytes

They are found in soft wet mud or roo0ted in shallow water. *Bacapa monnieri, Eclipta prostrata, Ipomoea aquatica, Ludwigia octovalvis,* etc. belong to this group.

g. Wet land hydrophytes

These are border-line species comprising of woody trees or shrubs e.g. *Terminalia arjuna, Vitex negundo,* etc., which are commonly found near the river and streams.

RIVERAIN VEGETATION

The vegetation along the bank of the rivers, rivulets, streams and the sandy riverbeds is quite characteristics. *Aegle marmelos, Ficus semicordata, F. racemosa, Terminalia arjuna* etc. are some of the common trees and shrubs along the stream and river courses. The shrubby vegetation is represented by *Calotropis gigantea, Ludwigia octovalvis, Ipomoea carnea, Ziziphus oenoplia* etc. The herbaceous vegetation is represented by *Ageratum conyzoides, Alternanthera pungens, Boerhavia diffusa, Cyperus compressus, Tridax procumbens,* etc.

Dominant families and genera of Tiger Reserve

Of the 136 families of flowering plants represented in the reserve area, the 10 most dominant families are: Poaceae, Fabaceae, Asteraceae, Euphorbiaceae, Cyperaceae, Rubiaceae, Acanthaceae, Convolvulaceae, Caesalpiniaceae, Lamiaceae, while *Crotolaria, Cyperus, Ficus, Cassia, Euphorbia, Acacia, Desmodium, Lindernia, Indigofera, Commelina, Sida* are amongst the dominant genera. *Begonia picta, Clematis gouriana, Dolichos trilobatus, Drosera burmannii, D. indica, Helinus lanceolatus, Lavendula bipinnata, Nervilia prainiana, Phalaris minor, Pittosporum floribundum, Rubia wallichiana, Striga angustifolia, Utricularia bifida, Zanthoxylum armatum,* etc. are some of the rare elements of the

flora of the reserve. The orchids are not common in the reserve area and the available ones are becoming rare day by day. *Cymbidium macrorhizum,* a very rare saprophytic orchid is known to occur in this reserve area.

Wildlife

A variety of wild animals inhabit the tiger reserve. Amongst the large carnivorous animals apart from the tiger, leopard, wolf, wild dogs, jackal and hyena are prominent while, elephant, chital, sambhar, monkey, langur, gaur, nilgai, wild boar are common herbivores. The dominant birds in the tiger reserve are peofowl, red jungle fowl and partridges.

PLANT RESOURCES OF THE TIGER RESERVE

The rich diversity of wild plants is the source of food, medicine, fiber, oil, fuel, fodder, building material, clothing and other items of daily need for the local population. Some of the important plants, which are used by the local settlers of the tiger reserve area are as follows.

1. Edible plants

Various plant parts and fruits of species like, *Diospyros melanoxylon, Buchanania lanzan, Aegle marmelos, Antidesma acidum, Bauhinia vahlii, Costus speciosus, Dillenia pentagyna, Dioscorea bulbifera, Dendrocalamus strictus, Emblica officinalis, Ficus racemosa, Ipomoea aquatica, Marsilea minuta, Moringa oleifera, Nelumbo nucifera, Oryza rufipogon, Tamarindus indica,* etc. are collected and used for food.

2. Fiber yielding plants

Fiber is obtained from plants like *Bauhinia vahlii, Butea superba, Calotropis gigantea, Corchorus olitorius, C. capsularis, Cochlospermum religiosum, Dillenia pentagyma, Ficus benghalensis, Urena lobata,* etc., which are used for making ropes and other such items of domestic need.

3. Timber plants

The timber obtained from *Tectona grandis, Albizia lebbeck, Buchanania lanzan, Cassia fistula, Dendrocalamus strictus, Pterocarpus marsupium, Terminalia alata, T. arjuna,* etc. is used for furniture, agricultural implements, various household items and for building construction.

4. Tannin yielding plants

A number of plants yield tannin used for various purposes. Some of the plants commonly exploited are, *Acacia nilotica, Bauhinia purpurea, Bridelia retusa, Buchanania lanzon, Careya arborea, Cassia fistula, Dillenia pentagyna, Emblica officinalis, Ficus bengalensis, F. racemosa, Nyctanthes arbortristis, terminalia alata, Trema orientalis,* etc.

5. Gum yielding plants

The common gum producing plants found in the tiger reserve are, *Acacia nilotica, Albizia lebbeck, Azadirachta indica, Aegle marmelos, Butea monosperma, Buchanania lanzan, Cochlospermum religiosum, Bombax ceiba, Terminalia alata,* etc. The gum extracted from these plants is used as food material, for medicinal and other domestic uses.

6. Oil yielding plants

A number of plants are used for extracting oil. The oil extracted from *Argemone mexicana, Cymbopogon maratinii, Madhuca longifolia, Bombax ceiba, Azadirachta india, Ricinus communis* is used for burning, as germicide and other medicinal purposes.

7. Dye yielding plants

Flowers of *Butea monosperma* are the source of yellow dye. Other species from which dye is obtained are *Mallotus philippensis, Memecylon unbellatum, Nyctanthes arbor-tristis. Pterocarpus marsupium,* etc.

8. Beverage plants

Flowers of *Madhuca longifolia* and fruits of *Diospyros melanoxylon* are largely used in the preparation of popular country liquor. The inflorescence of

Deforestation due to grazing and browsing by domesticated animals

Barassus flabellifer and *Phoenix sylvestris* are tapped for collection of tadi (neera) and preparation of country liquor.

9. Medicinal plants

A number of plant species found in the reserve area are used in house hold remedies by the local inhabitants for the treatment of diseases and ailments. Some of the well known medicinal plants occurring in the tiger reserve are *Aegle marmelos, Andrographis paniculata, Asparagus racemosus, Bombax ceiba, Boerhavia diffusa, Calotropis gigantea, Careya arborea, Cassia fistula, C. occidentalis, Costus speciosus, Dioscorea bulbifera, Emblica officinalis, Abrus precatorius, Butea monospera, Celosia argentea, Celastrus paniculatus, Eclipta alba, Ficus benghalensis, F. racemosa, Gloriosa superba, Hemidesmus indicus, Holarrhena pubescens, Ixora pavetta, Justicia adhatoda, Madhuca longifolia, Mucuna pruriens, Pterocarpus marsupium, Sida cordata, Tephrosia purpurea, Terminalia arjuna, T.bellirica, T. chebula, Uraria picta,* etc.

ETHNO BOTANY

Oraon, Chero Kherwar, Bhuian and Munda are the tribes, which inhabit the tiger reserve. Their life is largely dependent upon the bio-resources of the reserve. They use wild plants for food, fodder, fuel & others items of daily need & animals for food. Some of the plant species commonly used by them are :

1. Food plants

Dillenia indica, D. pentagyna, Annona squamosa, Polyalthia cerasoides, Nymphaea nouchali, Flacourtia indica, Cissus quadrangularis, Leea asiatica, Physalis peruviana, etc. are some of the species are consumed as fruit and vegetables.

2. Plants for hut and boat making

The timber obtained from *Dillenia pentagyna, Polylthia cerasoides, Lannea coromandelica, Holoptelea integrifolia,* etc. is used in the construction of huts, boats, etc.

Terminalia alata

3. Fiber yielding plants

Fibers are extracted from *Sida cordata, Urena sinuata,* etc.

4. Gum yielding plants

Lannea coromandelica, Boswellia serrata, etc. are used for extracting gum.

5. Plants with other uses

In addition to the above mentioned plants, a large number of species are used for various other purposes like *Annona squamosa* (drinks), *Miliusa tomentosa* (fire wood), *Dillenia pentagyna* (green manure), *Boswellia serrata* (Charcoal, resin), *Butea monosperma* (Leaves are used for making plates and cups), etc.

ETHNO-MEDICINAL PLANTS

The local tribes residing inside'the reserve area uses a number of plants for the treatment of various diseases and disorders. Some of the important species used in their local system of medicine are - *Cocculus hirsutus* (skin diseases), *Stephania japonica* (fever, diarrhoea), *Fumaria indica* (laxative, diuretic), *Capparis spinbsa* (scurvy, rheumatism, paralysis), *Cleome gynandra* (fever, rheumatism), *C. viscosa* (anthelmintic), *Hybanthus enneaspermus* (diuretic, bowel complaints), *Casearia tomentosa* (dropsy, fever, snake bite), *Flacourtia indica* (diarrhoea), *Polygaja arvensis* (asthma, bronchitis, fever), *P. crotalarioides* (cough, cold), *Polycarpaea corymbosa* (jaundice), *Hypericum japonicum* (asthma, dysentery), *Sida alba* (fever), *Byttnaria herbacea* (cholera, diarrhoea), *Helicteres isora* (diarrhoea, dysentery), *Melia azedarach* (leprosy), *Desmodium triflorum* (dysentery, diarrhoea) and *Bauhinia acuminata* (leprosy, asthma).

EXOTIC SPECIES

A large number of exotic species have been recorded growing in the tiger reserve area. These have migrated from outside and now more or less naturalized in the area. Some of the common exotic species are *Malvastrum coromandelianum* (S.America), *Bombay ceiba* (Malaya), *Pterospermum acerifolium* (Asia), *Waltheria indica* (Trop.America), *Corchorus aestuans* (Trop.Asia), *C. olitorius* (Africa), *Limonia acidissima* (Europe), *Melia azedarach* (W.Asia), *Swietenia mahagoni* (C.America), *Moringa oleifera* (Malaya), *Mimosa pudica* (Trop.America), *Pithecellobium dulce* (Mexico), *Atylosia scarabaeoides* (Australia), *Glircidia sepium* (C.America), *Macrotyloma uniflorum* (Africa), *Cassia obtusifolia* (Trop.America), *C. occidentalis* (S.America), *Parkinsonia aculeate* (Trop.America), *Tamarindus indica* (Trop.Africa), *Rosa multiflora* (China), *Callistemon citrinus* (Australia), *Eucalyptus crebra* (Australia), *E. citriodora* (Queensland), *E. tereticornis* (Australia), *E. rostrata* (Australia), *Lagerstroemia indica* (Indo-Japan), *L. speciosa* (Myanmar), *Passiflora foetida* (West Indies), etc.

Ten dominant families in respect of genera/species number, of Palamau district are shown in Table-I.

Table-I

Sl. No.	Name of the families	Number of	
		Genera	Species
1.	Poaceae	50	77
2.	Fabaceae	37	72
3.	Asteraceae	43	58
4.	Euphorbiaceae	19	35
5.	Cyperaceae	7	27
6.	Rubiaceae	19	26
7.	Acanthaceae	16	26
8.	Convolvulaceae	10	22
9.	Caesalpiniaceae	7	22
10.	Lamiaceae	15	21

Table-II

Sl. No.	Dominant families of Chotanagpur	Spp. No.	Sl. No.	Dominant families of Bihar & Orissa	Spp. No.
1.	Gramineae	150	1.	Leguminosae	282
2.	Leguminosae	132	2.	Gramineae	218
3.	Cyperaceae	70	3.	Cyperaceae	120
4.	Orchidaceae	60	4.	Compositae	103
5.	Compositae	60	5.	Euphorbiaceae	103
6.	Euphorbiaceae	50	6.	Acanthaceae	90
7.	Acanthaceae	45	7.	Rubiaceae	75
8.	Rubiaccae	45	8.	Labiatae	69
9.	Scrophulariaceae	40	9.	Scrophulariaceae	61
10.	Labiatae	35	10.	Convolvulaceae	61

Rare plants

The following are the rare elements of the flora : *Begonia picta, Cassytha filiformis, Chenopodium murale, Clematis gouriana, Cymbidium macrorhizum, Didymocarpus pygmaea, Dolichos trilobatus, Drosera burmannii, D. indica, Erechtites valerianaefolia, Exacum peduncularis, Helinus lanceolatus, Lavendula bipinnata. Marsdenia tenacissima, Nervilia prainiana, Parkinsonia aculeata, Phalaris minor, Pittosporum floribundum, Pygmaeopremna herbacea, Richardia scabra, Rothia indica, Rubia wallichiana, Striga angustifolia, utricularia bifida, U. graminifolia, Zanthoxylum armatum* etc. The orchids, so widely distributed in India, are scarce in the district and becoming rare day by day due to destruction of habitat and over exploitation.

A general view of deciduous forest

Endemic plants

None of the species collected from the district is endemic to Bihar state. But *Hoppea dichotoma* (Gentianaceae) and *Fissendocarpa linifolia* (Onagraceae) are restricted to India (Sarkar, 1990), found in the district. Some other species also found in the district which are endemic to India and its neighbouring countries (Rao, 1972, Nayar & Ahmed, 1984, Sarkar, 1985), e.g. *Caesulia axillaries* (N.E. India & Burma), *Chloroxylon swietenia* (S.W. India & Sri Lanka), *Colebrookea oppositifolia* (Himalaya, India and W. China), *Cyathocline purpurea* (Himalaya, Burma, China & Thailand), *Eragrostiella bifaria* (India, Burma & Sri Lanka), *Hamiltonia suaveolens* (Himalaya, India & China).

Exotic species naturalised in the area

About 123 exotic species naturalised in the district have been collected (Srivastava,1964; Maiti and Guha Bakshi,1981; Sarma and Sarkar,1994). Out of total 824 species, 14.92% are exotic. In the present work the country of origin of these exotic species have been indicated. In the Indian flora these naturalised exotic elements have been grouped in to 4-categories, viz. Neotropical, North temperate, North African and Austro-Asian. Out of 123 exotic species, 53.23% are of American origin, 5.7% of African origin, 4.88% of Australian origin and 4.07% of European origin, the rest are introduced from other countries, including China, Japan, Malaysia, West Indies etc.

List of the families of Palamau district with their genera and species number

Sl. No.	Name of the families	Genera	Species
	Dicotyledons :		
1.	Acanthaceae	16	23
2.	Aizoaceae	3	4
3.	Alangiaceae	1	1
4.	Amaranthaceae	10	16
5.	Anacardiaceae	5	5
6.	Annonaceae	4	5
7.	Apiaceae	8	8
8.	Apocynaceae	13	18
9.	Asclepiadaceae	6	8
10.	Asteraceae	43	58
11.	Balsaminaceae	1	1
12.	Begoniaceae	1	1
13.	Bignoniaceae	3	3
14.	Bombacaceae	1	1
15.	Boraginaceae	4	6
16.	Brassicaceae	2	2
17.	Buddlejaceae	1	1
18.	Burseraceae	2	2
19.	Cactaceae	1	2
20.	Leguminosae-Caesalpinioidieae	7	22
21.	Campanulaceae	2	2
22.	Capparaceae	1	3
23.	Caricaceae	1	1
24.	Caryophyllaceae	4	4
25.	Celastraceae	1	1
26.	Ceratophyllaceae	1	1
27.	Chenopodiaceae	1	3
28.	Cleomaceae	1	2
29.	Cochlospermaceae	10	22
30.	Combretaceae	3	7
31.	Convolvulaceae	10	22
32.	Cucurbitaceae	9	10
33.	Dilleniaceae	1	2
34.	Dilleniaceae	1	2
35.	Dipterocarpaceae	1	1
36.	Droseraceae	1	2
37.	Ebenaceae	1	2
38.	Ehretiaceae	2	2
39.	Elatinaceae	1	1
40.	Euphorbiaceae	19	35

Sl. No.	Name of the families	Genera	Species
41.	Leguminosae-Papilionoideae	37	72
42.	Fagaceae	1	1
43.	Flacourtiaceae	2	5
44.	Flindersiaceae	1	1
45.	Fumariaceae	1	1
46.	Gentianaceae	3	4
47.	Geraniaceae	1	1
48.	Gesneriaceae	1	1
49.	Hydrophyllaceae	1	1
50.	Hypericaceae	1	1
51.	Lamiaceae	15	21
52.	Lauraceae	2	2
53.	Lecythidaceae	1	1
54.	Leeaceae	1	2
55.	Lentibulariaceae	1	2
56.	Linaceae	1	1
57.	Lobeliaceae	1	2
58.	Loranthaceae	3	3
59.	Lythraceae	5	10
60.	Malvaceae	8	17
61.	Martyniaceae	1	1
62.	Melastomataceae	1	1
63.	Meliaceae	5	5
64.	Menispermaceae	1	2
65.	Menyanthaceae	1	2
66.	Leguminosae-Mimosoideae	4	9
67.	Moraceae	5	17
68.	Moringaceae	1	1
69.	Myrsinaceae	1	1
70.	Myrtaceae	4	8
71.	Nelumbonaceae	1	1
72.	Nyctaginaceae	2	2
73.	Nymphaeaceae	1	2
74.	Olacaceae	1	1
75.	Oleaceae	3	4
76.	Onagraceae	2	4
77.	Oxalidaceae	2	4
78.	Papaveraceae	1	1
79.	Periplocaceae	1	1
80.	Pedaliaceae	1	1
81.	Periplocaceae	3	3
82.	Pittosporaceae	1	1
83.	Plumbaginaceae	1	1
84.	Polygalaceae	1	2

Rocky hills with surub vegetation

BIOTIC INFLUENCE AND MAJOR THREATS TO THE VEGETATION

The rich fioristic diversity of the tiger reserve is under serious threat due to human activities as well as natural calamities such as gales, storms and floods. Men and animals are known to play a vital role in changing the pattern of vegetation of any place. The vegetation of the tiger reserve has also been degraded into scrub jungles as well as to grass lands in some places. Some of the major threats affecting the ecosystem and the degradation of the vegetation of tiger reserve are summarized briefly below-

Population pressure

Rapid increase of population has played a significant role in changing the vegetation pattern. Due to the increased human population, the requirement of natural resources like, fuel, fodder, timber, and other economically important plants for daily need of the human settlements within as well as of adjoining areas has increased many folds. As a result of the over exploitation, these resources are fast dwindling. Patches of forest have been converted into agricultural lands. The destruction of original vegetation of the reserve area has resulted in the invasion of a number of obnoxious weeds, which have covered large areas suppressing the regeneration of native flora. Someof the common weeds found in the reserve area are, *Ageratum conyzoides, Argemone mexicana, Bidens pilosa, Cassia occidentalis, Ipomoea carnea, Lantana camara, Tridax procumbens,* etc.

Cattle grazing

Due to non-availability of grazing ground, the domestic cattle like- goats, cattle and buffaloes are allowed to stray into the near by forests for grazing, destroying thereby the herbaceous and shrubby undergrowth as well as the germinating seedlings of large trees causing thereby a slow but steady depletion of the plants. The excessive lopping of fodder trees is

Board showing the theme of "Live and let live"

one of the main reasons for the loss of vegetation cover. Some of the forest areas have turned into fallow lands due to browsing and overgrazing by the cattles, which freely graze in the forest and on the hill slopes.

Timber extraction

In order to meet the domestic requirements, the timber is being extracted from the forests near the settlement areas, causing further depletion of the plant resources. The timber extracted from the reserve's forest is also sold illegally in the nearby areas. In addition, for various new developmental activities to cater to the needs of the local settlers and for various other constructions, the demand for timber is increasing day by day.

Extraction of minor forest products

Apart from timber, a number of minor forest products are also extracted from these forests. There are many plants, which produce fibers, oils, gums, tannins, dyes, beverages, etc. For collecting these products, they are being uprooted (herbaceous species) or cut (tree species).

Fire hazards

Fire is used occasionally for clearing the undergrowth of the Sal forest. Fire for hunting, clearing land, converting forest into pastur land has played havoc with the forest and affected the flora and fauna to a great extent. *Desmodium pulchellum, D.triflorum,* etc. are known to be fire indicator species, which can be seen growing in such areas.

Shifting cultivation

The practice of shifting cultivation practiced by the inhabitants on the hill slopes, which has adverse effect on the vegetation. In such places the "Sal" forest has changed to mixed forest.

Soil erosion

Soil erosion has been observed in the mixed forest areas facing frequent fires, which has depleted the plant cover or in "Sal" forest areas, where felling has been done. During heavy rainfall, surface soil is washed away exposing the hard rock. Over grazing is also one of the causes of soil erosion seen along the hill slopes.

Natural Calamity

Frequent flood in the region is a perennial problem, which is mainly responsible for the degradation of habitat and the loss of biodiversity.

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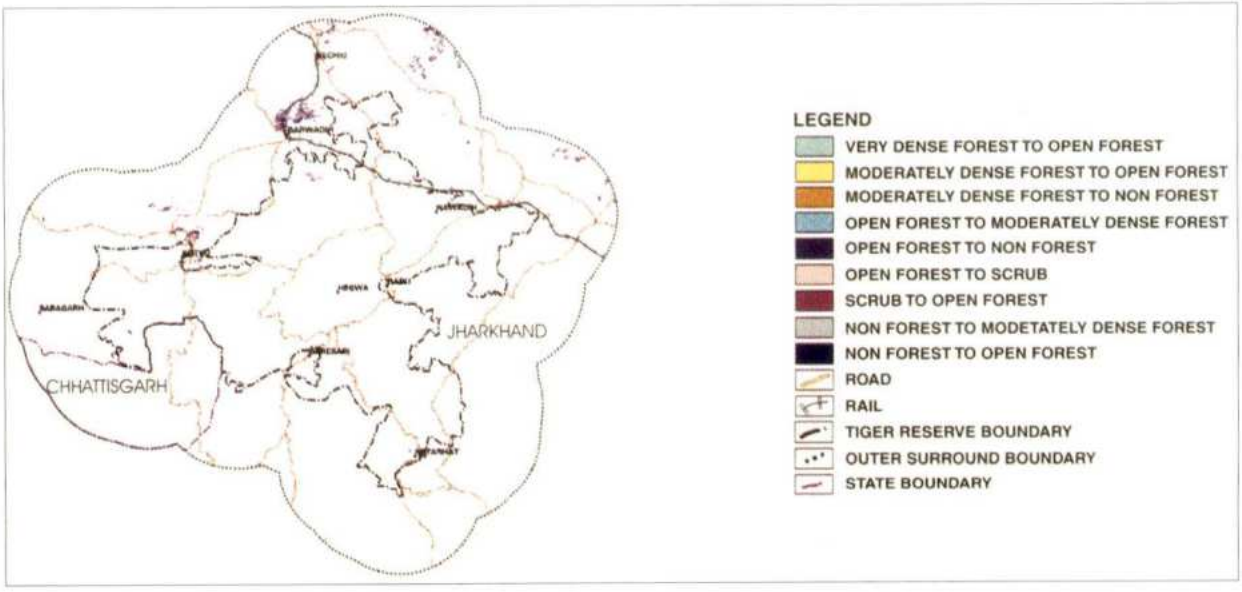


Map of Palamau Tiger Reserve

SALIENT FEATURES

Area

Core	:	213 sq km
Buffer	:	813 sq km
Total	:	1026 sq km

Longitude	:	83050' and 84036' East
Latitude	:	23025' and 23055' North
Altitude	:	300 m- 1140 m above MSL
Rainfall	:	Average 1036 mm

Temperature

Minimum	:	1°C
Maximum	:	50°C

Seasons

Winter	:	Mid-November to mid-February
Summer	:	Mid-February to mid-June
Monsoon	:	Mid-June to mid-September
Autumn	:	Mid-September to mid-November

By Rail :

The nearest important railway station is Daltongunj, connected to many places in the region with regular trains. Ranchi and Gaya are also convenient railway stations for the tourists coming from Delhi and Calcutta respectively.

By Air :

Ranchi, situated around 140 km away, is the nearest airport with regular air connections to Delhi, Calcutta, Patna and Lucknow.

By Road :

The sanctuary is well connected to other cities in the region by regular buses run by the state transport corporation and private companies.

PLACES NEAR BY

In the surrounding areas of the Palamau wildlife sanctuary is Ranchi around 140 km away. The Hazaribagh National Park close by has an ecosystem

Chero tribes with medicineman in the reserve

and inhabitants similar to that of Palamau, but is smaller in size. Netarhat, the 'Queen of Chotanagpur' is situated at an elevation of 3,700 feet above sea level. Here, one is exposed to abundant lush greenery and great landscape.

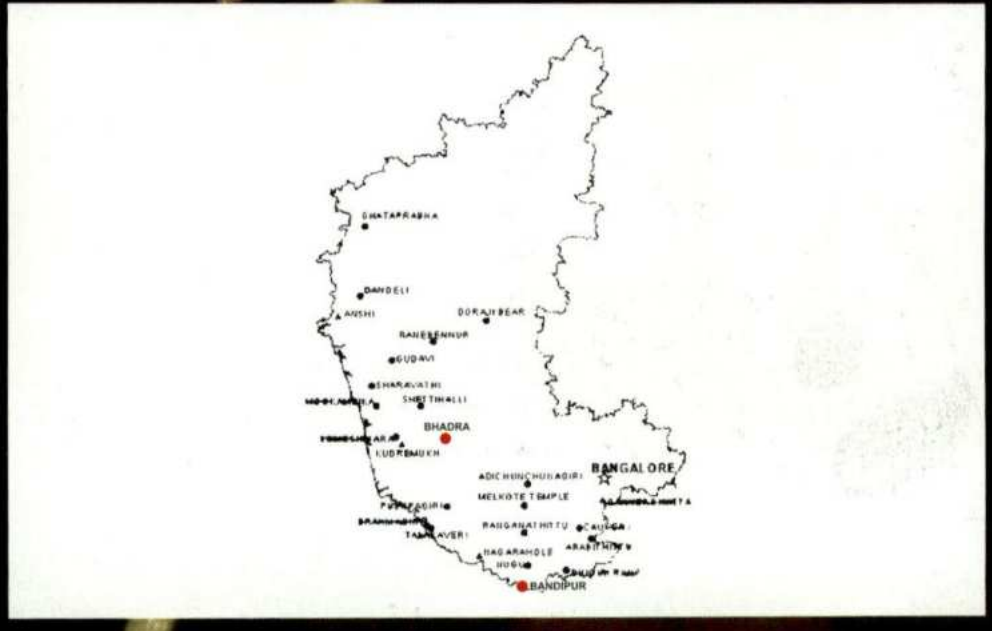
STD/ISD facilities are available at the Palamau wildlife sanctuary. Postal facilities are also available. Internet is not available in the reserve area. Telegraph facility is available at Daltongunj situated around 24 km away.

Gloriosa superba

KARNATAKA

Murdannia simplex

- Bandipur Tiger Reserve
- Bhadra Tiger Reserve



Bandipur Tiger Reserve

PSN Rao
Botanical Survey of India, Western Circle, Pune - 411 001

Bandipur National Park is one of India's well known protected areas and has a long history of protection. In the early part of twentieth century itself, the former Maharajas of Mysore realized its value and importance as a wildlife preserve and accordingly several Reserve Forest blocks over an area of 9000 ha. were declared a Game Sanctuary in 1931 under the Mysore Game and Forest Regulations of the same year, in 1941 the area was expanded to 80,000 ha. and reconstituted as Venugopal National Park, named thus after a local deity worshipped by the former Maharajas. An area of about 600 ha. 'sanctum sanctorum' in the park, called Bandipur Wildlife Park, was left completely untouched by forestry operations which continued in the rest of the area. In 1973, Bandipur became one of the first of India's Tiger Reserves, and in 1974, intention was declared under the Wildlife (Protection) Act to notify it a national park.

Curcuma neilgherrensis *Courtesy* : S. Punekar

Covered by dense vegetation dominated by Teak *Tectona grandis,* the park's "terrain is undulating and broken by chains of rolling hills with vast stretches of valleys that are sprinkled with meadows and seasonal water courses".

Bandipur forms an important part of a much larger stretch of protected forest area, with Rajiv Gandhi National Park to its north-west (across the Kabani Reservoir), Nugu Sanctuary to its north (connected by the Nugu Reservoir), Mudumalai Sanctuary (Tamil Nadu) adjoining its southern boundary, and Wynad Sanctuary (Kerala) connected in the south-west. This entire forest area is now a part of the Nilgiri Biosphere Reserve, and is one of India's most valuable habitats for species like the Elephant and the Tiger (Ranjit Lal & al, 1994).

Legal Status: Intention was declared to constitute the area into a national park, vide notification No. AFD/146/FWL/73 dated 5th June, 1974. For some unknown reason, this notification was not published, in the State Gazette, and a fresh notification, No. FFD. 193. FWL. 82, was issued on 15th March, 1985.

Area and Zoning: 87,420 ha. (874.20 sq km) The Tiger Reserve covers an area of 86,573 ha, and is roughly divided into a Core or Wilderness Zone of 52,300 ha. a Buffer Zone of 26,000 ha. a Tourism Zone of 8,200 ha. and an Administrative Zone of 100 ha. The balance 820 ha. is the area occupied by the two state high ways passing through the Tiger Reserve.

Location: District Mysore; Lat. Range 12° 03' 30" to 12° 54' 17" N; Long. Range 76° 07' 00" to 76° 52' 40" E; Nearest town Gundlupet (15 km); Nearest railhead Nanjangud (60 km); Nearest airport Mysore (80 km).

Approaches:
From Bangalore via Mysore (140 km), to Gundlupet (60 km), and then to the park (18 km). From Udagamandalam (in Tamil Nadu) via Gudalur (37.5 km) to Bandipur (inside the park) (35 km).

Topography and Climate : Altitude 680 m to 1454 m, the highest point located in the south-eastern part of the park; Temperature 11°C to 30°C (mp 1974); Mean annual rainfall 625 mm (at Moyar, near Bandipur) to 1250 mm (western boundary). Remote sensing imagery indicates that most of the park has closed forest (crown density 40% and above), and the northern and eastern extremities have sections of open forest with patches of scrub. There is no forest cover adjoining the northern and eastern boundaries, but the other parts are bounded by forest. A comparison of Landsat imagery of 1983 and 1989 indicates mixed results. The good news is that 104.48 sq km which was earlier an open forest (crown density between 10% to 40%) has been converted to closed forest, and 36.83 sq kms earlier scrub land (crown density below 10%) have improved to open/ closed forests. Unfortunately, about 15.54 sq kms of closed/ open forests have become non-forest 'areas, 32.82 sq kms of earlier dense forests has changed into open forest, 33.82 sq kms of earlier closed/ open forest have changed into scrub, and 0.50 sq kms of scrub has changed into non forests [FSI 1993].

Ipigenia magnifica *Courtesy* : S. Punekar

Forest types include Dry Deciduous Scrub Dry Teak Bearing Forest and Moist Teak Bearing Forest. The higher reaches of the park also contain semi-evergreen forests.

The park has scattered plantations of Teak *Tectona grandis* and *Eucalyptus* which are currently not being worked.

Plant species of special interest are *Kydia calycina,* and the bamboo *Bumbusa bambos*, both being favourite fodder of elephants.

The weed *Lantana* is spreading in the Tourism Zone and is being uprooted in certain select areas (Basappanavar 1985). Another weed, *Chromolaena odorata,* is not gregarious but other weeds like *Indigofera* sp. *Desmodium* sp. *Decastichia crotonifolia* and *Leea chirensis* are spreading fast.

OCCURRENCE AND CONTROL OF DISEASE

Rinderpest killed over 50 Gaur in 1968-69; no subsequent outbreak has been reported. There are

reports of Foot and Mouth Diseases striking livestock in adjoining village (Basappanavar 1985), though there are no definite records of this, or evidence that wild animals have been thus afflicted. A vaccination programme has been undertaken for cattle in adjoining villages, and approximately 70 percent of the cattle have been inoculated. Cattle passing through the park are always checked for vaccination. There is a veterinarian attached to the park at Bandipur.

OTHER FACTORS AFFECTING HABITAT

Forest fires occur between February and April affecting almost 10% of the area. Usually, two large conflagrations occur annually, the first and more severe one at the beginning of summer (March), and the second in April-May. All fires are believed to be caused by humans. There were 103 fires between 1979-80 and 1983-84, affecting a total area of 38,200 ha. of which 18,200 ha., was in the core zone. The total length of firelines is 1045 km. Since 1986 the occurrence of fire has been considerably reduced, reportedly due to effective fire protection measures (mp 1988).

Hailstorms may occur in May or June, though they are rare.

The park was afflicted by drought during 1982-83, affecting 50% of the Buffer Zone. No loss of fauna was noticed.

WATER RESOURCES

The Moyar, Mavinahalla, Nugu, and other rivers run along much of the southern boundary of the park, and the Kannegal Hole along the western border. Nugu river then flows northwards through the park, before eventually entering the Nugu reservoir, which adjoins the park to the north (tp). In addition, there are 12 major seasonal tributaries of these rivers. The Kabini reservoir is located along the northwestern boundary (tp). There are also 120 waterholes, of which 20 are artificial and seasonal, and 50 perennial.

Dracaena terniflora *Courtesy* : S. Punekar

Fourteen check dams have been constructed across seasonal streams, and six borewells have been excavated, to augment water supply (Basappanavar, 1985).

ANGIOSPERMIC FLORA OF BANDIPUR NATIONAL PARK

TREES

Acacia catechu Willd
A. ferruginea DC.
A. latronum Willd
A. leucophloea Willd
A. nilotica Willd ex Delile
A. polyacantha Willd
Acrocarpus fraxinifolius Wight & Arn.
Actinodaphne angustifolia Meixan.
Aegle marmelos (L.) Correa
Ailanthus excelsa Roxb.

Tacca leontopetaloides *Courtesy* : S. Punekar

Alangium salvifolium Wang
Albizia amara Boivin
A. lebbeck Benth.
A. odoratissima Benth.
A. procera Benth.
Anacardium occidentale L.
Annona squamosa Delile
Anogeissus latifolia (Roxb.) Bedd.
Aphanamixis polystachya (Wall.) R. Parker
Artocarpus heterophyllus Lam.
Atalantia racemosa Wight & Arn.
Azadirachta indica Juss.
Bauhinia malabarica Roxb.
Bischofia javanica Blume
Boswellia serrata Roxb. ex Colebr.
Bridelia crenulata Roxb.
Buchanania axillaris (Desr.) Ramamoorthy
B. lanzan Spreng.
Butea monosperma (Lam.) Taub.
Caesalpinia mimosoides Lam.
Canarium strictum Roxb.
Canthium dicoccum Merr.
Capparis divaricata Lam.
Caryota urens Blanco
Casearia elliptica Willd.
Cassia fistula L.
C. siamea Lam.
Casuarina equisetifolia J.R. Forst. & G. Forst.
Chloroxylon swietenia DC.
Chukrasia velutina Roem.
Cochlospermum religiosum (L.) Alston
Commiphora caudata Engl.
Dalbergia latifolia Roxb.
D. paniculata Roxb.
D. sissoo Roxb.
Dillenia Indica L.
Diospyros melanoxylon Roxb.
D. montana Roxb.
Elaeocarpus serratus L.
E. tuberculatus Roxb.
Elaeodendron glaucum Pers.
Emblica officinalis Gaertn.
Ervatamia heyneana T. Cooke
Ficus benghalensis L.
F. drupacea Thunb.
F. exasperata Roxb.
F. racemosa L.
F. tsjakela Burm. f.
F. virens Aiton
Flacourtia indica Merr.
Gummifera latifolia Aiton
G. turgida Roxb.
Garuga pinnata Roxb.
Givotia rottleriformis Griff.
Gmelina arborea Roxb.
G. asiatica L.
Grevillea robusta A. Cunn.
Grewia tiliifolia A. Rich.
Hymenodictyon excelsum Wall.

Haldina cordifolia (Roxb.) Ridsdale
Hardwickia binata Roxb.
Holoptelea integrifolia (Roxb.) Planch.
Hopea parvifolia Bedd.
H. wightiana Miq. ex Dyer
Humboldtia brunonis Wall.
Hydnocarpus laurifolia (Dennst.) Sleumer
Kingiodendron pinnatum (Harms) Gamble
Kydia calycina Roxb.
Lannea coromandelica (Hout.) Merr.
Lophopetalum wightianum Arn.
Maclura cochinchinensis (Lour.) Corner
Madhuca longifolia (L.) McBride
Mallotus philippensis (Lam.) Muell. - Arg.
Mangifera indica L.
Melia dubia Cav.

Alpinia malaccensis *Courtesy* : S. Punekar

Meyna laxiflora Robyns
Michelia champaka L.
Miliusa tomentosa (Roxb.) J. Sinclair
Mimusops elengi Wight
Mitragyna parvifolia (Roxb.) Karth.
Morinda tomentosa Heyne
Naringi crenulata (Roxb.) Nicolson
Pavetta indica L.
Persea macrantha (Nees) Kosterm.
Pithecellobium dulce Benth.
Plumeria rubra L.
Poeciloneuron indicum Bedd.
Psidium guajava L.
Pterocarpus indicus Willd.
P. marsupium Roxb.
Punica granatum L.
Radermachera xylocarpa K. Schum.
Salix tetrasperma Roxb.
Salmalia malabarica Schott & Endl.
Samanea saman (Jacquem.) Merr.
Santalum album L.
Sapindus emarginatus Vahl
Schleichera oleosa Oken
Schrebera swietenioides Roxb.
Semecarpus anacardium L.f.
Soymida febrifuga (Roxb.) A. Juss.
Spondias pinnata Kurz
Sterculia villosa Roxb.
Stereospermum personatum (Hassk.) Chatterjee
S. suaveolens DC.
Streblus asper Lour.
Strychnos nux-vomica L.
S. potatorum L.f.
Syzygium cumini L.
Tamarindus indica L.
Tectona grandis Roth
Terminalia alata Roth
T. arjuna Wight & Arn.
T. bellerica Roxb.
T. catappa (L.) Blume

T. chebula Retz.
Thespesia populnea (L.) Soland. ex Corr.
Toona ciliata M. Roem.
Trema orientalis (L.) Blume
Vitex altissima L.f.
V. negundo L.
Wendlandia thyrsoidea Steud.
Wrightia tinctoria R. Br.
Xeromphis spinosa (Thunb.) Keay
X. uliginosa (Retz.) Maheshw.
Ziziphus mauritiana Lam.
Z. xylopyra (Retz.) Willd.

ENUMERATION

Systematic survey of the area in different seasons has given 448 species belonging to 100 families which are enumerated and have been carefully observed in the field and have been identified in the Regional Herbarium, Southern Circle. In general the sequence of families is according to Bentham and Hooker. Species under each family are arranged in alphabetical order.

OTHER PLANTS

OPHIOGLOSSACEAE

Ophioglossum reticulatum L.

POLYPODIACEAE *(sensu lato)*

Actiniopteris dichotoma (Forrsk.) Kuhn
Hemionitis arifolia Burm. f.
Nephrolepis cordifolia (L.) Presl.
Pyrrosia acrostichoides (Forst.) Ching

PTERIDACEAE

Pteris quadriaurita Retz.
P. vittata L.

SALVINIACEAE

Azolla pinnata R. Br.

CUPRESSACEAE

Cupressus torulosa D. Don

Curculigo orchioides *Courtesy :* S. Punekar

RANUNCULACEAE

Clematis gouriana Roxb. ex DC.

ANNONACEAE

Annona squamosa L.

MENISPERMACEAE

Cissampelos pareira L.
Pachygone zeylanica (Gaertn.) Santapau & Wagh

NYMPHAEACEAE

Nymphaea nouchali Burm. f.

CAPPARACEAE

Cadaba fruticosa (L.) Druce

Capparis grandiflora Wall. ex Hook.f. & Thomson
C. sepiaria L.
Cleome monophylla L.

COCHLOSPERMACEAE

Cochlospermum religiosum (L.) Alston

FLACOURTIACEAE

Flacourtia indica (Burm. f.) Merr.

PITTOSPORACEAE

Pittosporum floribundum Wight & Arn.

POLYGALACEAE

Polygala chinensis L.
P. javana DC.

PORTULACACEAE

Portulaca oleracea L.

MALVACEAE

Abutilon indicum (L.) Sweet
Azanza lampas (Cav.) Alef.
Hibiscus lobatus (Murr.) Kuntze
H. panduraeformis Burm. f.
Kydia calycina Roxb.
Sida acuta Burm. f.
S. cordata (Burm. f.) Borssum. Waalk.
S. mysorensis Wight & Arn.

STERCULIACEAE

Eriolaena quinquelocularis Wight
Helicteres isora L.
Melochia corchorifolia L.
Waltheria indica L.

TILIACEAE

Corchorus olitorius L.
C. trilocularis L.
Grewia abutilifolia Vent. ex Juss.
G. bracteata Heyne ex Roth
G. hirsuta Vahl
G. oppositifolia Buch. ex DC.
G. orbiculata Roth
G. tiliaefolia Vahl
Triumfetta pilosa Roth

ERYTHROXYLACEAE

Erythroxylon monogynum Roxb.

LINACEAE

Linum mysorense Heyne ex Wall.

MALPIGHIACEAE

Hiptage benghalensis (L.) Kurz

ZYGOPHYLI.ACEAE

Tribulus terrestris L.

OXALIDACEAE

Biophytum candolleanum Wight
Oxalis corniculata L.

BALSAMINACEAE

Impatiens balsamina L.

RUTACEAE

Aegle marmelos (L.) Correa
Atalantia monophylla (Roxb.) DC.
A. racemosa Wight & Arn.
Feronia limonia (L.) L.D. Swingle
Murraya paniculata (L.) Jack.
Pleiospermium alatum (Wight & Arn.) L.D. Swingle
Toddalia asiatica (L.) Lam. var. **gracilis** Gamble

BURSERACEAE

Boswellia glabra Roxb.

MELIACEAE

Azadirachta indica A. Juss.
Chloroxylon swietenia DC.
Cipadessa baccifera (Roth) Miq.

OPILIACEAE

Opilia amentacea Roxb.

CELASTRACEAE

Celastrus paniculata Willd.
Elaeodendron gJaucum Pers.

Maytenus emarginata (Willd.) Ding Hou

RHAMNACEAE

Scotia circumcissa (L. f.) Druce
Ventilago maderaspatana Gaertn.
Ziziphus mauritiana Lam.
Z. oenoplia (L.) Mill.
Z. xylopyrus (Retz.) Willd.

VITACEAE

Ampelocissus tomentosa Planch.
Cissus quadrangularis L.
C. setosa Roxb.

LEEACEAE

Leea edgeworthii Santapau

SAPINDACEAE

Cardiospermum canescens Wall.
C. halicacabum L.
Dodonaea viscosa (L.) Jacquem
Schleichera oleosa (Lour.) Oken

ANACARDIACEAE

Anacardium occidentale L.
Buchanania lanzan Spreng.

LEGUMINOSAE-PAPILIONOIDEAE

Alysicarpus rugosus (Willd.) DC.
var. **styracifolius** Baker
A. vaginalis (L.) DC.
Atylosia albicans Benth.
A. scarabaeoides Benth.
Crotalaria alata Buch.-Ham. &
Roxb. ex Don
C. calycina Schrank
C. fulva Roxb
C. hirta Willd.
C. laevigata Link
C. mysorensis Roth
C. paniculata Willd.
C. quinquefolia L.
C. verrucosa L.
Cylista scariosa Aiton
Dalbergia lanceolaria L. f.
D. paniculata Roxb.
Desmodium gangeticum (L.) DC.
D. motorium (Houtt.) Merr.
D. pulchellum (L.) Benth.
D. velutinum (Willd.) DC.
Erythrina suberosa Roxb.
Glycine javanica L.
Indigofera cassioides Rottl. ex DC.
I. linnaei Ali
I. wightii Grah. ex Wight & Arn.
Moghania grahamiana (Wight & Arn.) Kuntze
Pongamia pinnata (L.) Pierre
Pterocarpus marsupium Roxb.
Rhynchosia minima DC.
R. viscosa DC.
Sophora glauca Lesch. ex DC.
Stylosanthes fruticosa (Retz.) Alston
Tephrosia candida DC.
T. tinctoria Pers.
Zornia gibbosa Span.

LEGUMINOSAE-CAESALPINIOIDEAE

Bauhinia racemosa Lam.
Caesalpinia decapetala (Roth) Alston
Cassia absus L.
C. auriculata L.
C. fistula L.
C. hirsuta L.
C. mimosoides L. var. **auricoma** Grah. ex Baker
C. montana Heyne ex Roth
C. occidentalis L.
C. siamea Lam.
C. sophera L.
Pterolobium hexapetalum (Roth) Santapau &
Wagh
Tamarindus indica L.

LEGUMINOSAE-MIMOSOIDEAE

Acacia chundra (Roxb.) Willd.
A. leucophloea Willd.
A. polycantha Willd.
AIbizia amara Boivin
Dichrostachys cinerea Wight & Arn.

CRASSULACEAE

Kalanchoe floribunda Wight & Arn.
K. laciniata DC.

K. pinnata (Lam.) Pers.

COMBRETACEAE

Anogeissus latifolia (DC.) Wall. ex Bedd.
Combretum ovalifolium Roxb.
Terminalia bellerica (Gaertn.) Roxb.
T. chebula Retz. var. **tomentella** C. B. Clarke
T. crenulata Roth
T. paniculata Roth

MYRTACEAE

Eucalyptus rostrata Schlect.
Syzygium cumini (L.) Skeels
S. malabaricum Camb.

LYTHRACEAE

Ammannia baccifera L.
Lagerstroemia parviflora Roxb.

ONAGRACEAE

Ludwigia octovalvis (Jacquem.) Raven

FLACOURTIACEAE

Casearia elliptica Willd.

CUCURBITACEAE

Coccinia grandis (L.) Voigt
Cucumis sativus L. var. **hardwickii** (Royle) Kitam.
Diplocyclos palmatus (L.) C. Jeffrey
Melothria amplexicaulis (Lam.) Cogn.
Trichosanthes bracteata (Lam.) Voigt
Zehneria umbellata Thwaites

MOLLUGINACEAE

Glinus lotoides L.

UMBELLIFERAE

Pimpinella monoica Dalzell

CAPRIFOLIACEAE

Lonicera leschenaultii Wall.

RUBIACEAE

Borreria articularis (L. f.) F. N. Will.
B. stricta (L. f.) K. Schum.
Canthium dicoccum (Gaertn.) Merr.
C. dicoccum (Gaertn.) Merr. var. **umbellatum** (Camb.) Santapau & Merchant
Gardenia gummifera L. f.
G. latifolia Aiton
Hedyotis nitida Wight & Arn.
Hymenodictyon excelsum (Roxb.) Wall.
Ixora arborea Roxb. ex Sm.
Knoxia sumatrensis (Retz.) DC.
K. wightiana Wall. ex Wight & Arn.
Mitragyna parvifolia (Roxb.) Korth.
Morinda tomentosa Heyne ex Roth
M. umbellata L.
Randia candolleana Wight & Arn.
Rubia cordifolia L.
Tarenna asiatica (L.) Santapau & Merchant
Wendlandia thyrsoides (Roem. & Schult.) Steud.
Xeromphis spinosa (Thunb.) Keay

COMPOSITAE

Acanthospermum hispidum DC.
Ageratum conyzoides L.
Artemisia nilagirica (C.B. Clarke) Pamp.
A. parviflora Buch.-Ham. ex Roxb.
Blainvillea acmella (L. f.) Philip.
Blepharispermum subsessile DC.
Blumea membranacea DC. var. **jacquemontii** (Hook. f.) Randeria
B. mollis (D. Don) Merr.
Conyza leucantha (D. Don) Ludlow & Raven
C. stricta Willd.
Dichrocephala latifolia (L. f.) Kuntze
Echinops echinatus DC.
Eclipta prostrata (L.) L.
Erigeron canadensis L.
Eupatorium glandulosum Kunth
Galinsoga parviflora Cav.
Glossogyne bidens (Retz.) Alston
Gynura nitida DC.
Lagascea mollis Cav.
Laggera alata (Don) Sch.-Bip. ex Oliver
Launaea acaulls (Roxb.) Babcock ex Craib
Pluchea tomentosa DC.
Sphaeranthus indicus L.
Sonchus brachyotus DC.

S. oleraceus L.
Tridax procumbens L.
Vernonia cinerea (L.) Less.
V. divergens (Roxb.) Edgew.
Vicoa indica DC.

CAMPANULACEAE

Cephalostigma flexuosum Hook. f. & Thomson

PLUMBAGINACEAE

Plumbago zeylanica L.

PRIMULACEAE

Anagallis arvensis L.

MYRSINACEAE

Ardisia solanacea (Poir.) Roxb.
Embelia tsjeriam-cottam (Roem. & Schult.) A. DC.

SAPOTACEAE
Madhuca indica J.F. Gmel.

EBENACEAE

Diospyros melanoxylon Roxb.
D. montana Roxb.

OLEACEAE
Chionanthus remiflorus Roxb.
Jasminum auriculatum Vahl
J. malabaricum Wight
J. ritchiei C.B. Clarke
Ligustrum walkeri Decne.
Olea dioica Roxb.

SALVADORACEAE

Azima tetracantha Lam.

APOCYNACEAE

Ichnocarpus frutescens (L.) Aiton
Rauvolfia densiflora (Wall.) Benth. ex Hook. f.
Wrightia tinctoria R. Br.

ASCLEPIADACEAE

Calotropis gigantea (L.) R. Br.
Caralluma umbellata Haw.
Ceropegia candelabrum L.
C. hirsuta Wight & Arn.
C. intermedia Wight
Dregea volubilis (L. f.) Benth. ex Hook. f.
Holostemma annulare (Roxb.) K. Schum.
Pergularia daemia (Forssk.) Chiov.
Secamone emetica R. Br.
Tylophora indica (Burm. f.) Merr.
T. rotundifolia Buch.-Ham. ex Wight

PERIPLOCACEAE

Cryptolepis buchanani Roem. & Schult.
Decalepis hamiltonii Wight & Arn.
Hemidesmus indicus (L.) Roem. & Schult. var. **pubescens** Hook. f.

LOGANIACEAE

Strychnos potatorum L. f.

GENTIANACEAE

Exacum pedunculatum L.
Swertia angustifolia Buch.-Ham. ex D. Don var. **pulchella** Burkill

BORAGINACEAE

Cynoglossum zeylanicum Thunb. ex Lehm.
Heliotropium brevifolium Wall.
Trichodesma indicum (L.) Lehm.
T. zeylanicum R. Br.

EHRETIACEAE

Cordia dichotoma Forst. f.
Ehretia laevis Roxb.
E. pubescens Benth.

CONVOLVULACEAE

Argyreia cuneata Ker-Gawl.
A. elliptica Choisy
Evolvulus alsinoides (L.) L.
Ipomoea muricata (L.) Jacquem
I. obscura (L.) Ker-Gawl.
I. staphylina Roem. & Schult.
Merremia hederacea (Burm. f.) Hall. f.

SOLANACEAE

Lycopersicum esculentum Mill.
Nicandra physaloides (L.) Gaertn.

Solanum indicum L.
S. khasianum C.B. Clarke var. **chatterjeeanum** Sengupta
S. nigrum L.
S. torvum Sw.
S. trilobatum L.
S. verbascifolium L.

SCROPHULARIACEAE

Bacopa monnieri (L.) Pennell
Buchnera hispida Buch.-Ham.
Scoparia dulcis L.
Sopubia delphinifolia (Roxb.) G. Don
S. trifida Buch.-Ham.
Striga asiatica (L.) Kuntze

BIGNONIACEAE

Dolichandrone arcuata C. B. Clarke
Radermachera xylocarpa (Roxb.) K. Sch.
Stereospermum personatum (Hassk.) Chatterjee

ACANTHACEAE

Andrographis lineata Nees
A. serpyllifolia Wight
Asystasia gangetica (L.) T. Anderson
Barleria buxifolia L.
B. cuspidata Heyne ex Roth
B. prionitis L.
Blepharis maderaspatensis (L.) Heyne ex Roth
Dyschoriste erectum (Burm. f.) Kuntze
D. vagans (Wight) Kuntze
Hygrophila auriculata (Schumm.) Heyne & Roth.
Justicia betonica L.
J. diffusa Willd. var. **hedyotidifolia** (Nees) C.B. Clarke
J. neilgherrensis Wall.
J. simplex Don
J. tranquebariensis L. f.
Peristrophe bicalyculata (Retz.) Nees
Phaulopis dorsiflora (Retz.) Santapau
Rhinacanthus nasuta (L.) Kurz
Thunbergia laevis Nees
Xenacanthus pulneyensis (C.B. Clarke) Bremek.

VERBENACEAE

Clerodendrum fragrans (Vent.) R. Br.
C. serratum (L.) Moon
Gmelina arborea Roxb.
G. asiatica L.
Lantana indica Roxb.
Phyla nodiflora (L.) Green
Premna latifolia Roxb. var. **viburnoides** C. B. Clarke
P. tomentosa Willd.
Priva cordifolia (L. f.) Druce
Stachytarpheta indica Vahl var. **jamaicensis** Trim.
Tectona grandis L. f.
Vitex altissima L. f.
V. negundo L. f.

LABIATAE (LAMIACEAE)

Coleus forsskohlii (Poir.) Briq.
Gomphostemma heyneanum Wall. ex Benth.
Leucas hirta Spreng.
L. lanata Benth.
L. lavandulaefolia Rees.
L. marrubioides Desf.
L. urticaefolia R. Br.
Ocimum sanctum L.
Orthosiphon diffusus Benth.
O. giabratus Benth.
O. pallidus Royle ex Benth.
O. rubicundus Benth.
Plectranthus mollis (Aiton) Spreng.
Pogostemon pubescens Benth.

NYCTAGINACEAE

Boerhavia chinensis (L.) Druce
Mirabilis jalapa Juss.

AMARANTHACEAE

Achyranthes aspera L.
Alternanthera pungens Kunth.
A. sessilis (L.) DC.
Amaranthus spinosus L.
A. gracilis Desf.
Celosia argentea L.
Digera muricata (L. f.) Mart.

CHENOPODIACEAE

Chenopodium ambrosioides L.

BASELLACEAE

Basella rubra L.

POLYGONACEAE

Polygonum chinense L.

P. glabrum Willd.

ARISTOLOCHIACEAE

Aristolochia indica L.

PIPERACEAE

Peperomia tetraphylla (G. Forst.) Hook. & Arn.

LAURACEAE

Litsea deccanensis Gamble
Neolitsea zeylanica Merr.

LORANTHACEAE

Dendrophthoe falcata (L. f.) Etting
D. trigona (Wight. & Arn.) Danser ex Santapau
Microsolen parasiticus (L.) Danser
Taxillus heyneanus (Schult.) Danser
Viscum angulatum Heyne ex DC.
V. nepalense Spreng.
V. orientale Willd.
V. ramosissimum Wall.

SANTALACEAE

Santalum album L.

EUPHORBIACEAE

Acalypha ciliata Forssk.
A. fruticosa Forssk.
Bridelia crenulata Roxb.
Chrozophora prostrata Dalzell
C. rottleri (Geis.) Juss. ex Spreng.
Croton bonplandianum Baill.
Emblica officinalis Gaertn.
Euphorbia antiquorum L.
E. cristata Heyne
E. geniculata Ort.
E. hirta L.
E, parviftora L.
E. thymifolia L.
Givotia rottleriformis Griff.
Glochidion ellipticum Wight
G. velutinum Wight
Jatropha curcas L.
Kirganelia reticulata (Poir.) Baill.
Melanthesa retusa Kostel
Phyllanthus rheedii Wight
P. simplex Retz.
Securinega leucopyrus (Willd.) Muell.-Arg.
S. virosa (Roxb. ex Willd.) Pax. & Hoff.
Tragia cannabina L. f.
T. involucrata L.

MORACEAE

Ficus benghalensis L.
F. drupacea Thunb.
F. glomerata Roxb.
F. parasitica Willd.
Plecospermum spinosum (Roxb. ex Willd.) Trécul
Streblus asper Lour.

URTICACEAE

Pouzolzia wightii Benn. var. **scabra** C.E.C. Fischer

CERATOPHYLLACEAE

Ceratophyllum demersum L.

HYDROCHARITACEAE

Ottelia alismoides Pers.
Vallisneria spiralis L.

ORCHIDACEAE

Aerides cylindricum Lindl.
Cirrhopetalum fimbriatum Lindl.
Coelogyne breviscapa Lindl.
Dendrobium aqueum Lindl.
Habenaria ovalifolia Wight
H. plantaginea Lindl.
Liparis viridiflora Lindl.
Luisia teretifolia Gaud.
Oberonia santapaui Kapadia
O. wightiana Lindl.
Polystachya purpurea Wight
Vanda testacea (Lindl.) Reichb.

ZINGIBERACEAE

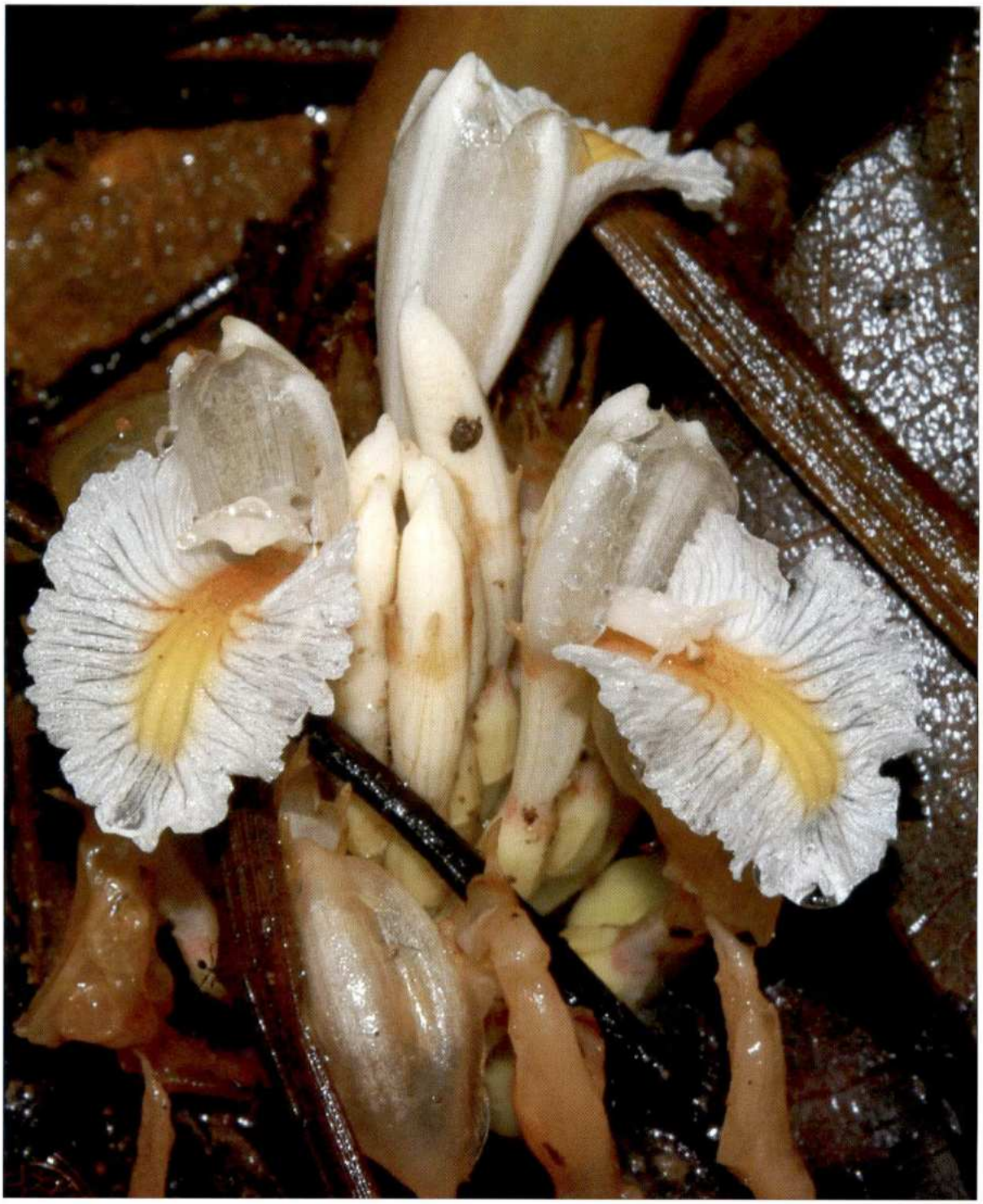
Curcuma neilgherrensis Wight
Globba bulbifera Roxb.
Hedychium coronarium J. Koenig ex Retz.

HYPOXYDACEAE

Curculigo orchioides Gaertn.

AGAVACEAE

Furcraea foetida (L.) Haw.



Amomum pterocarpum

Courtesy : S. Punekar

DIOSCOREACEAE

Dioscorea oppositifolia L.
D. pentaphylla L. var. **linnaei** Prain & Burkill

LILIACEAE

Asparagus racemosus Willd.
Chlorophytum laxum R. Br.
Gloriosa superba L.
Iphigenia indica (L.) A. Gray
Scilla hyacinthina (Roth) Macbr.
Smilax prolifera Roxb.

COMMELINACEAE

Commelina benghalensis L.
C. ensifolia R. Br.
Cyanotis fasciculata (Heyne ex Roth) Schult.
C. tuberosa (Roxb.) Schult. f.
Murdannia simplex (Vahl) Brenan

PALMAE

Phoenix humilis Royle

TYPHACEAE

Typha angustata Bory & Chaub.

ARACEAE

Pistia stratiotes L.

LEMNACEAE

Lemna perpusilla Torr.
Spirodela grandiflora Wall. ex Hook.f. & Thomson

ALISMATACEAE

Limnophyton obtusifolium (L.) Miq.

APONOGETONACEAE

Aponogeton natans Engl. & Kr.

CYPERACEAE

Carex bacccans Nees
Cyperus aristatus Rottb.
C. articulatus L.
C. compressus L.
C. dubius Rottb.
C. globosus Allion
C. ilia L.
C. paniceus (Rottb.) Boeck.
Fimbristylis dichotoma Vahl
F. falcata (Vahl) Kunth
F. monostachya Hassk.
Fuirena wallichiana Kunth
Lipocarpha triceps Nees
Scleria lithosperma Sw.

GRAMINEAE

Alloteropsis cimicina (L.) Stapf
Aristida setacea Retz.
Bambusa bambos (L.) Voss
Cymbopogon caesius (Nees) Stapf
Dendrocalamus strictus Nees
Echinochloa colonum Link
Eragrostiella bifaria (Vahl) Bor
Eragrostis gangetica (Roxb.) Steud.
E. unioloides (Retz.) Nees ex Steud.
Hackelochloa granularis (L.) Kuntze
Imperata cylindrica (L.) P. Beauv.
Paspalidium flavidium (Retz.) A. Camus
Setaria pallide-fusca (Schumach.) Stapf & C. E. Hubb.
Sporobolus tenuissimus (Schr.) Kuntze
Themeda cymbaria Hack.
T. triandra Forssk.

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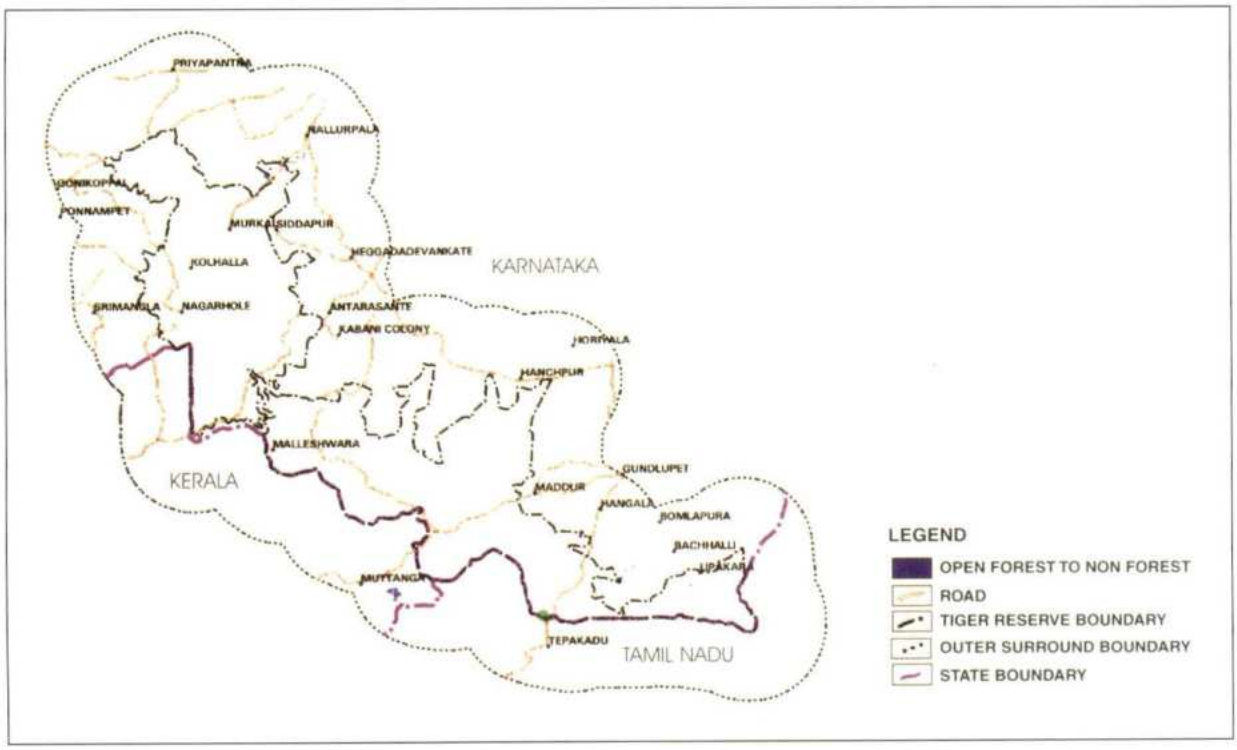
Chlorophytum tuberosum

Courtesy : S. Punekar



Map of Bandipur Tiger Reserve

SALIENT FEATURES

Area :

Core	:	523 sq km
Buffer	:	357 sq km
Total	:	880 sq km
Longitude	:	75° 12' 17" E to 76° 51' 32" E
Latitude	:	11° 35' 34" N to 11° 57' 02" N
Altitude	:	780 m - 1454.5 m above msl.
Rainfall	:	625 mm to 1250 mm.

Temperature :

Minimum	:	10° C
Maximum	:	29° C

Seasons :

Winter - November to mid-February

Summer - February to mid-June.

Monsoon - Mid-June to September

REACHING THERE

Bandipur National Park is located on the highway connecting Mysore and the hill station of Ootacamund (Ooty). It takes 2½ hours to reach Bandipur forest from Mysore and about 3 hours from Ooty. The nearest rail junction is Mysore (65 km) and the nearest international airport is the software Mecca of Bangalore (204 km).

LINKS TO THE OUTSIDE WORLD

The nearest town from Bandipur forest is Gundulpet, which is about 20 km away. All medical and communication (post, telegraph, phone and fax) facilities are available at Gundulpet. E-mail/Internet facilities are available at Mysore.

PLACES NEAR BY

Nagarhole, Madumulai and Wynad National parks all lie in the vicinity of Bandipur forest. A reservoir and a dam that separates Bandipur from Nagarhole reserve is an interesting place as well.

Bhadra Tiger Reserve

PSN Rao
Botanical Survey of India, Western Circle, Pune-411 001

The sanctuary consists entirely of closed forest showing moist and dry deciduous vegetation and was famous as a hunters' paradise in the past owing to undulating terrain. Bamboo (*Bambusa* and *Dendrocalamus* spp.) is very common throughout the area. Water sources are abundant with the Bhadra River and Reservoir forming a dominant part of the landscape. The sanctuary has been notified in two sections, Lakavalli and Muthodi, and is connected by forest corridor to Shettihally Sanctuary in the northwest and Kudremukh National Park in the southwest. The Muttodi section is much smaller than the Lakavalli, and is reported to have shola forests (type unclear) which are being degraded and need protection. It also contains appreciable greater altitudes than the Lakavalli section, including the sanctuary's highest point, Kalhatti Giri.

Legal Status : Declared a sanctuary on September 25, 1974, vide notification AFD 25 FWL 74.

Area and Zoning : 49,246 ha. (492.46 sq km) of this, the Lakavalli section 47,473 ha., while the Muttodi section is 1773 ha. The Core Zone covers 13,300 ha., the Tourism Zone 10,083 ha., and the Buffer Zone 25,863 ha. There is a proposal to add an area of 800 ha. to the sanctuary. This area has not been handed over to the Forest Department by the Revenue Department, nor has it yet been demarcated on the ground. Boundary demarcation is in progress (Ranjit Lal & al, 1994).

Location : Districts: Chikmagalur and Shimoga; Lat. range Lakavalli section lat. 13° 22' 08" to 13° 47' 37" N, and Muttodi section 13° 29' 52" to 13° 33' 28", Long. range Lakavalli section and Muttodi section 75° 44' 17" to 75° 46' 59" Nearest town Lakavalli (1.25 km); Nearest railhead Rangenahalli (6 km); Nearest airport Mangalore (153 km).

Approaches : From Bangalore to Birur (216 km) then to Tarikere (25 km) and on to the sanctuary (20 km).

Rhaphidophora pertusa *Courtesy* : S. Punekar

Amorphophallus commutatus

Courtesy : S. Punekar

Cryptocoryne spiralis

Courtesy : S. Punekar

Topography and Climate : Altitude 615 m to 1872 m, the highest point being on the eastern border; Temperature 10° C to 35° C; Mean annual rainfall 1000 mm.

Flora : According to Landsat imagery, the sanctuary consists entirely of closed forest (canopy cover 40% and above) though patches of open area have also been reported. To the east and south, the sanctuary is bordered with the plantations. Adjoining areas of the sanctuary show fairly good forest except in the northeast [Landsat, 1986]. The main forest types found in the sanctuary are Southern Dry Mixed Deciduous Forest Southern Moist Mixed Deciduous Forest and Western Sub-tropical Hill Forest.

Between 1979-80 and 1983-84, 121 ha. was planted with commercial timber species. Trees planted include *Acacia auriculiformis, Tectona grandis* (Teak) and *Acrocarpus fraxinifolius.* Fruit yielding trees have also been planted. The weed *Chromolaena odorata* has spread throughout the open areas of the sanctuary. There are old Teak and Eucalyptus plantations scattered throughout the sanctuary. Most of these plantations were raised prior to declaration of the sanctuary.

Occurrence and Control of Disease : A rinderpest epidemic spread between May and September 1989, killing 55 Gaur. Subsequently about 25,000 cattle living in and around the sanctuary were inoculated. Restrictions were imposed on the entry of cattle, and waterholes were disinfected. The nearest veterinarian is located at Bhadravati, 14 km away.

Other Factors Affecting Habitat : Forest fires are a threat to the sanctuary, occurring between February and April. However, so far no major damage has been caused and the fires have always been controlled in time. They are reportedly, mainly caused by villagers, some accidentally, others deliberately. About 500 km of firelines are reportedly maintained. No subsequent outbreak has been reported.

Amorphophallus paeoniifolius *Courtesy :* S. Punekar

Water Resources : The Bhadra reservoir covers a part of the north and western section of the sanctuary, and the Bhadra river flows along its south-western boundary. There are also several perennial and seasonal streams, one perennial reservoir (other than Bhadra), five seasonal reservoirs, 11 seasonal lakes, and several artificial tanks.

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TREE FLORA OF BHADRA WILDLIFE SANCTUARY

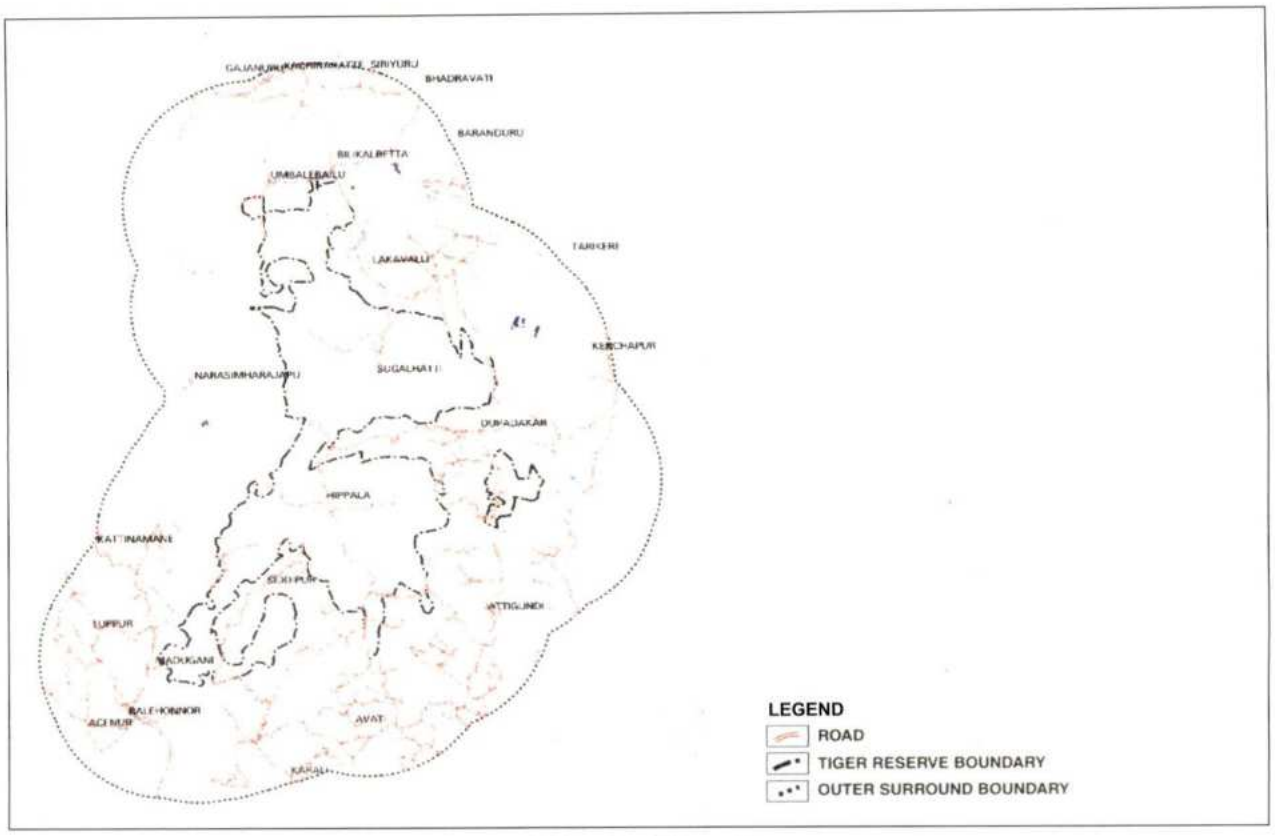
Acacia auriculiformis Benth.
Acrocarpus fraxinifolius Wight & Arn.
Albizia odoratissima (L. f.) Benth.
A. procera (Roxb.) Benth.
Alstonia scholaris (L.) R. Br.
Anogeissus latifolia (D.C.) Gnill. & Perr.
Bauhinia malabarica Roxb.
Bischofia javanica Blume
Bombax ceiba L.
Bridelia crenulata Roxb.
Buchanania lanzan Spreng.
Butea monosperma (Lam.) Taub.
Calophyllum spp.
Careya arborea Roxb.
Caryota urens L.
Cassia fistula L.
C. siamea Lam.
Casuarina equisetifolia L.
Chloroxylon swietenia DC.
Cinnamomum verum J.S. Pres.
Dalbergia latifolia Roxb.
D. sissoo Roxb.
Derris indica L.
Dillenia pentagyna Roxb.
D. oehreata Gilg.
Emblica officinalis Gaertn.
Eucalyptus tereticornis Smith
Ficus benghalensis L.
F. drupacea Thunb.
F. hispida L.
Garcinia indica Choisy
Gardenia gummifera L. f.
Gmelina arborea Roxb.
Grewia tiliifolia Vahl
Haldina cordifolia (Roxb.) Ridsdale
Hardwickia binata Roxb.
Holoptelea integrifolia (Roxb.) Planch.
Hopea parvifolia (Ward.) Van Slooten.
H. wightiana Miq. ex Dyer.
Hydnocarpus laurifolius (Dennst) Sleum.
Kydia calycina Roxb.
Lagerstroemia microcarpa Hance.
L. parviflora Roxb.
L. speciosa (L.) Pers.
Mallotus philippensis (Lam.) Muell.-Arg.
Mangifera indica L.
Melia dubia Cav.
Michelia champaka L.
Mimusops elengi L.
Mitragyna parvifolia (Roxb.) Korth.
Persea macrantha (Nees) Kosterm.
Pterocarpus marsupium Roxb.
Santalum album L.
Sapindus emarginatus Hort. Alger.
Schleichera oleosa (Lour.) Oken
Semecarpus anacardium L. f.
Spondias pinnata (L. f.) Kurz
Sterculia villosa Roxb.
Syzygium cumini (L.) S. Keels
Tamarindus indica L.
Tectonal grandis L. f.
Terminalia alata Heyne ex Roth
T. arjuna (Roxb. ex D.C.) Wight
T. bellirica (Gartn.) Roxb.
T. chebula Retz.
T. paniculata Roth
Trema orientalis (L.) Blume
Vitex altissima L. f.
V. negundo L.
Wrightia tinctoria R. Br.
Xeromphis spinosa (Thunb.) Keay
Xylia xylocarpa Taub.
Ziziphus mauritiana Lam.
Z. xylopyrus (Retz.) Willd.

OTHER PLANTS

Abrus precatorius L.
Abutilon indicum (L.) Sweet
Acacia caesia (L.) Willd.
A. sinuata (Lour.) Merr.
Argyreia thomsonii Craib.
Bambusa bambos (L.) Voss
Calotropis gigantea (L.) R. Br.
Calycopteris floribunda Lam.
Canthium parviflorum Baill
Cordia dichotoma Forst.
C. macleodii Hook. f. & Thoms.
Curcuma longa L.
Cymbopogon citratus Stapf
Dendrocalamus strictus (Roxb.) Nees
Entada phaseoloides Merr.
Helicteres isora L.
Hemidesmus indicus (L.) R. Br.
Holarrhena pubescens (Buch. Ham.) Wall. ex G.Don.
Imperata cylindrica (L.) Raeusch.
Ixora arborea Lodd.
Lantana camara L.
Leucas aspera Link.
Ocimum sanctum L.
Zingiber officinale Rosc.
Ziziphus oenoplia (L.) Mill.

Ariopsis peltata *Courtesy :* S. Punekar

Ariopsis peltata *Courtesy :* S. Punekar



Map of Bhadra Tiger Reserve

Arisaema caudatum Courtesy : S. Punekar

Arisaema tortuosum Courtesy : S. Punekar

SALIENT FEATURES

Area

Core	:	276.66 sq km
Buffer	:	175.03 sq km
Total	:	451.69 sq km
Longitude	:	75-15' and 75-50' E
Altitude	:	750 m to 2100 m
Rainfall	:	1200 mm to 2600 mm

Temperature

Minimum	:	10° C in winter
Maximum	:	32° C in summer

Seasons

Winter - November to January
Summer - February to May
Monsoon - May to October

HIGHWAYS

No highway

TOURISM

Muthodi is serene, picturesque and beautiful moist deciduous forest patch with lush green vegetation of Bamboo and tree species all round the year and it is situated in the valley of Jagara. The visit does not disappoint the tourists even when the animals expected are not sighted.

Tourists all over the country even foreigners are visiting Project tiger Reserve and Nature Camps in Muthodi and B.R.P. and the total turn over is around 1000 tourists visit the reserve.

The Sanctuary is well connected to important cities like Chikmagalur, Shimoga, Tarikere and Bhadravathi by road and rail.

Main Attraction

Great Indian Gaur, Barking Deer.

BHADRA TIGER RESERVES-REACHING THERE

By Air

Mangalore is the nearest airport.

By Rail

The nearest rail-head is at Mangalore.

By Road

The road distance of the major cities: Bangalore 257 kms, Chikmaglur 251 kms, and Hassan 187 kms.

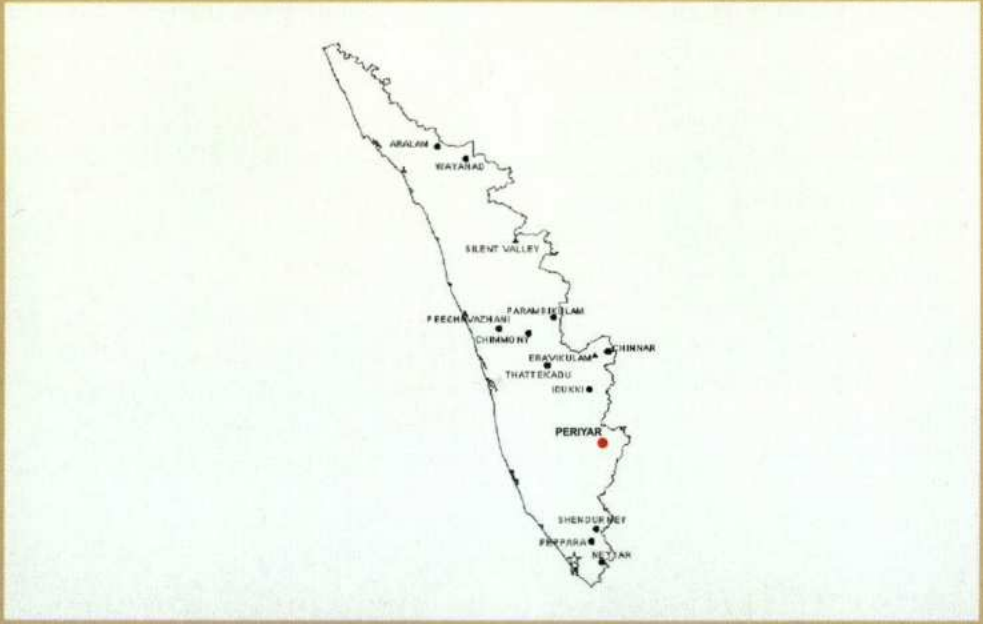
Amorphophallus bulbifer
(Courtesy : S. Punekar)

Pothos scandens
(Courtesy : S. Punekar)

KERALA

A view of Mullaperiyar Dam

Periyar Tiger Reserve



Periyar Tiger Reserve

M Mohanan & GVS Murthy
Botanical Survey of India, Southern Circle, Coimbatore-641003

Periyar is one of the tiger reserves established in Kerala in 1978 under the 'Project Tiger' of the Govt. of India. (Singh & Singh, 2002). One of the largest and most ambitious single species conservation projects launched on 1st April 1973 in the country' this project aims at preserving and maintaining a viable population of tigers and their localities as national heritage for the benefit of posterity. Although this project initially helped immensely in increasing the tiger population from 34 in 1974 to 44 in 1984 and to 45 by 1989, a sharp decline in the number of tigers to 33 in 1993 raises reasonable doubts about the viability of this project. A recent estimate has only 29 tigers. Waller (1973) in a report submitted to the IUCN and WWF in Nov. 1970 even states, "it is questionable whether any tiger remains there but Periyar could be a perfect situation for re-introduction of this species". He further adds, "this is the largest of all Indian parks or sanctuaries and approaches nearest to the requirements of a true national park".

The importance of this area as an ideal game sanctuary and tourist center was first recognized by the Maharaja of Travancore, Shri Chithira Thirunal as early as in 1734 and he declared it a game sanctuary viz. 'Nellikkampatty'. This was later developed into a wildlife sanctuary in 1952 and to a national park on 27 Oct. 1982. The best game sanctuary in the state to see nature in her virginal beauty, this park attracts a large number of both inland and foreign tourist daily. Waller (1973) observes " this is one of the most splendid sanctuaries in India both scenically with its combination of lakes, grasslands and forests and zoologically as a viable eco-unit. It holds the greatest potential of all India's sanctuaries for a future national park." Periyar is also brought under Project Elephant making it the 10th such reserve.

LOCATION

The reserve lies surrounding the 26 km^2 Periyar reservoir near Kumili in Idukki District of Kerala, between lat. 9° 16' to 9° 37' N and long. 76° 56' to 77° 25' E. The total area is about 777 km^2. It is bordered on the east by Madurai and Tirunelveli Districts of Tamil Nadu, west by Kottayam District and south by Pathanamthitta District. The park has its headquarters at Thekkady.

TOPOGRAPHY

The Periyar tiger reserve is situated at an elevated plateau the Periyar Plateau slanting towards west in Anamalai-Palni block of the Southern Western Ghats. The eastern part of this plateau is the Elamalai or Cardamom hills popularly known as the High Ranges. The area comprises undulating hilly terrain with the elevation ranging from 150 m at Pamba valley to over 2000 m and is covered by dense forests. The mountainous plateau above 1400 m is a vast table land and presents a panoramic view of greenery covered by grasslands. There are many peaks conspicuous by their heights and varied configuration presenting a grant and imposing spectacle. Some of the loftier hills in the area are Vellimala (2016 m), the highest peak, Kottamala, Sundaramala, Chokkampattimala, Karimala, Pachayarmala etc.

The artificial lake extending to 26 km^2 with a maximum depth of 46 m has numerous creaks and surrounding hills with wild forests and cloud-clapped peaks with sweeping grasslands presenting an enthralling scene for the visitors. It is not one vast

Entrance of Periyar Tiger Reserve

expense of open water but a series of long channels radiating up to narrow valleys through the surrounding hills (Croix, 1960). The reservoir is formed by the construction of a dam across the river 'Mullaperiyar' in 1895. This river is formed by the union of Periyar originating at Chokkampattimala near Sivagiri and the Mullayar originating at Vellimala at Mullakkudy. The reserve has a considerable number of wildlife including elephants, gaur, sambar etc. (Gee, 1952). The area encircling the reservoir constituting the national park is drained by the Periyar and its tributaries viz. Mullayar, Perumthurayar, Chiruthoni, Chittar, Perinjankuttiyar, Muthirapuzha, Pooyamkutty, Churakottayar, and the innumerable streams forming a river system along their course. The western part of the reservoir is drained by river Pamba and Azhutha forming its boundary.

The Mullaperiyar project was initially meant for irrigation of a vast tract of barren lands in the plains of Tamil Nadu by diverting its water through another river Vaigai taking its origin in these hills and flowing eastwards. Subsequently this has been converted into a hydro-electric project.

GEOLOGY

Most parts of this sanctuary are covered by pre-cambrain archean crystalline hard rocks. They are essentially Gneisses and Schists. Gneiss is a grey or white, coarse or medium grained light felspathic rock usually containing garnet and biotite and occasionally flakes of graphite in varying proportions. In some places it may also contain pegmatite and quartz. Cordierite bearing rocks have also been recorded from this area.

The gneiss bed of Periyar basin and neighborhood passes gradually into charnockites which are grey or bluish-black containing hypersathne, quartz, feldspar and granites. Gneiss is often traversed by dykes of varied composition. Norite, a green dyke boarded on either sides by gneiss is very common in Periyar along with xenoliths with thin veins of quartz. Gabbro dykes which is usually grey is also reported from the area. Residual laterite, a peculiar ferruginous material which is porous, pitted and clay-like rock with red, yellow and grey colour is found in circular or elliptical patches as a covering over the flat-topped ridges and hillocks. Magnatite and ilmenite are also found in the Periyar river sands.

Soil

Soil of the uplands which is generally developed from the bed rocks is relatively shallow, poor and rocky while those of the lowlands which is developed from the alluvial materials brought down from the uplands is deep, fine-textured and fertile. The hill tops of the sanctuary are mostly covered by laterite soil which is derived from rocks rich in aluminium such as gneiss, granites etc. It is generally reddish or yellowish, gravelly on the top and mixed with iron beneath. It is rich in nitrogen but poor in phosphorus and calcium due to heavy leaching.

The hills may also contain forest soil (medium black soil) derived by the decomposition of trap rocks. It is highly fertile and contains more quantities of lime, magnesia, potash and aluminium but is poor in nitrogen and other organic matter. Red soil is found in lower elevations. It is derived from crystalline metamorphic rocks. When get mixed with other types it forms sandy and clayey loam. This is the most prominent soil in the lower elevations. Alluvial soil is common in low-lying marshy areas and along the banks of rivers. This is also highly fertile.

CLIMATE

The area enjoys a tropical warm-humid climate. It is generally moderate for most part of the year except for a very little variation in temperature in the summer months from March to May. Summer is followed by SW monsoon, which continues till the end of September. October and November forms the post-monsoon (autumn). The NE monsoon follows and extends up to February with less rain after December. This coincides with winter also.

The temperature varies depending on the elevations and is usually between 7. 2°C in the hill top and 32°C in the lower elevations in winter. Warmest months are February to May.

Owing to its location on the edge of escarpment facing Arabian Sea, the area receives the maximum rainfall from SW monsoon from June to Sept. The retreating NE monsoon brings showers from Oct. to Nov. The annual rainfall varies from 699 cm in the western region to less than 152 cm in the eastern region. The average annual rainfall is about 172 cm.

The atmosphere remains humid almost throughout the year, more so during SW monsoon. Relative humidity varies from 70 to 90 percent.

REVIEW OF EARLIER WORK

Although there are many references to this part of Kerala in ancient literature, the first reference specific to Periyar and 'Kuzhumur' (now identified as Kumili) seems to be the one in sangam literature (Ahananuru and Purananuru) of the first seven centuries of Christian era (Chaitanya, 1994). A comprehensive account on the geographical and topographical aspects of the area besides socio-economic and political aspects are found in the monumental work. " The memoir of the surveys of Travancore and Cochin" (1863) by the British surveyors, Lieutenants Benjamin Swain Ward (1786-1835) and Peter Eyre Corner (1794-1821).

A perusal of literature and herbarium collections reveals that the flora of this reserve received little attention although earlier workers did many sporadic collections in the area while they were concentrating on the floristically richer areas like Peermade, Devikulam, Anamudi etc. Vivekananthan (1981) records that the first botanical collection from the district (Idukki) was made in 1882 by Beddome in Peermade and adjacent Anamudi. Barnes (1908), a pioneer in recognizing the tremendous botanical wealth of the High Ranges also made few collections in the area. Other notable plant collectors in this area include, Meebold, Lawson and Anstead. Jacob collected grasses besides some other plants. But it was Bourdillon, the first conservator of forests of Travancore who first attempted to prepare a detailed 'report' on the trees of this area in 1893 after an extensive survey from 1871. This was later consolidated into a book 'Forest Trees of Travancore' (1908). This work was continued by his successor Rama Rao (1914), with the help of Vencoba Rao who was also a devoted collector who contributed significantly by collecting plants and also obtaining comments on the medicinal aspects of plants from a local 'Vaidyan' (Ayurvedic Physician).

Sambhar dear grazing near Thekkady lake

Gee (1952) and Croix (1960) have provided a vivid description of the artificial lake and surrounding hills besides wildlife on a tourists perspective where as Waller (1973) gave a splendid account on the vegetation, flora and fauna in his report submitted to IUCN and WWF in 1970. Spillet (1968) and Sankhala (1970) have also enriched the knowledge on this park while Saharia (1982), Krishnamurthy (1980), Bedi & Bedi (1984) and Kothari & al. (1981) have provided the salient features of the national parks & sanctuaries in general. Krishnamurthy (1960) and Chandrasekharan (1962) have classified the forests of this region while Karunakaran (1975) described the vegetation for the working plan of Kottayam District. Although Vivekananthan (1980) concentrated more on the Anamudi-Devikulam area, he has also made remarkable contribution on the flora of this reserve besides collecting a new *Cassia* (Sharma & al., 1998) and *Gomphostemma* (Vivekananthan & Gopalan, 1984). Menon and Pillai (1991) studied the vegetation changes of the area using land sat imageries for about 10 years from 1973 and noted major special and temporal changes in habitat.

Despite all the efforts mentioned above, this area remained under explored till 1998 when Sasidharan made an intensive study on the flora. He with his co-workers (Jomy & al., 1994, 1998, 1999, 1999a; Rajesh & al., 1996, 1997, 1997a; Sasidharan & al., 1997, 1998, 1999, 1999a, 2001) has made significant effort that resulted in the discovery of several new and interesting taxa. Krishnankutty (2002) studied the fuel wood consumption pattern in the reserve and suggested alternatives in reducing its negative impact on the flora of the sanctuary.

The varied and rich wildlife in the area was studied by Krishnan (1971), Vijayan (1980), Vijayakumaran Nair & Balasubramaniyam (1985), Nair & al. (1985, 1986), Jafer & al. (1997), Arun (1999), Arun & al. (1996), Ramachandran (1984, 1985, 1986), Ramachandran & al. (1986, 1987) and Easa (2001, 2002).

VEGETATION

The warm-humid climate, the perennial water source from Periyar, its tributaries and numerous other streams and the highly fertile soil are the major environmental factors that contributed to the

establishment of a very complex and rich flora (and fauna) in this reserve. This tremendous biodiversity has been preserved without much alteration ever since the area was declared a game sanctuary. The vegetation of this area is essentially similar to that of the entire Southern Western Ghats but for some difference in the floristic constituents and forms a part of the megadiversity region. These forests have been classified by various workers since 19th century. Of the recent ones, that of Chandrasekharan (1962, 1973) is very exhaustive. According to this classification, the forests of this region falls under three major categories namely: a) Tropical wet evergreen forests with three climax types, five secondary types and an edaphic type; b) Tropical moist deciduous forests with one climax type and two secondary types and c.) Montane subtropical forests with a single climax type. As per Champion & Seth's (1968) classification, the types of vegetation found here are: Southern tropical evergreen forests with two types; Southern tropical semi evergreen forests with one type; South Indian moist deciduous forests having three categories, a single type of Tropical fresh water swamp forests and two types of Southern subtropical broad-leaved hill forests. Vijayan (1980) classified the area into six types with total area covered by each type and percentage as follows: West coast tropical evergreen forest (305 km^2 / 41.51%) West coast semi evergreen forests (275 km^2 / 37.11%), southern secondary moist mixed deciduous forests (98 km^2 / 13.22%); South Indian subtropical hill Savannah (12 km^2 / 1.62%); Reed brakes (10 km^2 / 1.34%) and Eucalyptus plantations (41 km^2 / 5.53%). The fact that about 78% of the total area is occupied by the evergreen and semi evergreen vegetation types clearly indicates that the flora of this area is very rich and varied. The types of forests and association found in this area according to the biogeographic analysis of Gadgil and Meher Homji (1982) are :1. Wet evergreen forests of west coast Western Ghats with *Cullenia, Mesua, Palaquium* in the major parts of the area and shola type with *Elaeocarpus serratus, Gordonia obtusa, Meliosma simplicifolia, Schefflera stellata* type towards the high ranges. 2. Wet evergreen teak ecotone with *Tectona Lagerstroemia, Dillenia , Terminalia* type in the lower elevations. The classification of the Periyar tiger reserve that follows is essentially that of Champion and Seth (1968) with little modification in terminology. (Mohanan & Nair, 1999; Mohanan & Daniel, 2005)

I. Tropical moist forests
   1. Tropical wet evergreen forests
      i. West coast tropical evergreen forests
      ii. Southern hill-top tropical evergreen forests
   2. Tropical semi evergreen forests
      i. West coast semi evergreen forests
   3. Tropical moist deciduous forests
      i. Southern moist mixed deciduous forests
      ii. Southern secondary moist mixed deciduous forests
      iii. Moist teak forests
      iv. Wet bamboo brakes
   4. Tropical fresh water swamps
      i. Tropical riverine forests.

II. Subtropical montane forests
   1. Southern subtropical hill forests

III. Montane temperate forests
   1. Southern montane wet temperate forests
   2. Southern montane wet grasslands.

West coast tropical evergreen forests: Unique by their closed canopies with a dark, gloomy, sombre appearance, these lofty and dense forests presents a complex structure remarkable by the multiplicity of species in various synusiae viz. trees, shrubs, herbs, lianas, stragglers and epiphytes. These are multistoreyed forests often with emergent trees of over 60 m high and are confined to areas between 200 1500 m. Such forests occur in eastern side of the national park at Mangaladevi, Koruthode, Sabarimala and Pookavanam. The major association found in this type is *Cullenia-Mesua-Palaquium* type.

Other types met with here are *Hopea-Dipterocarpus-Vateria and Polyalthia-Myristica-Calophyllum.*

The top canopy is formed of trees like *Antiaris, toxicaria, Artocarpus hirsuta, Bhesa indica, Bischofia javanica, Calophyllum apetalum, C. polyanthum, Canarium strictum, Cullenia exariallata, Diospyros buxifolia, Dimocarpus longan, Dipterocarpus indicus, D. bourdillonii, Dysoxylum malabaricum, Elaeocarpus tuberculatus, Garcinia xanthochymus, Holigarna arnottiana, H. grahamii, Hopea parviflora, H. glabra, Kingiodendron pinnatum, Lophopetalum wightianum, Mangifera indica, Mesua ferrea, Myristica dactyloides, Palaquium ellipticum, Polyalthea coffeoides, Pterygota alata, Syzygium gardneri, Tetrameles nudiflora* and *Vateria indica.*

The second storey has medium sized trees usually tolerant to partial shade like *Actinodaphne bourdillonii, Aglaia barberi, A. lawii, Aphanamixis polystachya, Aporusa lindleyana, Baccaurea courtallensis, Canthium dicoccum, Carallia brachiata, Diospyros bourdillonii, D. candolleana, D. paniculata, Drypetes alata, D. malabarica, Elaeocarpus glandulosus, E. serratus, Garcinia spicata, G. morella, Humboldtia vahliana, Hydnocarpus pentandra, Knema attenuata, Litsea coriacea, Semicarpus auriculata, S. travancorica, Otonephelium stipulaceum,* etc.

The third storey may have small trees and large shrubs such as *Aphanamixis polystachya, Achronychia pedunculata, Agrostistachys indica, Antidesma menasu, Atalantia wightii, Canthium angustifolium, Clausena indica, Chionanthus malabarica, Elaeocarpus munronii, Euonymus indica, Flacourtia montana, Goniothalamus rhyncantherus, Grewia flavescense, Ixora nigricans, Isonandra lanceolata, Leea indica, Meiogyne pannosa, M. ramarowii, Orophea uniflora, Pavetta hispidula, Tabernaemontana gamblei,* etc.

The fourth storey posseses shrubs, undershrubs and herbs such as *Alpinia galanga, Amomum muricatum, Begonia malabarica, Barleria courtallica, Costus speciosus, Curcuma nielgherrensis, Elatostema lineolatum, Glycosmis macrocarpa, Ixora coccinea, Murdannia nudiflora, Molineria trichocarpa, Neanotis monosperma, Strobilanthes heyneanus, S. wareensis, Ophiorrhiza brunonis, Orophea zeylanica, Pavetta calophylla, Psychotria congesta, Saprosma corymbosum, Sarcandra chloranthoides, Schumanianthus virgatus, Zingiber macrostachyum,* etc.

Common climbers are *Adenia hondala, Ancistrocladus heyneanus, Argyreia hirsuta, Aristolochia indica, Artabotrys zeylanicus, Butea parviflora, Calamus huegelianus, Clematis gouriana, Combretum ovalifolium, Desmos lawii, Dioscorea oppositifolia, Entada rheedii, Erycibe paniculata, Erythropalum scandens, Gnetum edule, Sarcostigma kleinii, Senecio walkeri, Strychnos colubrina, Tetracera akara, Uvaria narum,* etc.

Saprophytic ground orchids are *Epipogium roseum, Zeuxine gracilis, Z. longilabris,* etc. The common ground orchids are *Calanthe masuca, Eulophia epidendrea, Habenaria crinifera, Geodorum densiflorum, Peristylus goodyeroides, Nervilia aragona,* etc. The common root parasites are *Aeginetia indica, A. pedunculata, Christisonia bicolor,* etc.

The steep valleys are generally occupied by the gregarious palms like *Arenga wightii, Pinanaga dicksoni* and gigantic ferns such as *Angiopteris erecta, Marattia fraxinea* and *Cyathea gigantia.* The semi-parasites that are common include *Dendrophthoe falcata, Helicanthus elastica, Helixanthera intermedia, Macrosolen parasiticus, Taxillus tomentosus* and *Viscum orientale.* More common among epiphytes belong to the orchid genera *Bulbophyllum, Coelogyne, Dendrobium, Eria, Oberonia,* etc. and species of pteridophytes belonging to the genera *Pyrrosia, Drynaria,* etc.

Southern hill-top tropical evergreen forests: This type is generally found along valleys surrounding ridges between 1200 m to 1700 m. Trees are shorter with fuller, rounded crowns. A transitional stage from tropical to subtropical type these forests occur in south of Mlappara, east of Mullakkudy, and Thannikkudy. The association found in Mullakkudy and Thannikkudy are *Dysoxylum-Palaquium-Cullenia* type (Sasidharan, 1998). The top canopy in this type is dominated by *Acrocarpus fraxinifolius,*

Calophyllum austro-indicum, Cassine paniculata, Cullenia exarillata, Dysoxylum binectariferum, Elaeocarpus tuberculatus, Ficus arnottiana, Glochidion ellipticum, Gordonia obtusa, Holigarna arnottiana, Mesua ferra, Litsea oleoides, Meliosma pinnata var. *arnottiana, Persea macrantha, Palaquium ellipticum, Syzygium gardneri,* etc.

The second storey consists of younger forms of the upper storey and *Alseodaphne semicarpifolia, Agrostistachys borneensis, Casearia ovata, Chionanthus ramiflorus, Cinnamomum* spp., *Coffea crassifolia, Diospyros ovalifolia, Drypetes wightii, Elaeocarpus glandulosus, Lepisanthes tetraphylla, Hydnocarpus alpina, Scolopia crenata,* etc.

The third storey is formed of small trees and large shrubs much as *Achronychia pedunculata, Aglaia simplicifolia, A. tomentosa, Ardisia pauciflora, Clausena austro-indica, Erythroxylum monogynum, Goniothalamus wightii, Meliosma simplicifolia, Microtropis stocksi, Meiogyne pannosa, Tarenna canarica,* and *Wendlandia bicuspidata.*

The ground is covered by herbs and shrubs like *Amomum muricatum, Asystasia dalzelliana, Euonymus crenulatus, Diotacanthus grandis, Dichapetalum gelonoides, Dendrocnide sinuata, Gomphandra coriacea, Strobilanthes heyneanus, S. foliosus, S. wareensis, Oreocnide integrifolia, Pavetta* spp., *Phaulopsis imbricata, Plectranthus wightii, Pogostemon paniculatus, Psychotria flavida, Taberaemontana gamblei,* etc.

Mlappara and Aladi-Chokkampatti hills are with a different association, *Cullenia-Mesua-Acrocarpus,* the top canopy of which has *Acrocarpus fraxinifolius, Canarium strictum, Cullenia exarillata, Mesua ferrea, Elaeocarpus tuberculatus, Myristica dactyloides, Syzygium hemisphericum* and *S. zeylanicum.*

The middle storey is not much different from the previous type but may also have *Dysoxylum beddomei,* and *Gordonia obtusa.* Similarly the lower canopy has *Aporusa filiforme, Litsea ligustrina* and *Diospyros ovalifolia.* Additional elements in the ground floor apart from the previous type are: *Octotropis*

Tabernaemontana atternifolia - An endemic to W. Ghats

travancorica, Saprosma foetida, Exoecaria robusta, etc. The unique feature of this area is the presence of a viable population of *Nageia wallichiana,* the only indegineous south Indian conifer (Sasidharan, 1998).

The common climbers in these forests are *Embelia ribes, Elaeagnus conferta, Jasminum cordifolium, Milletia rubiginosa, Mucuna hirsuta, Vigna dalzelliana,* etc.

West coast semi-evergreen forests : This type is generally found along banks of rivers and streams adjoining the evergreen forests and is common in Thekkady, Swamikkayam and Vallakkadavu. An intermediate form between evergreen and deciduous types, these forests also shows stratification though not as well marked as in the evergreens. It extends to over 190 km^2 area of the reserve.

Dominant elements of the first storey are *Actinodaphne bourdillonii, Ailanthus triphysa, Alstonia scholaris, Artocarpus heterphyllus, A. hirsutus, Bischofia javanica, Buchanania lanceolata, Calophyllum inophyllum, Carallia brachiata, Chukrasia ciliata, Elaeocarpus tuberculatus, Ficus drupacea, F. nervosa, F. virens, Grewia tiliifolia, Holigarna arnottiana, Hopea parviflora, H. ponga, Hydnocarpus pentandra, H. alpina, Ixora brachiata, Knema attenuata, Lagerstroemia speciosa, Litsea oleoides, L. glabrata, Madhuca neriifolia, Mangifera indica, Myristica dactyloides, Syzygium hemisphericum, S. gardneri, Tetrameles nudiflora, Terminalia bellirica, Toona ciliata,* etc.

The middle layer is composed of *Agrostistachys borneensis, Aporusa lindleyana, Cinnamomum verum, Chionanthus mala-elengi, Croton malabaricus, Dimocarpus longan, Diospyros ovalifolia, D. candolleana, Harpullia arborea, Mastixia arborea* var. *meziana, Otonephelium stipulaceum, Phoebe lanceolata, Pterospermum reticulatum, Viburnum punctatum, Vitex altissima,* etc.

More common plants in the lower storey are *Aidia gardneri, Archedendron monadelphum, Clausena indica, Croton laccifer, Ixora brachiata, Memecylon edule, M. talbotianum, Syzygium mundagam,* etc.

Compared to the evergreen type ground in these forests are better covered by herbs and grasses. They are *Centotheca latifolia, Costus speciosus, Crotalaria* spp., *Curcuma* spp., *Strobilathes* spp., etc. *Major climbers are Acacia pennata, Calycopteris floribunda, Combretum latifolium, Elaeagnus indica, Entada rheedii, Gnetum edule, Reissantia indica,* etc.,

Tropical moist deciduous forests: The two types of deciduous forests viz. Southern moist mixed deciduous forests and Southern secondary moist mixed deciduous forests are considered here together as there are little differences in the floristic composition except for the degree of degradation. Covering an area of over 100 km^2 in the reserve in lower elevations (250-350 m) at Mullakkudy, Edappalayam, Pambavalley and Methaganam, these forests have a mixed composition with a few evergreen trees also. The chief association found in this type is *Tectona-Dillenia-Lagerstroemia/ lanceolata/Terminalia paniculata* series (Gadgil & Meher Homji, 1986). The conopy is rather open although two to three stroyes may be discernable.

The dominant trees in the top canopy are *Albizia amara, Achronychia pedunculata, Actinodaphne malabaricum, Alstonia scholaris, Anogeissus latifolia, Bombax ceiba, Chukrasia tabularis, Dalbergia latifolia, D. sissoides, Diospyros montana, Grewia tiliifolia, Haldinia cordifolia, Hymenodictyon orixense, Lagerstroemia microcarpa, Pterocarpus marsupium, Terminalia paniculata, T. crenulata, Tetrameles nudiflora, Sterospermum colais, Sterculia villosa, Tectona grandis* and *Xylia xylocarpa.*

In the middle layer smaller trees like *Bridelia retusa, Buchanania lanzan, Butea monosperma, Careya arborea, Catunaregam spinosum, Clausena dentata, Ficus hispida, Glochidion ellipticum, G. tomentosum, Macaranga peltata, Phyllanthus emblica, Sterculia foetida, S. guttata, Wrightia arborea,* etc. are common.

The lower layer has *Abelmoschus moschatus, Allophylus cobbe, Chrmolaena odorata, Clerodendrum viscosum, Desmodium pulchellum, D. triangulare, Ecbolium viride, Flemingia strobilifera, Glycosmis pentaphylla, Helecteres isora, Ixora malabarica,*

Lantana camara, Pavetta tomentosa, Solanum torvum, S. anguivi, members of the families Acanthaceae, Orchidaceae and ferns. Common climbers are *Acacia pennata, A. torta, Butea parviflora, Cynachum callialatum, Capparis rheedii, Combretum albidum, Connarus wightii, Dalbergia horrida, Dioscorea* spp. *Tiliacora acuminata, Naravelia zeylanica,* etc. The floor of the forests are covered with grasses.

Moist teak forests: These are found in lower elevations receiving an annual rainfall of over 2000 mm. Besides teak these forests may also have *Albizia odoratissima, Anogeissus latifolia, Bombax ceiba, Butea monosperma, Careya arborea, Cassia fistula, Dalbergia latifolia, Holarrhena pubescens, Kydia calycina, Lagerstroemia microcarpa, Mallotus philippensis, Mitragyna parviflora, Pterocarpus marsupium,* etc. the floor is covered by grasses of the genera *Themeda* and *Cymbopogon*. Many small herbs are also present.

Wet bamboo brakes (reed brakes): Vijayan (1980) recorded that about 10 km^2 of the area in the park is covered by reeds. Reed brakes are found along Periyar river at Melmala, Manikkamala and Odamala. Such forests occur in places wherever there is a break in the canopy. Common reeds are *Ochlandra travancorica, Pseudoxytenanthera monadelpha* and *P. bourdillonii*.

Tropical riverine forests : Periyar and its major tributaries together form a specialized habitat for a plant community remarkably similar in appearance but with different taxonomic affinity. Components of this community are *Agrostistachys borneensis, Calophyllum apetalum, Glochidion javanicum, Garcinia wightii, Holigarna arnottiana, Homonoia riparia, Humboldtia vahliana, Hydnocarpus alpina, H. pentandra, Lagerstroemia reginae, Lophopetalum wightianum, Neolamarckia cadamba, Rapanea wightiana, Prunus ceylanica, Syzygium heyneanum, S. malabaricum, Cyperus pangoeri, Polygonum* spp., etc.

Southern sub-tropical hill forests : This type occurs generally on plateaus in the upper reaches of mountains between 1000 and 1800 m. These are "miniature shoals" which are considered to be a transitional stage between wet evergreen and temperate shola forests. Stratification in this type is not clearly marked. Thanmikkudy, Edappalayam, Manakarala and Kavakppara are areas where this type is prevalent. The dominant trees in this type are *Bischofia javanica, Callicarpa tomentosa, Gordonia obtusa, Maesa indica, Neolitsea cassia, Persea macrantha,* etc. The common grasses are *Arundinella ciliata, A. purpurea, Cymbopogon citratus, Eulalia trispicata, Ischaemum timorense, Panicum* spp., etc. The common shrubs are *Desmodium pulchellum, Vernonia divergens, Pogostemon purpurascens,* etc.

Southern montane wet temperate forests (Sholas): Unique by their distinct features, these are small isolated compact and sharply defined woodlands scattered amidst vast stretches of grasslands above 1500 m in Vellimala, Kottamala, Uppermanalar, Pachayarmala, Sunderamala, Chokkampattimala, Mangal**ad**evi and Kalvarimala. This type is characterized by stunted trees with short boles, dense entire and rounded crowns with coriaceaous leaves and crooked and twisted branches densely clothed with lichens, mosses and other epiphytes. Stratification is not clear in this type, but two well-marked storeys are discernable.

The dominant trees in the top storey are *Actinodaphne campanulata, Alseodaphne semicarpifolia, Bhesa indica, Callicarpa tomentosa, Casearia* spp., *Cinnamomum wightii, C. perotteti, Cryptocarya stocksii, Elaeocarpus tuberculatus, Eugenia discifera, Garcinia cowa, Glochidion neilgherrense, Gordonia obtusa, Litsea wightiana, Microtropis ramiflora, Neolitsea fischeri, Phoebe wightii, Rapanea capitellata, Rhododendron arboreum, Syzygium parameswaranii, Ternstroemia japonica, Vernonia arborea, V. travancorica, Xantolis tomentosa.,* etc.

The second storey is with smaller trees like *Actinodaphne salicina, Gomphandra coriacea, Ixora notoniana, Ligustrum roxburghii, Pittosporum tetraspermun, Schefflera capitata, Rapanea wightiana, Symplocos* spp. and *Wendlandia notoniana.*

Bamboo brakes near Thekkady

The ground layer may have shrubs and herbs such as *Anotis monosperma, Canthium neilgherrense, Elatostema lineolatum, Hedyotis stylosa, Impatiens* spp. *Maesa indica, Mallotus muricatus, Symplocos pulchera, S. macrophylla, S. monantha, Rauvolfia verticillata, Strobilanthes anceps, S. foliosa, S. luridus,* etc. Climbers are *Clematis wightiana, Elaeagnus conferta, Rubia cordifolia, Rubus racemosus, Schefflera venulosa, Senecio* spp., etc. Epiphytes are abundant, more common are orchids like *Aerides ringens, Bulbophyllum tremulum, Coelogyne odoratissima, Dendrobium herbaceum, Eria dalzelli,* etc. others include *Hoya ovalifolia, Peperomia* spp. and mosses, lichens and ferns.

Southern montane wet grasslands: Often mixed with shrubs and herbs, these grasslands are very extensive covering over 57 km^2 in places such as Arjunankotta, Uppupara, Kavalappara, Mangaladevi, Kumarikulam, Palkachimala, Kathivamudi, Swamykkayam and Kalvarimala. Most part of these grasslands have already been cleared for Eucalyptus plantations. The chief communities of grasses met with in this type are (a.) *Sehima-Dicanthium* type dominated by *Heteropogon contortus, Sehima nervosum* and *Dicanthium* spp. (b.) *Cymbopogon Themeda cymbaria* type wherein *Cymbopogon flexuosus* and *Themeda cymbaria* are dominant and (c.) *Saccharum-Imperata-Phragmites* type consisting of *Phragmites karka, Saccharum spontaneum* and *Imperata cylindrica*. Other temperate grasses found here are *Agrostis schimidii, A. zenkeri and Bromus diandrus* along with species of *Exacum, Bupleurum,* etc. More common grasses here include *Apocopis mangalorensis, Arundinella mesophylla, A. purpurea, Chrysopogon zeylanicus, Dimeria lawsonii, D. thwaitesii, Eragrostis* spp., *Eulalia trispicata, Isachne kunthiana, Ischaemum commutatus, Leersia hexandra, Pseudoraphis spinensis, Themeda cymbaria, Tripogon bromoides,* intermixed with sedges like *Kyllinga cylindrica, Pycreus angulatus, Mariscus cyperinus,* etc. and shrubs and herbs like *Phoenix loureirii, Strobilanthes kunthianus, Indigofera pulchella, I. wightii, Lilium wightianum, Hypericum mysorense and Thalictrum japonicum*.

FLORISTIC DIVERSITY

The tremendous diversity in the flora of this reserve has been revealed by the explorations conducted by Sharma & al. (1998) who collected 1050 vascular taxa including new and many interesting ones and Sasidharan (1998, 2003) who extensively surveyed the area collecting 1965 flowering plants as shown below:

	No. of families	No. of genera	No. of species
Dicotyledons	128	613	1440
Monocotyledons	23	210	525
Total	151	823	1965

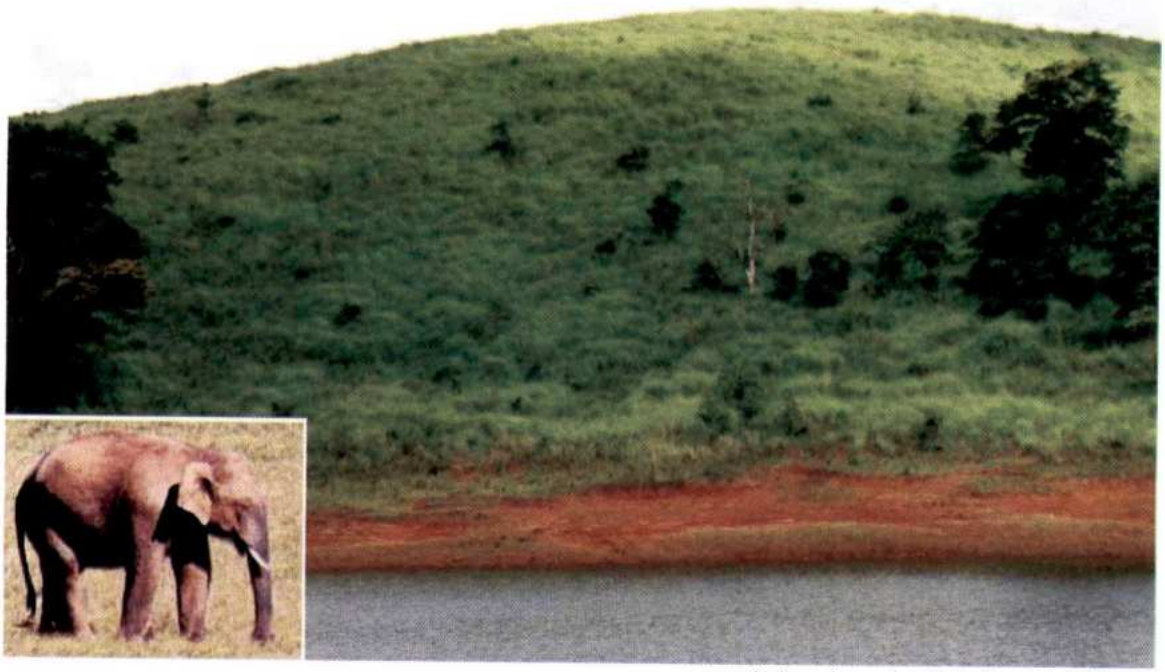
Poaceae, the largest family in India ranks first with 168 species belonging to 76 genera in 17 tribes out of the total 296 species reported from Kerala (Sreekumar & Nair, 1991). About 7% of the total area of the reserve is occupied by grasses (Asari, 1985). *Eragrostis* and *Panicum* with 9 species each are the dominant grass genera. These include six new records for Kerala and one new report for S. India *(Jomy & Sasidharan,* 1999*)*. Leguminosae the largest family in the world comes second with 155 species in 52 genera. With 148 species in 62 genera of the 216 species reported for Kerala, Orchidaceae attain maximum development in this area. This is the highest ever record of orchids from any sanctuary in Kerala (Sasidharan & Jomy, 1999) and includes 88 epiphytes and 60 terrestrials. *Oberonia* is the largest genus with 17 species followed by *Habenaria* with 15 species, *Dendrobium* with 12 species and *Bulbophyllum* with 11 species. Cyperaceae with 91 species in 15 genera take the fourth position while Rubiaceae with 90 species in 34 genera are the fifth largest family. Asteraceae occupying the six position are also well represented with 84 species in 43 genera, *Vernonia* has the largest number of species. The seventh largest family is the Euphorbiaceae with 81 species in 25 genera while Acanthaceae, the richest family in Indian region take the eighth position. *Strobilanthes* with 23 species is the second largest genus in the area. The 9th and 10th positions in the order of dominance are occupied by Lamiaceae with 47 species in 14 genera and Lauraceae with 36 species in 9 genera. 28 of the 137 dicot families and 6 of the 22 monocot families are represented by single species (Sasidharan,1998).

Diversity at generic level is also equally high. *Strobilanthes* with 23 species, *Crotalaria* with 22 species and *Desmodium* and *Cyperus* with 20 species each are the dominant genera. They are followed by *Fimbristylis* and *Ficus* (18 each), *Oberonia* (17), *Habenaria, Syzygium* and *Diospyros* (15 each), *Eriocaulon* (14), *Vernonia* and *Ipomoea* (13 each), *Phyllanthus, Litsea, Hedyotis* and *Solanum* (12 each), *Dendrobium Psychotria, Blumea* and *Bulbophyllum* (11 each), *Justicia, Cassia, Symplocos* and *Lindernia* (10 each).

There are 467 genera represented by single species. A comparision of the diversity of families, genera and species of PTR with other wild life sanctuaries / National parks is given in Table I. Similarly a comparison of the dominant families with other areas such as Nilgiris, Silent Valleys, Nilambur, Palakkad and with Indian flora is given in Table II.

ENDEMISM

A correct analysis of the endemic elements and the determination of their proportion in the flora are very useful in indicating the antiquity, isolation and diversification of a habitat. Floristic analysis of the Periyar reserve reveals that there are 515 species of plants that are endemic to the S. Western Ghats and of these 5 are exclusively confined to the reserve. This high percentage (26%) of endemism clearly indicates the antiquity of the area and diversity of the flora. Of



A view of grassland inhabited by elephants

the 58 genera endemic to Peninsular India eight are present here.

As far the endemism in familial level is concerned, *Orchidaceae* rank first with 55 endemic species followed by Rubiaceae (35), Acanthaceae (32), *Poaceae,* Fabaceae, Lauraceae, Balsaminaceae and Euphorbiaceae (25 each), Lamiaceae (19), Melastomataceae (18) and Asteraceae (11) (Sasidharan, 1998).

Very high percentage of endemism is reported at generic level also. Of the 28 species of *Impatiens* collected from the area, 26 are South Indian endemics. Similarly 18 out of the 23 species of *Strobilanthes* collected from this area are found to be endemic to South India. Nine of the 23 species of *Crotalaria,* six of the 14 species of *Syzygium,* all the eight species of *Sonerila,* 10 of the 16 species of *Litsea,* six of the eight species of *Ceropegia,* nine of the 12 species of *Hedyotis,* eleven of the 13 species of *Vernonia,* ten of the 17 species of *Oberonia,* eleven of the 15 species of *Habenaria,* nine of the 11 species of *Bulbophyllum* and eight of the 12 species of *Dendrobium* are endemic to South India (Sasidharan, 1998).

RARE AND THREATENED PLANTS

These are extinction prone species subjected to various threats. Information on such species has been scattered in various reports. A total of 460 plants of Kerala have been placed under various threats. From Periyar Tiger Reserve, 12 plants have been listed as threatened by Vivekananthan, (1978). Sasidharan (1998) collected 150 species which were placed under various threat categories by different authors including the following 17 species categorized as possibly extinct:

Anacolosa densiflora, Ardisia blatteri, Casearia rubescens, Ceropegia maculata, Coffea crassifolia, Cordia octandra, Crotalaria peduncularis, Diplocentrum congestum, Humboldtia bourdillonii, Ilex gardneriana, Nothopegia racemosa, Osbeckia aspera var. *travancorica, Smithia venkobarowii, Symplocos monantha, Syzygium bourdillonii, Taeniophyllum scaberulum* and *Vernonia multibracteata.*

Endangered plants: *Bulbophyllum aureum, Ceropegia beddomei, Dalbergia beddomei, Derris benthamii var. wightii, Dipterocarpus bourdillonii, Garcinia wightii, Impatiens leptura, I. rupicola, Isonandra stocksii, Memecylon flavescens, M. lawsonii, Mesua ferrea* ssp. *pulchella* var. *coromandeliana, Myriactis wightii* var. *bellidioides, Peucedanum anamallayense, Sageraea grandiflora, Strobilanthes jeyporensis* and *Vernonia salvifolia.*

Vulnerable plants: *Aspidopteris canarensis, Begonia albococcinea, B. trichocarpa, Bulbophyllum elegantulum, B. kaitiense, Cayratia pedata var. glabra, Desmodium ferrugineum, Didymocarpus fischeri, D. ovalifolia, Dysoxylum beddomei, Hedyotis bourdillonii, Impatiens herbicola, Ixora monticola, Lasianthus strigillosus, Medinilla malabaricum, Phaeanthus malabaricus, Piper barberi, Pogostemon travancoricus, Rotala ritchiei, Semecarpus auriculata, Sonerila speciosa, Vernonia heynei* and *V. peninsularis.*

Rare, threatened or insufficiently known plants: *Actinodaphne campanulata, Aenhenrya rotundifolia, Aglaia barberi, Allophylus concanicus, Amomum pterocarpum, Anaphyllum wightii, Andrographis explicata, Anisochilus argenteus, A. sericeus, Ardisia sonchifolia, A. stonii, Arisaema barnesii, Arthraxon lanceolatus, Belosynapsis vivipara, Bentinckia condapanna, Boesenbergia pulcherrima, Bulbophyllum fuscopupureum, Calamus brandisii, C. vattayila, Capparis fuscifera, Ceropegia metziana, C. pusilla, Crotalaria barbata, C. clarkei, C. fysonii, C. grahamiana, C. obtecta, Cyclea fissicalyx, Debregeasia ceylanica, Dendrobium haemoglossum, Desmos viridiflorus, Dictyospermum ovalifolium, Drypetes malabarica, Dysoxylum ficiforme, Elaeocarpus munronii, Embelia adnata, Epithema carnosum var. hispida, Euonymus paniculatus, E. serratifolius, Exacum anamalayanum, E. courtallense, Glochidion bourdilloni, G. johnstonei, Glycosmis macrocarpa, Goniothalamus rhyncantherus, Hedyotis anamalayana, H. swertioides, Helichrysum perlanigerum, Hoya retusa, H. wightii, Impatiens vericunda, Isachne setosa, Ixora johnsoni, Kingiodendron pinnatum, Kunstleria keralensis, Marsdenia tirunelvelica, Mycetia acuminata, Myristica malabarica, Oberonia bicornis, Octotropis travancorica, Orophea uniflora, Pavetta calophylla, Pecteilis gigantea, Plectranthus rivularis, Pothos armatus, P. thomsonianus, Premna glaberrima, Psychotria anamalayana, P. keralensis, P. macrocarpa, Pterospermum reticulatum, Rhododendron arboreum* ssp. *nilagiricum, Salacia beddomei, S. macrosperma, Schefflera bourdillonii, Semecarpus travancorica, Smilax wightii, Solenocarpus indica, Sonerila grandiflora, S. sahyadrica, Strobilanthes lawsonii, Symplocos wynaadense, S. macrophylla* ssp. *macrophylla, Syzygium benthamianum, S. mundagam, S. occidentale, Tarenna monosperma, Trichosanthes anamalaiensis, Tylophora rotundifolia* and *Vanasushava pedata.*

NEW DISTRIBUTIONAL RECORDS

New record for India: *Ficus caulocarpa,* distributed from Sri Lanka to Solomon Islands through Myanmar, Malaysia and Indonesia is collected from Periyar tiger reserve. Another species, *Ficus costata,* a typical Sri Lankan element has also been recorded from here (Sasidharan & Jomy, 1999).

New record for S. India : *Arthraxon meeboldii.*

New record for Kerala: *Acampe ochracea, Brachiaria brizantha, Dimeria mooneyi, Gastrochilus dalzellianus, Hoya retusa, Indopoa paupercula, Oropetium thomaeum, Setaria verticillata* and *Tragus biflorus.*

Other interesting plants: Rajesh & al (1997) relocated *Taeniophyllum scaberulum* from the reserve. Jomy & al (1994) recorded *Ophioglossum pendulum* for the first time from mainland of India from here, while *Arthopteris palisotii,* a little known climbing fern has been collected from the park by Rajesh & al (1997). *Symplocos monantha* which was thought to be extinct, *Syzygium myhendrae* and *Ellipanthus tomentosus* were also relocated in this area. (Sasisdharan & al, 2002).

PLANT ANIMAL RELATIONSHIP

This park is also rich in animals. Apart from Tiger (29 nos) this park also houses about 800 Elephants, 500 Gaur, 200 Sambhar, 2000 Pigs, 20 Panthers and innumerable other animals such as Nilgiri langur, wild boar, barking deer, mouse deer,

Malabar Giant Squirrel, common laugur, bonnet monkey, leopards and sloth bears besides a wealth of birds. The flora being the basic entity providing food shelter etc also depend on the fauna for pollination and dispersal. The interrelations are now being studied with a view to assessing the resource availability vis-à-vis their utilization in the reserve. For example the availability of *Bambusa bambos, Ochlandra* spp., *Phoenix loureirii* which are the main food of elephants is a main factor that controls the distribution and movements of elephants. Elephants also consume foliage and twigs of *Ardisia solancea, Costus speciosus, Ficus* spp., *Grewia abutilifolia, Helicteres isora, Phyllanthus emblica,* fruits of *Artocarpus hirsutus, Careya arborea* and *Tamilnadia uliginosa.* Gaurs feed on Grewia spp., *Desmodium triangulare, Phyllanthus emblica, Smilax zeylanica, Cassia fistula* and *Terminalia bellirica.* Sambhar prefers mostly grasses. The conservation of the flora is hence essential for the survival of these wild life also.

CONCLUSION

Presence of over 1965 species of plants including 6 new taxa and 515 endemics with 5 species exclusive to the a small area of 777 km^2 clearly indicates its potentiality as an ideal choice for the preservation of Biodiversity. Located on the crest line of the Western Ghats which is one of the world's 25 hot spots (Mittermeier & al., 1998), this reserve, as indicated by Waller (1972) forms a perfect situation for the protection of Tiger. This national park with all its beauty and diversity should be preserved for posterity.

Grasslands adjoining cultivated fields

Table - I

Comparision of No. of families/ genera / species of PTR with other wildlife sanctuaries in adjacent areas

Area	No. of species	No. of genera	No. of families	Reference
Periyar Tiger Reserve	1965	823	151	Sasidharan, 1998
Silent valley National Park	4966	559	134	KFRI, 2003 Manilal, 1998
Parambikulam Wildlife Sanctuary	1432	704	136	KFRI, 2003
Chinnar Wildlife Sanctuary	961	582	135	KFRI, 2003
Eravikulam National Park	326	216	83	KFRI, 2003
Peechi – Vazhani Wildlife Sanctuary	829	545	120	KFRI, 2003
Shendurney Wildlife Sanctuary	951	581	118	KFRI, 2003
Mudhumalai Wildlife Sanctuary	1015	539	-	Stephan, 1994
Nilgiri Biosphere Reserve	3379		174	Balakrishnan & Ansari, 1990

Table - II

Comparision of dominant families of the flora

Family	No. of genera & species in India	No. of genera & species in Nilgiri District	No. of genera & species in Silent Valley	No. of genera & species in Nilambur	No. of genera & species in Palakkad	No. of genera & species in Periyar Tiger Reserve
Poaceae	255/1225	98/192	32/56	47/76	53/81	76/168
Fabaceae	123/775	90/325	26/55	53/102	58/132	52/155
Orchidaceae	145/990	46/113	49/108	28/39	42/73	60/145
Rubiaceae	90/395	39/116	49/276	32/58	28/52	34/90
Asteraceae	161/754	61/145	25/45	32/48	28/38	43/84
Euphorbiaceae	74/419	37/93	23/38	31/65	32/61	35/81
Acanthaceae	84/379	34/104	18/31	22/55	29/59	21/70
Cyperaceae	24/449	11/87	10/22	13/50	13/48	15/91
	(Jain, 1983)	(Sharma & al, 1977)	(Manilal, 1987)	(Sivarajan & Mathew, 1997)	(Vajravelu, 1990)	(Sasidharan, 1998)

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Map of Periyar Tiger Reserve

A view of Thekkady lake

SALIENT FEATURES

Periyar Tiger Reserve with an extent of 777 km^2 lies between lat. 9°16' to 9°37' North and long. 76°56' to 77°25' East in Western Ghats in the district of Idukki of Kerala state. Total geographic area of the Reserve is 777 km^2 out of which 350 km^2 is Core and 427 km^2 is Buffer zone. It was created in 1978-79. The rerrain of which also forms the interstate boundary between Kerala and Talil Nadu. The altitude varies from 100 m to 2016 m above the mean sea level.

The Periyar lake formed on Periyar river is the nucleus of the Tiger Reserve. The average temperature in the Reserve varies from 15°C to 31°C while the average annual rainfall has been recorded as 2500 mm. There is no habitation inside the Reserve. On the Tamil Nadu side range of the Reserve there are 22 estates and on the Kerala side there are 36 village areas.

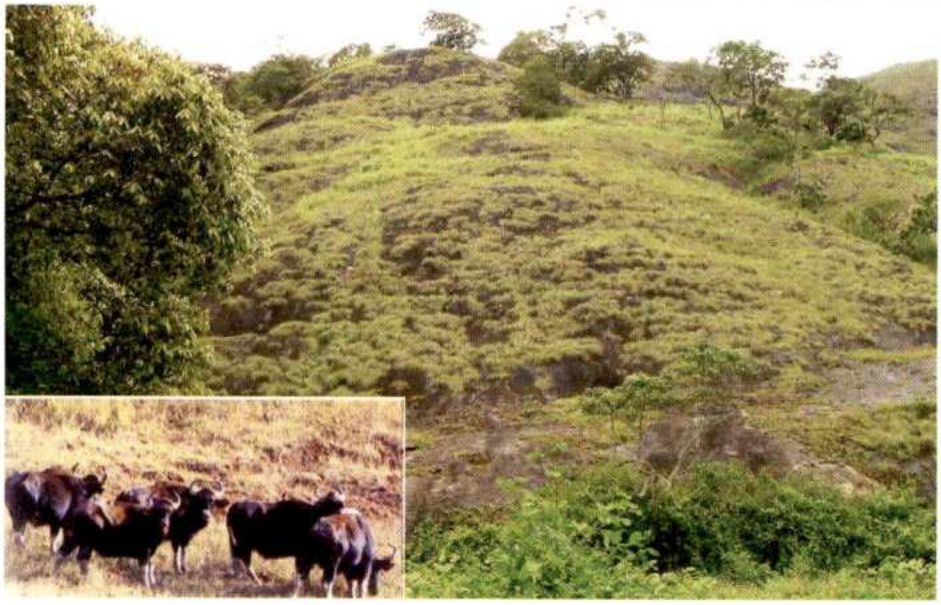
Forest Cover in Periyar Tiger Reserve (1997-2002)

(Area in km^2)

Category	Assessment year			Net Change (1997-2002)
	1997	2000	2002	
(A) Very dense Forest	174	174	174	-
(B) Moderately Dense Forest	920	920	919	-1
(C) Open Forest	405	405	404	-1
Total Forest (A+B+C)	**1,499**	**1,499**	**1,497**	**-2**
Scrub	14	14	14	-
Non-Forest	448	448	450	2
Total Area	**1,961**	**1,961**	**1,961**	

(Source : Report Forest Survey of India, 2005)

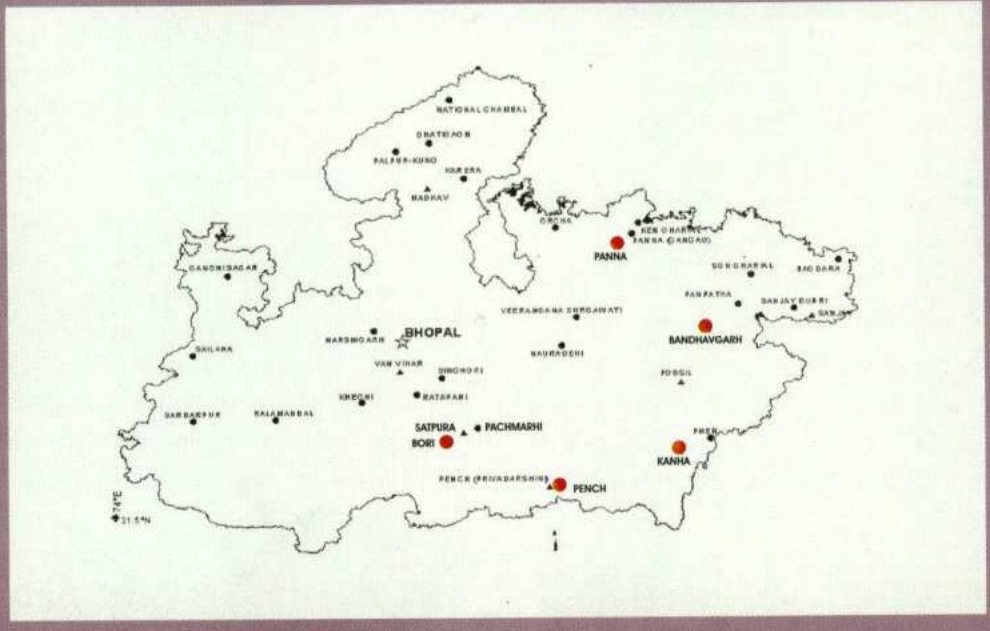
Grassland on rocky mountains



MADHYA PRADESH

Grassland in Bandhavgarh

- **Bandhavgarh Tiger Reserve**
- **Bori-Satpura Tiger Reserve**
- **Kanha Tiger Reserve**
- **Panna Tiger Reserve**
- **Pench Tiger Reserve**



Bandhavgarh Tiger Reserve

SK Srivastava
Botanical Survey of India Northern Circle, Dehradun-248 195

Biodiversity conservation in general and of tiger and other endangered species in particular have been the driving force behind the creation of Protected Areas. Bandhavgarh is historically a well-known place in the Vindhyan ranges of North-Eastern Madhya Pradesh. It had been the capital of Baghel kingdom till 1602 when it was shifted to Rewa. The title of Bandhavesh against the name of Mahraja of Rewa was deri0ved from the name of this place. Bandhavgarh is a small plateau of about 300 ha. There is an old fort situated on the main plateau surrounded by rampart constructed by walls at certain places and formed by cutting rocks. The main temple with an idol of Lord Rama is said to be one of the oldest and is believed to have been constructed in Adikal more than 3000 years ago. Legend has it that Lord Rama bequeathed the fort to his brother Laxmana, hence the name "Bandhavgarh" which means brother's fort. It is also said that Kabir Das, the famous 16th century saint had lived and composed his verses at Bandhargarh. Today, thousands of Kabir Panthi pilgrims come to Bandhavgarh to attend a function and pay homage at the temple. At the base of the fort is the monolithic statue of Lord Vishnu reclining on the seven-hooded snake, known as "Sheshsaiya". Statues of all the incarnations of Lord Vishnu can be seen in the fort area. The fort is surrounded by 32 man-made caves having inscriptions, carvings and paintings.

This area was the favourite hunting reserve of ex-rulers of Rewa state, hence it remained completely protected from poaching and illicit felling. After abolition of state, degradation of this area started. Deeply sored from the situation, late Maharaja Martand Singh of Rewa prevailed upon the Madhya Pradesh Government to declare an area of 105 sq. km as National Park in 1968. In 1993 it was declared a Tiger Reserve consisting of an area of ca 1161.47 sq. km under Project Tiger of which 624.75 sq km is the core zone, which includes the Bandhavgarh National Park having an area of ca 448.84 sq km.

AREA AND LOCATION

Bandhavgarh Tiger Reserve is situated inside the reserve forest on Rewa-Umaria road in district Shahdol of Madhya Pradesh. Biogeographically the reserve area lies in the zone 6A-Deccan peninsula, Central highlands. The reserve falls in the Vindhyan ranges, in North-Eastern Madhya Pradesh, one of the micro endemic centres. It lies between lat. 23°27' to 23°58' N and long. 80°43' to 81°13' E. It is surrounded on all sides by Umaria forest division, but for a short stretch in east along Johila river, which forms the boundary of North Shahdol forest division. Five forest ranges for the proper management and conservation of biodiversity and tiger species in the reserve have been designated. These are Tala, Magdhi, Khitauli, Kalahava and Panpatha. The reserve is surrounded by large number of hillocks, providing natural protection against invasion. A portion of the Tiger reserve known as old park area or Tala range is well protected from general exploitation and destruction since it was the hunting reserve of erstwhile princely Rewa State. The area has many streams, ponds and water falls providing varied ecological habitat and plant diversity. Wherever these springs appear or reappear, small marshy or swampy patches are formed. Due to the steep rampart around

Nymphaea nouchali

the plateau grazing pressure is not much. The altitude of the tiger reserve area varies between 440-810 m.

RAINFALL

The average rainfall ranges from 850 to1000 mm. Ninety five per cent of the precipitation is recorded from South-western monsoon during rainy season and the rest comes from North-eastern monsoon during the winters. Maximum temperature during the summer exceeds 43°C while the minimum winter temperature is about 15°C. The cold season prevails from the middle of October to the middle of February and the hot season from the middle of February to June.

GEOLOGY AND SOIL

The main rock is Vindhyan sandstone, which occurs in thick sheet and also found in the shape of larger boulders. Pieces of quartzites are commonly seen which yield very sandy soil, light brown in colour and easily erodible. The sandstone rocks also get withered easily. Due to ease in cutting of these rocks, it is mainly employed in making statues and buildings. The base of the hillocks has the soil of alluvial nature brought down by water during the rains.

Soil is porous, very sandy, light brown in colour and easily erodible. It is common for even a very live stream to vanish after a distance of few yards.

VEGETATION

The area of the reserve falls in Sal zone of North-eastern Madhya Pradesh, which belongs to the tropical moist deciduous type of forests. The representation and richness of the floristic elements available in the tiger reserve area has been greatly affected by the park history of this place. The vegetation of the tiger reserve has been categorized into three subtypes.

(i) Sal forests: The vegetation found on the lower slopes and on the plains represent a good patch of *Shorea robusta* Roxb. ex Gaertn. The main associates of Sal viz., *Pterocarpus marsupium* Roxb., *Lagerstroemia parviflora* Roxb., *Terminalia bellerica* (Gaertn.) Roxb., *Phyllanthus emblica* L., *Buchanania lanzan* Spreng., *Careya arborea* Roxb. are frequent in the second storey. Along watercourse *Syzygium cumini* (L.) Skeels, *Glochidion* sp., *Litsea chinensis* Lam. etc. are seen. The common climbers are *Combretum albidum* G. Don, *Ventilago maderaspatana* Gaertn., *Butea parviflora* Roxb. ex DC. and *Butea superba* Roxb. ex Willd. The undergrowth along the forest road represents good number of grasses and other herbaceous species. These are *Perotis indica* (L.) Kuntze, *Flemingia strobilifera* (L.) Ait. & Ait., *Indigofera echinata* Willd., *Desmodium motorium* (Houtt.) Merr., *Sporobolus diander* (Retz.) P. Beauv., *Andrographis paniculata* (Burm. f.) Wall. ex Nees, etc. On the rocky slopes a large number of *Dioscorea* species are found. Ferns, mosses, liverworts and other herbaceous elements are frequently observed along the stream banks, springs and on the seepaged old dilapidated walls of the fort. These are *Adiantum lunulatum* Burm., *Diplazium esculentum* (Retz.) Sw., *Aleuritopteris grisea* Blanf., *Cheilanthus tenuifolia* (Burm. f.) Sw., *Marchantia polymorpha* L., *Plagiochasma appendiculata* L., *Bryum* sp., *Fissidens* sp., *Rhodobryum giganteum* Schwaegr., *Lasia spinosa* (L.) Thwaites, *Colocasia esculenta* (L.) Schott, *Hygrophila auriculata* (Schumach) Heine, etc. Among the grass species *Heteropogon contortus* (L.) P. Beauv. ex Roem. & Schult, *H. melanocarpus* (Ell.) Benth. and *Imperata cylindrica* (L.) Raeuschel., are found on near by sandy soil. The plants growing in stagnant water or in marshy land are *Ludwigia octovalvis* (Jacq.) Raven, *Hygrorhiza aristata* (Retz.) Nees ex Wight & Arn., *Polygonum barbatum* L., *P.*

Gardenia gummifera

plebejum R. Br. and *Neptunia oleracea* Lour. The forest edges represent coarse grasses like *Phragmites karka* (Retz.) Trin. ex Steud., *Saccharum spontaneum* L., *Imperata cylindrica* (L.) Raeusch. etc.

(ii) Mixed forest: This forest is represented by the deciduous element of plants but the vegetation seen in the lower storey comprises evergreen species. Among the tree species *Shorea robusta* Roxb. ex Gaertn. mixed with *Tectona grandis* L., *Terminalia alata* Heyne ex Roth, *T. chebula* Retz., *Lannea coromandelica* (Houtt.) Merr., *Sterculia urens* Roxb., *Boswellia serrata* Roxb. ex Colebr., *Bombax ceiba* L., *Garuga pinnata* Roxb., *Soymida febrifuga* (Roxb.) A. Juss. and *Anogeissus latifolia* (Roxb. ex DC.) Wall. ex Guill. & Perr. are common. On the exposed slopes of the rocky hills the density of sal is quiet low and other species are *Albizia odoratissima* (L. f.) Benth., and *Bridelia retusa* (L.) Spreng. Among the medium sized trees are *Cochlospermum religiosum* (L.) Alston, *Madhuca longifolia* (J. Koenig) Macbr. var. *latifolia* (Roxb.) Chevalier, *Erythrina stricta* Roxb., *Mallotus philippensis* (Lam.) Muell. Arg., *Cleistanthus collinus* (Roxb.) Benth. ex Hook. f., *Diospyros exsculpta* Buch.-Ham., *Aegle marmelos* (L.) Correa, *Dillenia pentagyna* Roxb., *Bridelia squamosa* (Lam.) Gehrm., *Helicteres isora* L., *Gardenia gummifera* L. f., *Citrus medica* L., *Holarrhena pubescens* (Buch.-Ham.) Wall. ex G. Don, *Acacia catechu* (L. f.) Willd., *Ficus racemosa* L. etc. On the remnants of ancient historical structure *Ziziphus mauritiana* Lam., *Phyllanthus emblica* L., *Calotropisprocera* (Ait.) R. Br., *Boerhavia diffusa* L. and species of *Saccharum* growing luxuriantly. Among the lianas and climbers *Bauhinia vahlii* Wight & Arn., *Smilax zeylanica* L., *Abrus precatorius* L., *Mucuna pruriens* (L.) DC., *Clematis smilacifolia* Wall., *Millettia extensa* (Benth.) Benth. ex Baker, *Celastrus paniculatus* Willd., *Ichnocarpus frutescens* (L.) R. Br., *Pueraria tuberosa* (Roxb. ex Willd.) DC. and *Dioscorea* species are found. The forest undergrowth represents *Eranthemum purpurascens* Wight ex Nees, *Desmodium heterocarpon* (L.) DC., *D. gangeticum* (L.) DC., *Leonotis nepetifolia* (L.) R. Br., *Nelsonia canescens* (Lam.) Spreng., *Barleria cristata* L.,

Polygonum hydropiper subsp. *microcarpum* var. *triquetrum*

Elephantopus scaber L. and *Vernonia cinerea* (L.) Nees etc. Clumps of *Dendrocalamus strictus* (Roxb.) Less, are found nearly all over the area- in scattered manner. Common grasses grow as the undergrowth and on edges of rock are *Apluda mutica* L., *Aristida depressa* Retz., *Bothriochloa pertusa* (L.) A. Camus, *Chloris dolichostachya* Lagasca, *Chrysopogon fulvus* (Spreng.) Chiov., *Hackelochloa granularis* (L.) Kuntze, *Hemarthria compressa* (L. f.) R. Br., *Oplismenus burmannii* (Retz.) P. Beauv. and *O. compositus* (L.) P. Beauv.

Dendrophthoe falcata (L. f.) Etting a common parasite growing on *Terminalia* and *Madhuca* species and *Cuscuta reflexa* Roxb. a parasitic twinner are frequent. *Drosera burmanii* Vahl an insectivorous plant grows in paddy fields after the harvesting.

(iii) Grasslands : The Tiger reserve has a good representation of intermingling grasslands locally known as **'baheras'** which provide good habitat

Sal Forest

for herbivores and hunting cover for predators. Gopal (1991) reported the extent of grasslands in the park as 10.6 per cent of the area where as according to satellite imagery the extent of low level grassland **'Vahs'** is only 6.08 per cent and the grassland with scrub comprises another 5.07 per cent of the total area. Present study noticed that the percentage of grass cover is intact. The common grass species are *Aristida adscensionis* L., *Dimeria ornithopoda* Trin., *Apluda mutica* L., *Arundinella setosa* Trin., *Digitaria longiflora* (Retz.) Pers., *Bothriochloa intermedia* (R. Br.) A. Camus, *Cymbopogon* sp., *Dichanthium annulatum* (Forssk.) Stapf, *Heteropogon contortus* (L.) P. Beauv. ex Roem. & Schult., *Imperata cylindrica* (L.) Raeuschel, *Phragmites karka* (Retz.) Trin. ex Steud., *Saccharum spontaneum* L., etc. The species growing on rocky slopes are *Thysanolaena maxima* (Roxb.) Kuntze, *Themeda quadrivalvis* (L.) Kuntze and *Arundinella setosa* Trin. Bandhavgarh Tiger reserve including National Park have few water bodies of which, some have silted and few contain water throughout the year. Bhadrashila lake is one of the wetland lying near Tala range along the road to Umaria. The lake is full of aquatic vegetation which has been broadly categorized into two groups.

(i) Free floating, submerged and anchored species: *Ceratophyllum demersum* L., *Hydrilla verticillata* (L. f.) L.C. Rich., *Lemna perpusilla* Torr. are the free floating forms. *Eichhornia crassipes* (Mart.) Schlecht., *Potamogeton indicus* Roxb., *Ipomoea aquatica* Forssk., *Monochoria vaginalis* (Burm. f.) K. Presl., *Nymphaea pubescens* Willd., *Hygrorhiza aristata* (Retz.) Nees ex Wight & Arn. are the submerged anchored forms.

(ii) Plants growing in marsh: Large numbers of species grow in marshy land along the lake. These are *Aeschynomene aspera* L., *Ammannia baccifera* L., *Coix aquatica* Roxb., *Cyperus distans* L. f., *Eleocharis palustris* (L.) R. Br., *Ludwigia octovalvis* (Jacq.) Raven, *Polygonum barbatum* L., *P. glabrum* Willd., *P. plebejum* R. Br., *Rotala indica* (Willd.) Koehra, *Centella asiatica* (L.) Urban and *Bacopa monnieri* (L.) Wettst. Common tree species found along the lake are *Terminalia arjuna* (Roxb. ex DC.) Wight & Arn., *Syzygium cumini* (L.) Skeels, *Ficus racemosa* L., *Toona ciliata* M. Roem. and *Litsea chinensis* Lam.

EARLIER TAXONOMIC WORK

Sebastine and Balakrishnan (1959) surveyed North-eastern part of Madhya Pradesh and published a floristic account in the year 1963. Their study included some part of the forest of Bandhavgarh area. Later Tiwari (1968) published a checklist of plant species from Bandhavgarh reserve forest. Babu (1996) did floristic survey of Bandhavgarh National Park. Other than this no other floristic work has been published covering the area of Bandhavgarh National Park. Management plan for the park was written by Dixit (1972) and Sonakia (1992). Pabla (1998) studied the wild life monitoring methodology for protected areas in India in general and Bandhavgarh National Park in particular.

Floristic Diversity

The flora of Bandhavgarh Tiger reserve comprises 529 species belonging to 380 genera under 119 families. Of these, monocots are represented by 125 species, 86 genera under 22 families whereas dicots are represented by 394 species, 286 genera under 90 families. Pteridophytes are represented by 10 species and 8 genera under 7 families (Table 1).

The plants represented in the reserve have been catagorised on the basis of their habit. Herbaceous plants dominate the flora representing 342 species followed by trees (92), shrubs (67) and lianas 28 (Table 2).

Table-1

Group	Families	Genera	Species
Pteridophytes	7	8	10
Angiosperms			
Dicots	90	286	394
Monocots	22	86	125
Total	**119**	**380**	**529**

Table-2

	Trees	Shrubs	Lianas	Herbs
No. of Species	92	67	28	342

Family Poaceae represented by 46 genera and 62 species dominates in the reserve followed by Fabaceae 29/56; Asteraceae 27/33; Cyperaceae 7/26; Euphorbiaceae 11/18; Acanthaceae 13/17; Rubiaceae 10/15; Lamiaceae 10/12; Malvaceae 9/12; Amaranthaceae 8/10 and Caesalpinaceae 3/10 (Table 3). Similarly, *Cyperus* with 11 species, is the largest genus in the Tiger reserve, followed by *Ficus* with 9 species (Table 4).

Table 3 : Dominant Families

SI. No.	Name of the family	No. of Genera	No. of Species
1.	Poaceae	46	62
2.	Fabaceae	29	56
3.	Asteraceae	27	33
4.	Cyperaceae	7	26
5.	Euphorbiaceae	11	18
6.	Acanthaceae	13	17
7.	Rubiaceae	10	15
8.	Lamiaceae	10	12
9.	Malvaceae	9	12
10.	Amaranthaceae	8	10
11.	Caesalpiniaceae	3	10
12.	Moraceae	2	10
13.	Apocynaceae	8	9
14.	Scrophulariaceae	7	9
15.	Tiliaceae	3	9

Table 4 : Dominant Genera

SI. No.	Name of the Genera	No. of Species	SI. No.	Name of the Genera	No. of Species
1.	*Cyperus*	11	11.	*Scirpus*	4
2.	*Ficus*	9	12.	*Panicum*	4
3.	*Crotalaria*	6	13.	*Triumfetta*	4
4.	*Desmodium*	6	14.	*Ziziphus*	4
5.	*Indigofera*	6	15.	*Alysicarpus*	4
6.	*Cassia*	6	16.	*Dalbergia*	4
7.	*Fimbristylis*	6	17.	*Acacia*	4
8.	*Eragrostis*	6	18.	*Terminalia*	4
9.	*Blumea*	5	19.	*Polygonum*	4
10.	*Euphorbia*	5	20.	*Phyllanthus*	4

MEDICINAL PLANTS

A large number of highly valued medicinal plant species form the natural component of the flora of the Tiger reserve. Some of them, along with the uses and the parts used, are given in Table 5.

Table 5: Medicinal plants

Sl. No.	Name of the species	Parts used	Diseases
1.	*Tribulus terrestris* L.	Fruits	Painful micturition & calculous infections
2.	*Biophytum sensitivum* (L.) DC.	Leaves	Asthma & diabetes
3.	*Feronia limonia* (L.) Swingle	Pulp	Diarrhoea
4.	*Azadirachta indica* A. Juss.	Bark	Skin diseases
5.	*Celastrus paniculatus* Willd.	Seeds	Rheumatic pains
6.	*Tephrosia purpurea* (L.) Pers.	Roots	Diarrhoea, rheumatism & asthma
7.	*Uraria picta* (Jacq.) Desv.	Root sap	Churna diseases
8.	*Cassia fistula* L.	Fruits	Purgative
9.	*Cassia tora* L.	Leaves	Ringworm & skin diseases
10.	*Terminalia bellirica* (Gaertn.) Roxb.	Fruits	Ingredients of Triphala
11.	*Terminalia chebula* Retz.	Fruits	Ingredients of Triphala
12.	*Ammannia baccifera* L.	Leaves	Laxative
13.	*Melothria heterophylla* (Lour.) Cogn.	Roots	Dysuria and spermatorrhoea
14.	*Anagallis arvensis* L.	Whole plant	Leprosy, dropsy & hydrophobia
15.	*Madhuca longifolia* (J. Koenig) Macbr. var. *latifolia* (Roxb.) Chevalier	Bark tannin	Scabies & rheumatism
16.	*Diospyros malabarica* (Desr.) Kostel	Rind & bark	Scabies & rheumatism
17.	*Diospyros melanoxylon* Roxb.	Roasted Seeds, Calyx Peduncles	Cough & spermatorrhoea
18.	*Jasminum multiflorum* (Burm. f.) Andr.	Roots	Antidote of cobra decoction venom
19.	*Nyctanthes arbor-tristis* L.	Leaves	Sciatica, intestinal worms & Fever
20.	*Holarrhena pubescens* (Buch.-Ham.) Wall. ex G. Don	Bark and seeds	Dysentery

Sl. No.	Name of the species	Parts used	Diseases
21.	*Plumeria rubra* L.	Latex	Rheumatism
22.	*Wrightia arborea* (Dennst.) Mabb.	Bark	Diarrhoea & dysentery
23	*Gymnema sylvestre* (Retz.) R. Br. ex Schult.	Leaves	Diabetes
24.	*Hemidesmus indicus* (L.) R. Br.	Whole plant	Urinary diseases
25.	*Strychnos potatorum* L.f.	Seeds	Diarrhoea & diabetes
26.	*Canscora diffusa* (Vahl) R. Br. ex Roem. & Schult.	Whole plant	Epilepsy & insanity
27.	*Trichodesma indicum* (L.) R. Br. ex Lehm.	Roots	Stomach disorders
28.	*Cordia dichotoma* G. Forster	Leaves	Ulcers
29.	*Evolvulus alsinoides* (L.) L.	Leaves	Asthma
30.	*Ipomoea carnea* Jacq.	Whole plant	Curing wounds
31.	*Ipomoea pes-tigridis* L.	Leaves	Pimples
32.	*Cuscuta reflexa* Roxb.	Whole plant	Fevers
33.	*Solanum violaceum* Ortega	Whole plant fever	Cough, asthma,
34.	*Solanum nigrum* L.	Leaves diseases	Liver & skin
35.	*Solanum virginianum* L.	Whole plant	Nervous and respiratory disorders
36.	*Bacopa monnieri* (L.) Wettst.	Whole plant	Memory tonic
37.	*Scoparia dulcis* L.	Whole plant	Diabetes & dropsy
38.	*Stereospermum chelonoides* (L.f.) DC.	Root bark	Asthma & skin
39.	*Adhatoda zeylanica* Medik.	Root, leaves & flowers	Cough and cold
40.	*Andrographis paniculata* (Burm. f.) Wall. ex Nees	Whole plant	Malaria & hepatic disorders
41.	*Hygrophila auriculata* (Schumach.) Heine	Whole plant	Jaundice
42.	*Peristrophe paniculata* (Forssk.) Brummitt	Whole plant	Antidote to snake bite
43.	*Clerodendrum indicum* (L.) Gaertn.	Resin	Syphilitic rheumatism

Sl. No.	Name of the species	Parts used	Diseases
44.	*Lantana camara* L. var. *aculeata* (L.) Moldenke	Whole plant	Catarrh and bronchitis
45.	*Tectona grandis* L. f.	Oil	Ringworm & Itches
46.	*Vitex negundo* L.	Leaves	Vermifuge & tonic
47.	*Leonotis nepetifolia* (L.) R. Br.	Flowers	Ringworm
48.	*Ocimum canum* Sims.	Leaves	Cold & cough
49.	*Ocimum tenuiflorum* L.	Leaf decoction	Cold, cough & skin diseases
50.	*Boerhavia diffusa* L.	Roots	Urinary, kidney diseases & jaundice
51.	*Achyranthes aspera* L.	Whole plant	Renal dropsies
52.	*Celosia argentea* L.	Seeds	Diarrhoea & eye diseases
53.	*Gomphrena celosioides* Mart.	Roots	Eye diseases
54.	*Chenopodium album* L.	Whole plant	laxative & anthelmintic
55.	*Dendrophthoe falcata* (L.f.) Ett.	Bark	Menstrual disorders
56.	*Viscum articulatum* Burm. f.	Whole plant	Blood diseases
57.	*Euphorbia nivulia* Buch.-Ham.	Latex	Eye diseases
58.	*Jatropha curcas* L.	Whole plant	Skin diseases
59.	*Phyllanthus emblica* L.	Fruits	Skin diseases
60.	*Phyllanthus urinaria* L.	Whole plant	Diarrhoea & dysentery
61.	*Phyllanthus virgatus* G. Forst.	Leaves	Eye diseases
62.	*Ricinus communis* L.	Roots & Leaves	Jaundice
63.	*Urtica dioica* L.	Whole plant	Menstrual diseases
64.	*Ficus benghalensis* L.	Bark & diabetes	Dysentery, diarrhoea
65.	*Ficus microcarpa* L.f.	Bark	Liver diseases
66.	*Ficus racemosa* L.	Root	Dysentery & diabetes
67.	*Ficus religiosa* L.	Figs	Laxative
68.	*Ceratophyllum demersum* L.	Whole plant	Antidote for scorpion sting
69.	*Costus speciosus* (J. Koenig) Sm.	Roots	Antidote for snake bite
70.	*Curculigo orchioides* Gaertn.	Tubers	Jaundice
71.	*Asparagus racemosus* Willd.	Roots	Diuretic & Dyspepsia
72.	*Iphigenia indica* (L.) A. Gray	Corms	Colic pain

OTHER USEFUL PLANTS

Edible fruits: *Mangifera indica* L., *Psidium guajava* L., *Antidesma ghaesembilla* Gaertn., *Artocarpus heterophyllus* Lamk., *Ficus mollis* Vahl, *Ficus virens* Dryand., *Musa paradisiaca* L.

Vegetables : *Moringa oleifera* Lam., *Luffa cylindrica* (L.) M. Roem., *Momordica charantia* L., *Trichosanthes cucumerina* L., *Polygonum plebeium* R. Br., *Euphorbia elegans* Spreng.

Leafy vegetables: *Portulaca oleracea* L., *Melochia corchorifolia* L., *Alternanthera sessilis* (L.) R. Br. ex DC., *Amaranthus viridis* L.

Timber species : The Tiger reserve has about 92 tree species, many of which are used as timber (Table 6).

Table : 6 Other Useful Plants

Sl. No.	Name of the species	Parts used	Uses
1.	*Miliusa tomentosa* (Roxb.) J. Sinclair	Wood	House poles
2.	*Shorea robusta* Gaertn.	Wood	Timber
3.	*Bombax ceiba* L.	Wood	Matchsticks
4.	*Chloroxylon swietenia* DC.	Wood	Timber
5.	*Cassine glauca* (Rottb.) Kuntze	Wood	Carpentary work
6.	*Dalbergia latifolia* Roxb.	Heart Wood	Furniture
7.	*Pterocarpus marsupium* Roxb.	Wood	Furniture
8.	*Acacia ferruginea* DC.	Wood	Making carts
9.	*Terminalia alata* Heyne ex Roth	Wood	Timber
10.	*Madhuca longifolia* (J. Koenig) Macbr. var. *latifolia* (Roxb.) Chevalier	Wood	Making comb
11.	*Tectona grandis* L. f.	Wood	Timber
12.	*Grevillea robusta* A. Cunn. ex R. Br.	Wood	Cabinet work
13.	*Holoptelea integrifolia* (Roxb.) Planch.	Wood	Timber
14.	*Trema orientalis* (L.) Blume	Wood	Cabinet work
15.	*Artocarpus heterophyllus* Lam.	Wood	Cabinet work
16.	*Ficus arnottiana* (Miq.) Miq.	Wood	Making charcoal

Nymphaea pubescens

Dye yielding plants: *Impatiens balsamina* L., *Chloroxylon swietenia* DC., *Butea monosperma* (Lam.) Taub., *Woodfordia fruticosa* (L.) Kurz, *Iphigenia indica* (L.) A. Gray.

Fodder yielding plants: *Euphorbia heterophylla* L., *Arundinella pumila* (Hochst. ex A. Rich.) Steud, *Chloris virgata* Sw., *Eragrostis ciliata* (Roxb.) Nees, *Heteropogon contortus* (L.) P. Beauv. ex Roem. & Schult., *Panicum repens* L.

Plants used for agricultural implements: *Dalbergia lanceolaria* L.f, *Ougeinia oogeinensis* (Roxb.) Hohen., *Pterocarpus marsupium* Roxb., *Acacia ferruginea* DC.

Plants used as fish poison: *Verbascum chinensis* (L.) Santapau, *Dolichandrone falcata* (Wall. ex DC.) Seem, *Baliospermum montanum* (Willd.) Muell. Arg.

Insectivorous plant: *Drosera indica* L.

MISCELLANEOUS

Culinary purpose: *Citrus aurantifolia* (Christens) Sw.

Curries: *Murraya koenigii* (L.) Spreng.

Cooking oil: *Ventilago denticulata* Willd.

Worshipped: *Ficus benghalensis* L., *Ficus religiosa* L., *Ocimum tenuiflorum* L.

Rope making: *Bauhinia vahlii* Wight & Arn.

Religious ceremonies: *Calotropis procera* (Ait.) R. Br., *Mangifera indica* L.

Fencing: *Carissa opaca* Stapf ex Haines, *Tabernaemontana divaricata* (L.) R. Br.

Cotton: *Bombax ceiba* L., *Gossypium hirsutum* L.

Pickles and taris: *Carissa congesta* Wight, *Citrus aurantifolia* (Christens) Sw.

Thatching: *Phoenix sylvestris* (L.) Roxb., *Saccharum spontaneum* L.

Milletia extensa

Ornamental: *Impatiens balsamina* L., *Lagerstroemia parviflora* Roxb., *Quisqualis indica* L.

Narcotic: *Cannabis sativa* L.

Paper manufacturing: *Boswellia serrata* Roxb. ex Colebr.

Tanning: *Pongamia pinnata* Pierre

Condiments: *Tamarindus indica* L.

Soap: *Acacia sinuata* (Lour.) Merr.

Harmful weeds: *Parthenium hysterophorus* L.

Boat building: *Diospyros malabarica* (Desr.) Kostel.

Bidi making: *Diospyros melanoxylon* Roxb.

Perfume: *Jasminum sambac* (L.) Alton

FAUNA OF THE TIGER RESERVE

The reserve has earned a worldwide reputation for tigers and their high density. The major predators like tiger, leopard, wild dog, wolf and jackal depend on the large population of herbivores in the reserve area. The lesser predators are fox, jungle cat, ratel, palm civet, and mongoose. The other mammals present here are sloth bear, porcupine, Indian pangolin, variety of bats including the giant fruit bat, Indian tree shrew and many other species of rodents. The avifauna is well represented. More than 200 species of birds have been recorded within the reserve. Stream banks, tanks and marshy areas have good representation of awifauna life. The raptors are mainly represented by crested serpent eagle, shaheen falcon, bonnelli's eagle, shikra marsh and hen harriers. There is a good population of malabar pied hornbill, particularly in the fort and its vicinity. Peafowls, painted and grey partridge, red jungle fowl, sarus crane, lesser adjutant stork, large racket tailed drongo, brown fish

owl, paradise fly-catcher, green pigeon are quite common here.

Bandhavgarh Tiger reserve, with its abundance of streams, marshes, woodland edges and wild flowers, is a paradise for bufferflies. Over 70 species have been recorded here which include the common rose, blue tiger, striped tiger, great eggfly. Common crow, common and mottled emigrant, spot sword tail peacock, pansy and orange oakleaf are also seen. Water pools and marshlands are the abode of dragonflies and damselflies. Various machans have been constructed in the reserve area to observe wildlife and Tiger in Tala, Magdhi and Kalavaha ranges.

The tiger is a predator and essentially subsist on much wider base of herbivorous prey animals, which in turn are sustained by even wider base of vegetation. Sal and mixed forest interspersed with Bamboo and reed covered stream banks in lower meadows provide adequate shelter and food for both, the tigers and its prey.

VEGETATION DISTRIBUTION IN UNGULATE RANGES

Different species show different preferences including different vegetation communities in their ranges. Barking deer, chinkara and chital ranges have compratively more sal while gaur, chowsingha and wild boar appears to avoid sal forest and prefer partial to mixed forest and grassland (Pabla, 1998).

MANAGEMENT, THREATS AND CONSERVATION

The Tiger reserve status brings the Protected areas into limelight and activates their management. The management of Bandhavgarh tiger reserve focuses on protection, fire control, soil, water and biodiversity conservation, habitat improvement, ecotourism and ecodevelopment. Intensive protection and antipoaching drive has resulted in nabbing of many poachers and illicit felling of timber trees. Fire and grazing cases are on the decline. Ecodevelopment inputs are underway to ellicit the public support.

Name of the animal	Plant species	Part fed
Chitals	*Shorea robusta*	Tender twigs
	Emblica officinalis	Tender twigs and fruits
	Scoparia dulcis	Leaves
	Triumfetta annua	Leaves
	Elephantopus scaber	Leaves
Langurs	*Shorea robusta*	Tender twigs, leaves
	Emblica officinalis	Fruits
Sambars	*Iseilema* sp.	Prefer grasses
	Saccharum spontaneum	Foliage of herbs, shrubs
	Dendrocalamus strictus	Foliage
Gaurs (found on hill top)	*Saccharum spontaneum*	Graze on tall grasses
	Themeda quadrivalvis	
	Thysanolaena maxima	

Monocharia vaginalis

Habitat improvement is one of the prime task for protecting and conserving the floral and faunal diversity. Bandhavgarh Tiger Reserve has a good representation of grass meadow which provides a habitat for large number of ungulates. Swamps and other waterbodies represent an *in situ* conservation sites for aquatic plants.

In the present scenario all tiger reserve are facing biotic pressure. To overcome this the site specific ecodevelopment plans should be formulated which includes the participation of local communities in the protection of these vital natural resources. Tiger reserve and all the biodiversity that abound in them should not be harvested for commercial exploitation. An educational effort has to be made to increase the level of awareness of urban dwellers who appear to have grown distant from nature because of the prevailing lifestyles in the cities that extract a heavy toll on our natural resources.

ENUMERATION

Abelmoschus ficulneus (L.) Wight & Arn. ex Wight
Abrus precatorius L.
Abutilon indicum (L.) Sweet
Acacia catechu (L.f.) Willd.
A. farnesiana (L.) Willd.
A. ferruginea DC.
A. sinuata (Lour.) Merr.
Acalypha ciliata Forssk.
Acanthospermum hispidum DC.
Achyranthes aspera L.
A. bidentata Blume
Acrocephalus hispidus (L.) Nicolson & Sivadasan
Adenostemma lavenia (L.) Kuntze
Adhatoda zeylanica Medik
Adiantum capillus-veneris L.
A. lunulatum Burm.f.
Aegle marmelos (L.) Correa
Aerides multiflorum Roxb.
Aerva sanguinolenta (L.) Blume
Aeschynomene indica L.
Ageratum conyzoides L.
Ailanthus excelsa Roxb.
Alangium salvifolium (L.f.) Wang.
Albizia odoratissima (L.f.) Benth.

A. procera (Roxb.) Benth.
Allmania nodiflora (L.) R. Br. ex Wight
Alternanthera sessilis (L.) R. Br. ex DC
Alysicarpus bupleurifolius (L.) DC.
A. hamosus Edgew.
A. monilifer (L.) DC.
A. vaginalis (L.) DC.
Amaranthus spinosus L.
A. viridis L.
Ammannia baccifera L.
A. multiflora Roxb.
Ampelocissus latifolia (Roxb.) Planch.
A. tomentosa (Heyne ex Roth) Planch.
Anagallis arvensis L.
Andrographis paniculata (Burm.f.) Wall. ex Nees
Anisochilus carnosus (L.f.) Wall. ex Benth.
Anisomeles indica (L.). Kuntze
Anogeissus latifolia (Roxb. ex DC.) Wall. ex Guill. & Perr.
Antidesma ghaesembilla Gaertn.
Antigonon leptopus Hook. & Arn.
Apluda mutica L.
Argemone mexicana L.
Aristida depressa Retz.
A. redacta Stapf
A. setacea Retz.
Artemisia nilagirica (C.B.Clarke) Pamp.
Arthraxon lancifolius (Trin.) Hochst.
Artocarpus heterophyllus Lam.
Arundinella pumila (Hochst. ex A. Rich.) Steud.
A. setosa Trin.
Asclepias curassavica L.
Asparagus racemosus Willd.
Athyrium esculentum Retz.
A. falcatum Bedd.
Azadirachta indica A. Juss.
Bacopa monnieri (L.) Wettst.
Baliospermum montanum (Willd.) Muell. Arg.
Bambusa bambos (L.) Voss.
Barleria cristata L.
B. prattensis Santapau
Barringtonia acutangula (L.) Gaertn.
Bauhinia racemosa Lam.
B. semla Wunderlin
B. vahlii Wight & Arn.
Begonia picta Sm.
Bidens pilosa L.
var. **minor** (Blume) Sheriff
Biophytum sensitivum (L.) DC.
Blainvillea acmella (L.) Philipson
Blepharis maderaspatensis (L.) Heyne ex Roth
Blumea eriantha DC.
B. lacera (Burm. f.) DC.
B. membranacea DC.
B. mollis (D. Don) Merr.
B. oxyodonta DC.
Blyxa octandra (Roxb.) Planch. ex Thwaites
Boehmeria macrophylla Hornem.
Boerhavia diffusa L.
Bombax ceiba L.
Boswellia serrata Roxb. ex Colebr.
Bothriochloa pertusa (L.) A. Camus
Bridelia squamosa (Lam.) Gehrm.
Bryonopsis laciniosa (L.) Naud.
Buchanania lanzan Spreng.
Bupleurum ramosissimum Wight & Arn.
var. **wightii** (P.K. Mukh.) Bennet
Butea monosperma (Lam.) Taub.
B. superba Roxb.
Byttneria herbacea Roxb.
Cajanus platycarpus (Benth.) Maesen
C. scarabaeoides (L.) du Petit-Thouars
Calotropis procera (Aiton) R. Br.
Campanula benthamii Wall. ex DC.
Canna indica L.
Cannabis sativa L.
Canscora diffusa (Vahl) R. Br. ex Roem.
Capillipedium parviflorum (R. Br.) Stapf
Capparis zeylanica L.
Cardiospermum L.
C. halicacabum L.
Carex cruciata Wahlenb.
Careya arborea Roxb.
Carissa congesta Wight
C. opaca Stapf ex Haines
Cascabela thevetia (L.) Lippold
Cassia absus L.
C. fistula L.
C. mimosoides L.
C. occidentalis L.
C. pumila Lam.
C. tora L.
Cassine albens (Retz.) Kosterm.
Catharanthus pusillus (Murr.) G. Don
Catunaregam spinosa (Thunb.) Tirveng.
Cayratia trifolia (L.) Domin
Celastrus paniculatus Willd.
Celosia argentea L.
Centella asiatica (L.) Urban
Centipeda minima (L.) A. Br. & Aschers
Ceratophyllum demersum L.
Cheilanthes grisea (Blanf.) Blanf.
C. tenuifolia (Burm.f.) Sw.
Chenopodium album L.
Chionachne koenigii (Spreng.) Thwaites
Chloris barbata Sw.
C. dolichostachya Lagasca
C. virgata Sw.
Chloroxylon swietenia DC.
Christella parasitica (L.) Lev.
Chrysopogon fulvus (Spreng.) Chiov.
Cissampelos pareira L. var. **hirsuta** (Buch.-Ham.) DC.
Cissus repanda Vahl
Citrus aurantifolia (Christm & Panz.) Swingle
Clematis smilacifolia Wall.

Desmodium laxiflorum

Cleome monophylla L.
C. viscosa L.
Clerodendrum inerme (L.) Gaertn.
Clitoria annua Graham
C. ternatea L.
Cochlearia cochlearioides (Roth) Sant. & Mahesh.
Cochlospermum religiosum (L.) Alston
Coix lacryma-jobi L.
Colebrookea oppositifolia Sm.
Colocasia esculenta (L.) Schott
Combretum albidum G. Don
Commelina erecta L.
C. paludosa Blume
Corchorus aestuans L.
C. olitorius L.
Cordia dichotoma G. Forst.
Coronopus didymus (L.) Sm.
Costus speciosus (Koenig) J. Sm.
Crateva religiosa Forst.f.
Crotalaria acicularis Benth.
C. albida Heyne ex Roth
C. hirsuta Willd.
C. linifolia L.f.
C. mysorensis Roth
C. prostrata Rottl. ex Willd.
Cryptolepis buchanani Roem. & Schult.
Curculigo orchioides Gaertn.
Curcuma angustifolia Roxb.
Cuscuta reflexa Roxb.
Cyanotis fasciculata (Heyne ex Roth) J.A. & J.H. Schult.
Cyathocline purpurea (Buch. Ham. ex D. Don) Kuntze
Cymbopogon martinii (Roxb.) Wats.
Cynodon dactylon (L.) Pers.
Cynoglossum zeylanicum (Vahl ex Hornem.) Thunb.
Cyperus brevifolius (Rottb.) Hassk.
C. corymbosus Rottb.
C. difformis L.
C. diffusus Vahl
C. distans L.f.
C. flavidus Retz.
C. halpan L.
C. niveus Retz.
C. nutans Vahl
C. pangorei Rottb.
C. rotundus L.
Dalbergia lanceolaria L.f.
D. latifolia Roxb.
D. paniculata Roxb.
D. volubilis Roxb.
Dendrocalamus strictus (Roxb.) Nees
Dendrophthoe falcata (L.f.) Etting.
Desmodium gangeticum (L.) DC.
D. heterocarpon (L.) DC.
D. laxiflorum DC.
D. motorium (Houtt.) Merr.
D. velutinum (Willd.) DC.
Dichanthium annulatum (Forssk.) Stapf
Digitaria stricta Roth ex Roem. & Schult.
Dioscorea bulbifera L.
D. pentaphylla L.
Diospyros malabarica (Desr.) Kostel.
D. melanoxylon Roxb.
Diplazium esculentum (Retz.) Sw.
Dodonaea angustifolia L.f.
Dolichandrone falcata (Wall. ex DC.) Seem.
Drosera burmannii Vahl
Echinops echinatus Roxb.
Eclipta prostrata (L.) L.
Eleiotis monophylla (Burm.f.) DC.
Elephantopus scaber L.
Eleusine indica (L.) Gaertn.
Emilia sonchifolia (L.) DC.
Equisetum debile Roxb.
Eragrostis ciliata (Roxb.) Nees
E. diarrhena (Schult.) Steud.
E. gangetica (Roxb.) Steud.
E. unioloides (Retz.) Nees ex Steud.
E. zeylanica Nees & Meyen
Eranthemum purpurascens Wight ex Nees
Erigeron asteroides Roxb.
Eriocaulon cinereum R. Br.
Eriolaena candollei Wall.
Eriophorum comosum (Wall.) Wall. ex Nees
Erythrina suberosa Roxb.
Eucalyptus umbellata Dum.
Eulalia trispicata (Schult.) Henr.
Euphorbia elegans Spreng.
E. heterophylla L.
E. hirta L.
E. nivulia Buch.-Ham.
E. thymifolia L.
Evolvulus alsinoides (L.) L.
E. nummularius (L.) L.
Feronia limonia (L.) Swingle
Ficus arnottiana (Miq.) Miq.
E. benghalensis L.
E. benjamina L. var. **nuda** (Miq.) Barret
E. comosa Roxb.
E. microcarpa L.f.

E. mollis Vahl
E. racemosa L.
E. religiosa L.
E. tinctoria G. For. subsp. **gibbosa** (Blume) Corner
E. virens Dryander
Fimbristylis bisumbellata (Forssk.) Bubani
F. dichotoma (L.) Vahl
F. falcata (Vahl) Kunth
F. littoralis Gaud.
F. ovata (Burm.f.) Kern
F. schoenoides (Retz.) Vahl
Flacourtia indica (Burm. f.) Merrill
Flemingia strobilifera (L.) R. Br.
Floscopa scandens Lour.
Fuirena ciliaris (L.) Roxb.
F. umbellata Rottb.
Fumaria indica (Hassk.) Pugsley
Galactia tenuiflora (Klein ex Willd.) Wight & Arn.
Gardenia gummifera L.f.
F. latifolia Ait.
F. turgida Roxb.
Garnotia tenella (Arn. ex Miq.) Jan.
Glochidion lanceolarium (Roxb.) Voigt
Gnaphalium affine D. Don
G. polycaulon Pers.
Gomphrena celosioides Mart.
G. sessilis L.
Goniogyna hirta (Willd.) Ali
Gossypium hirsutum L.
Grangea maderaspatana (L.) Poir.
Grevillea robusta A. Cunn. ex R. Br.
Grewia hirsuta Vahl
G. rothii DC.
G. tiliifolia Vahl
Gymnema sylvestre (Retz.) R. Br. ex Schult.
Habenaria commelinifolia (Roxb.) Wall. ex Lindl.
Hackelochloa granularis (L.) Kuntze
Haldina cordifolia (Roxb.) Ridsdale
Helicteres isora L.
Hemarthria compressa (L.f.) R. Br.
Hemidesmus indicus (L.) R. Br.
Hemigraphis latebrosa (Heyne ex Roth) Nees
Heteropogon contortus (L.) P. Beauv. ex Roem. & Schult.
Hibiscus lobatus (J. A. Murr.) Kuntze
H. radiatus Cav.
Hiptage benghalensis (L.) Kurz
Holarrhena pubescens (Buch.-Ham.) Wall. ex G. Don
Holoptelea integrifolia (Roxb.) Planch.
Hybanthus enneaspermus (L.) F. Muell.
Hydrilla verticillata (L.f.) Royle
Hydrocotyle sibthorpioides Lam.
Hygrophila auriculata (Schumach.) Heine
Hygroryza aristata (Retz.) Nees ex Wight & Arn.
Hymenodictyon orixense (Roxb.) Mabb.
Ichnocarpus frutescens (L.) R. Br.
Impatiens balsamina L.
Imperata cylindrica (L.) Raeuschel.
Indigofera astraglina DC.
I. cassioides Rottl. ex DC.
I. linifolia (L.f.) Retz.
I. linnaei Ali
I. nummularifolia (L.) Livera ex Alston
Iphigenia indica (L.) A. Gray
Ipomoea carnea Jacquem
I. pes-tigridis L.
Isachne globosa (Thunb.) Kuntze
Ischaemum indicum (Houtt.) Merr.
I. rugosum Salisb.
Iseilema laxum Hack.
Ixora pavetta Andr.
Jacaranda mimosaefolia D. Don
Jasminum multiflorum (Burm.f.) Andr.
J. sambac (L.) Aiton
Jatropha curcas L.
Justicia quinqueangularis J. Koenig ex Roxb.
J. simplex D..Don
Kalanchoe pinnata (Lam.) Pers.
Kydia calycina Roxb.
Lagerstroemia parviflora Roxb.
Laggera crispata (Vahl) Hepper & Wood.
Lannea coromandelica (Houtt.) Merr.
Lantana camara L. var. **aculeata** (L.) Moldenke
Lasia spinosa (L.) Thwaites
Launaea procumbens (Roxb.) Ramayya & Rajagopal
Lavandula bipinnata (Roth) Kuntze
Leea macrophylla Roxb. ex Hornem.
Lemna perpusilla Torr.
Leonotis nepetifolia (L.) R. Br.
Lepidagathis hamiltoniana Wall. ex Nees
L. trinervis Wall. ex Nees
Leucas biflora (Vahl) R. Br.
L. hyssopifolia Wall. ex Benth.
Lindenbergia indica (L.) Vatke
Lindernia anagallis (Burm.f.) Pennell
L. caespitosa (Blume) Panigrahi
L. crustacea (L.) F. Muell.
Linum mysurense Heyne ex Benth.
Lipocarpha chinensis (Osbeck) Kern
Lobelia alsinoides Lam.
Ludwigia octovalvis (Jacquem.) Raven
L. perennis L.
Luffa cylindrica (L.) M. Roem.
Lygodium flexuosum (L.) Sw.
Lysimachia candida Lindl. ssp. **obovata** (Buch.-Ham. ex Hook.f.) Kunth
Madhuca longifolia (J. Koenig) Macbr. var. **latifolia** (Roxb.) Chevalier
Malachra capitata (L.) L.
Mallotus philippensis (Lam.) Muell.-Arg.
Mangifera indica L.
Martynia annua L.
Melia azedarach L.
Melochia corchorifolia L.
Melothria heterophylla (Lour.) Cogn.
M. maderaspatana (L.) Cogn.
Merremia tridentata (L.) Hall. f.

Micromeria biflora (Buch.-Ham. ex D. Don) Benth.
Miliusa tomentosa (Roxb.) J. Sinclair
Millettia extensa (Benth.) Baker
M. peguensis Ali
Mimosa himalayana Gamble
Mitragyna parvifolia (Roxb.) Korth.
Mollugo pentaphylla L.
Momordica charantia L.
Monochoria vaginalis (Burm.f.) K. Presl
Moringa oleifera Lam.
Mucuna pruriens (L.) DC.
Murdannia nudiflora (L.) Brenan
M. spirata (L.) Brukner
Murraya koenigii (L.) Spreng.
Musa paradisiaca L.
Najas graminea Delile
Naringi crenulata (Roxb.) Nicolson
Neanotis calycina (Hook.f.) Lewis
Nelsonia canescens (Lam.) Spreng.
Nelumbo nucifera Gaertn.
Nepeta hindostana (Heyne ex Roth) Haines
Nervilia aragoana Gaud.
Nyctanthes arbor-tristis L.
Nymphaea pubescens Willd.
Nymphoides hydrophylla (Lour.) Kuntze
N. indica (L.) Kuntze
Ocimum canum Sims
O. tenuiflorum L.
Oldenlandia affinis (Roem. & Schult.) DC.
O. pumila (L.f.) DC.
Oplismenus burmannii (Retz.) P. Beauv.
O. compositus (L.) P. Beauv.
Opuntia vulgaris Mill.
Oropetium thomaeum (L.f.) Trin.
Oryza sativa L.
Ougeinia oojeinensis (Roxb.) Hochr.
Oxalis corniculata L.
Panicum miliaceum L.
P. notatum Retz.
P. paludosum Roxb.
P. repens L.
Paraleptochilus decurrens (Blume) Copel. var. **lanceolata** (Fee) Dixit
Parthenium hysterophorus L.
Paspalidium flavidum (Retz.) A. Camus
Paspalum scrobiculatum L.
Pennisetum hohenackeri Hochst. ex Steud.
Pentanema indicum (L.) Ling
Peristrophe paniculata (Forssk.) Brummitt
Perotis indica (L.) Kuntze
Phoenix acaulis Buch.-Ham. ex Roxb.
P. sylvestris (L.) Roxb.
Phragmites karka (Retz.) Trin. ex Steud.
Phyla nodiflora (L.) E. Greene
Phyllanthus emblica L.
P. reticulatus Poir.
P. urinaria L.
P. virgatus G. Forst.

Solanum virginianum

Pistia stratiotes L.
Plumbago zeylanica L.
Plumeria rubra L.
Pogonatherum paniceum (Lam.) Hack.
Polycarpaea corymbosa (L.) Lam.
Polycarpon prostratum (Forssk.) Asch. & Schweinf.
Polygala abyssinica R. Br. ex Fresen.
Polygonum barbatum L.
P. hydropiper L. subsp. **microcarpum** var. **triquetrum** Danser
P. limbatum Meisn.
P. plebeium R. Br.
Pongamia pinnata (L.) Pierre
Portulaca oleracea L.
P. quadrifida L.
Potamogeton nodosus Poir.
Pouzolzia pentandra (Roxb.) Benn.
Psidium guajava L.
Pterocarpus marsupium Roxb.
Pueraria tuberosa (Roxb. ex Willd.) DC.
Pulicaria angustifolia DC.
Pupalia lappacea (L.) Juss.
Radermachera xylocarpa (Roxb.) K. Schum.
Reinwardtia indica Dumort.
Rhynchosia capitata DC.
Ricinus communis L.
Rotala mexicana Cham. & Schlecht.
R. rotundifolia (Roxb.) Koehne
R. serpyllifolia (Roth) Bremek.
Rotula aquatica Lour.
Rumex dentatus L. subsp. **klotzschianus**
Rungia pectinata (L.) Nees
Saccharum spontaneum L.
Sacciolepis myosuroides (R. Br.) A. Camus
Sagittaria trifolia L.
Scirpus articulatus L
S. lateriflorus J.F. Gmelin
S. mucronatus L.
Scoparia dulcis L.
Semecarpus anacardium L.f.
Senecio nudicaulis Buch.-Ham. ex D. Don

Sesbania bispinosa (Jacq.) W.F. Wight
Setaria intermedia Roem. & Schult.
S. verticillata (L.) P. Beauv.
Shorea robusta Gaertn.f.
Sida acuta Burm. f.
S. cordata (Burm.f.) Borss.
S. cordifolia L.
Siegesbeckia orientalis L.
Smilax zeylanica L.
Smithia conferta Sm.
Solanum nigrum L.
S. violaceum Ortega
S. virginianum L.
Sonchus asper (L.) Hill
Sorghum halepense (L.) Pers.
Spergula fallax (Lowe) Krause
Spermacoce hispida L.
S. pusilla Wall.
Spermadictyon suaveolens Roxb.
Sphaeranthus indicus L.
Sporobolus diander (Retz.) P. Beauv.
Stellaria media (L.) Vill.
Sterculia urens Roxb.
Stereospermum chelonoides (L.f.) DC.
Striga asiatica (L.) Kuntze
Strychnos potatorum L.f.
Syzygium cumini (L.) Skeels
Tabernaemontana divaricata (L.) R. Br.
Tamarindus indica L.
T. dioica Roxb. ex Roth
Tectona grandis L.f.
T. hookeriana Wight & Arn.
T. purpurea (L.) Pers.
Teramnus labialis (L.f.) Spreng.
Terminalia alata Heyne ex Roth
T. arjuna (Roxb. ex DC.) Wight & Arn.
T. bellirica (Gaertn.) Roxb.
T. chebula Retz.
Themeda triandra Forssk.
Thespesia lampas (Cav.) Dalzell & Gibson
Thunbergia fragrans Roxb.
Thysanolaena maxima (Roxb.) Kuntze
Torenia thouarsii (Cham. & Schlechtend.) Kuntze
Trapa bispinosa Roxb.
Trema orientalis (L.) Blume
Tribulus terrestris L.
Trichodesma indicum (L.) R. Br. ex Lehm.
Trichosanthes cucumerina L.
Triumfetta annua L.
T. pentandra A. Rich.
T. pilosa Roth
T. rhomboidea Jacq.
Typha angustifolia L.
Uraria picta (Jacq.) Desv.
Urena lobata L. subsp. **sinuata** (L.) Borss.
Urtica dioica L.
Utricularia scandens Benj.
Vallisneria natans (Lour.) Hara
Vanda tessellata (Roxb.) Hook. ex G. Don
Ventilago denticulata Willd.
Verbascum chinense (L.) Santapau
Vernonia anthelmintica (L.) Willd.
V. aspera Buch.-Ham.
Vetiveria zizanioides (L.) Nash
Vicia sativa L.
Viscum articulatum Burm.f.
Vitex negundo L.
Wahlenbergia erecta (Roth ex Roem. & Schult.) Tyrn
Waltheria indica L.
Woodfordia fruticosa (L.) Kurz
Wrightia tinctoria R. Br.
Xanthium indicum Koen.
Zeuxine strateumatica (L.) Schlechter
Zingiber capitatum Roxb.
Ziziphus mauritiana Lam.
Z. oenoplia (L.) Mill.
Z. rugosa Lam.
Z. xylopyra (Retz.) Willd.
Zornia gibbosa Spang.

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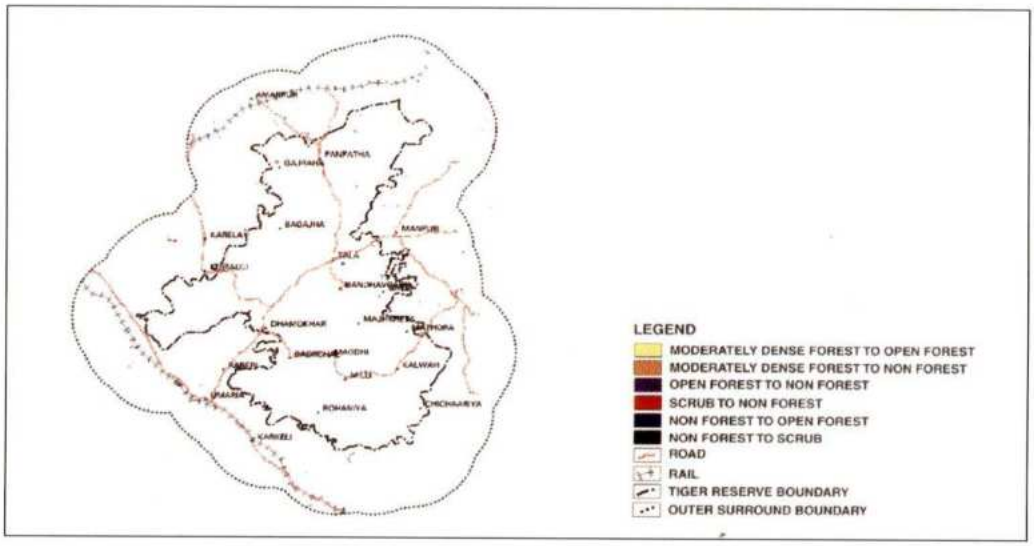


Map of Bandhavgarh Tiger Reserve

Andrographis paniculata

SALIENT FEATURES

Area

Core	:	624.752 sq km
Buffer	:	536.719 sq km
Total	:	1161.471 sq km
Longitude	:	80°43' to 81°13' E
Latitude	:	23°27' to 23°58' N
Altitude	:	440 m to 810 m above M.S.L.
Rainfall	:	1175 mm
Location	:	170 kms from Jabalpur, 210 kms from Khajuraho, Madhya Pradesh.
Coverage Area	:	448 sq km

Temperature

Minimum	:	2^0C
Maximum	:	44^0C

Seasons

Monsoon	:	Mid-June to end-September
Winter	:	November to mid-February
Summer	:	Mid-April to mid-June

The nearest railway stations near Bandhavgarh are Jabalpur(164 km), Katni(102 km) on the Central Railway and Umaria (35 km) on the South Eastern Railway.

The most convenient route to Bandhavgarh is by air to Khajuraho from where it is a five-hour drive (237 km).

Nearby Excursions : Bandhavgarh fort, Shiv Purana

Nearby Cities : Umaria.

Saccharum spontaneum

Bori-Satpura Tiger Reserve

Parul Sharma & KP Singh
Botanical Survey of India, Central Circle, Allahabad-211 002

The state of Madhya Pradesh covers one sixth of the world's tiger population and was declared **"Tiger State"** during 1995 (Tiwari, 1998) in view of the need for enhanced protection of this endangered species. The state is well blessed with forests and has a rich history of conservation of wildlife.

The Bori-Satpura tiger reserve covering an area of 1486 sq km lies between lat. 22°19' to 22°43' N and long. 77°54' to 78°34' E and was established in August, 2000 (Anonymous, 2003). The altitude varies from 300 to 1352 m. It envelops three wildlife conservation units viz., Bori wildlife sanctuary, Satpura national park and Pachmarhi wildlife sanctuary. The area is rich in plant diversity and 'gene pool' as the combination of different edaphic factors at various altitudes gives rise to rich and luxuriant vegetation, which is richest in Central India. The tiger reserve is situated in the 'Central Highland' biogeographic province and falls under Satpura-Maikal range. Satpura national park is the core zone while the two sanctuaries represent the buffer zone of the tiger reserve.

The Satpura national park encompassing an area of 585.17 sq km was established on 13th October, 1981. It lies in Hoshangabad district of Madhya Pradesh and represents one of the biodiversity hotspots of India. The highest peak in Madhya Pradesh, Dhupgarh (1352 m) is located in the park area. The area is noteworthy on account of the integration of the two major plant communities of Sal and Teak forests. However, the majority of the area comprised of mixed forests. The great diversity of geomorphology and vegetation gives rise to multitude of habitats and ecological niches that supports a rich wildlife.

Pachmarhi wildlife sanctuary derives its name from Pachmarhi town, the only hill station in Madhya Pradesh. The sanctuary covering an area of 417.78 sq km was established on 1st June, 1977 on the northern slopes of the Satpura. Pachmarhi town lies high up in a plateau bounded by three principal peaks in these hills namely Dhupgarh, Mahadeo and Chauragarh and surrounded from all sides by deep, narrow gorges, harbours thick vegetation of ferns and other plants that makes the area around Pachmarhi a botanical treasure house. The riparian forests in the area provide congenial habitats for the survival of a number of animals and plants.

Bori is the oldest reserve forest in India and was established as a wildlife sanctuary on 1st August, 1977 because the area has a great potential for the development of wildlife. It lies on the southern slopes of Satpura range in Hoshangabad district covering an area of 485.72 sq km. The area of wildlife sanctuary comes under south Indian moist deciduous forests and slightly moist teak forests. The general vegetation of the area is typically of a dry deciduous type. Bori is famous for its Teak and Bamboo forests.

GEOLOGY, TOPOGRAPHY AND CLIMATE

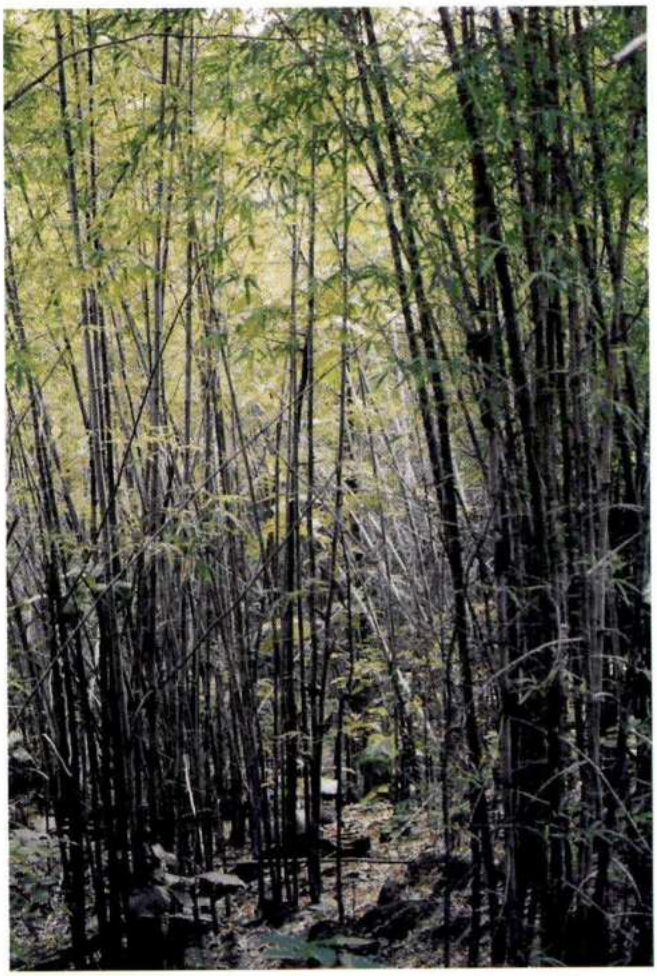
Satpura Tiger Reserve has the Gondwana system and Deccan trap series of rock formations chiefly composed of sandstones and shales. The terrain is extremely rugged throughout the area apart from a few dated valleys and plateaus. The rugged terrain is

traversed by numerous streams and rivers, which constitutes some of the major tributaries of the river Narmada. The main water course includes the Denwa, Sonbhadra, Tawa and Nagdwari. Perennial streams and dark shady gorges have provided suitable habitats for the growth of several moisture loving species of ferns, orchids, bryophytes, algae, many tiny herbs of immense eological and economical value. The cool months are November to February while March to June are intensively dry and very hot months.

The soil of Pachmarhi wildlife sanctuary consists of sandy loam but towards north at some places the soil is clayey. Bagra conglomerate produces soils, which are shallow but fairly suitable for forest growth. The undulating forest floor in Bori wildlife sanctuary consists of fertile black-cotton soil, mixed with sandy loam.

VEGETATION

The Satpura Tiger Reserve has not been worked out exclusively by its name. However, its account has been dealt under various other areas of the region. Based on those publications as well as observations made by one of the authors (Parul Sharma) the vegetation of the Satpura Tiger Reserve has been discussed. The first published account of the forests and the natural history of the present Satpura tiger reserve was made by Capt. Forsyth in his book on "The Highlands of Central India" in 1872. Brandis and Stewart (1874) described the arboreal vegetation of the area. Subsequently, Rao and Narayanswamy (1960) described 308 species from Pachmarhi and adjoining areas and Kapoor and Yadav (1962) added 92 species to it. Joseph (1963) reported 432 taxa from Bori forests. Other important contributors like Saxena (1971), Bir and Kumari (1980), Mukherjee (1984), Oomachan and Masih (1992), Verma & al (1993), Khanna and Mudgal (2001) also studied the botany of area and added new knowledge to the flora. According to Champion and Seth (1968) the forests of the area are classified into following types:



Bamboo Forest in Satpura Tiger Reserve

South Indian moist deciduous forests

These forests are mainly deciduous in nature but lower storeys are largely evergreen. Top canopy is rarely dense and even. Climber and epiphytes are generally abundant. The common constituents of these forests are the tall trees of *Tectona grandis* L. *Shorea robusta* Roxb. ex Gaertn. f., *Pterocarpus marsupium* Roxb., *Terminalia alata* Heyne ex Roth, *T. bellerica* (Gaertn.) Roxb., *T. chebula* Retz., *Lannea coromandelica* (Houtt.) Merr., *Dalbergia paniculata* Roxb., *Haldina cordifolia* (Roxb.) Ridsdale, *Bombax ceiba* L., *Garuga pinnata* Roxb., *Lagerstroemia parviflora* Roxb. and *Anogeissus latifolia* (Roxb. ex DC.) Wall. ex Bedd., while smaller trees and shrubs comprise *Bridelia squamosa* (Lam.) Gehrm, *Mallotus*

Savanha Vegetation

philippensis (Lam.) Muell.-Arg., *Diospyros melanoxylon* Roxb., *Buchanania lanzan* Spreng., *Cassia fistula* L., *Schleichera oleosa* (Lour.) Oken, *Miliusa tomentosa* (Roxb.) Sinclair, *Careya arborea* Roxb., *Dillenia pentagyna* Roxb., *Helicteres isora* L., *Gmelina arborea* Roxb., *Schrebera swietenioides* Roxb., *Embelia basaal* (Roem. & Schult.) A. DC., *Holarrhena pubescens* (Buch.-Ham.) Wall. ex G. Don, *Ficus* spp. and *Leea* spp. The bamboo *Dendrocalamus strictus* (Roxb.) Nees forms dense thickets. The conspicuous climbers and stragglers in these forests are *Millettia extensa* (Benth.) Baker, *Bauhinia vahlii* Wight & Arnott, *Celastrus paniculatus* Willd., *Ichnocarpus frutescens* (L.) R. Br., *Hemidesmus indicus* (L.) R. Br., *Ziziphus oenoplia* (L.) Mill., *Dioscorea pentaphylla* L., *D. bulbifera* L. and *D. oppositifolia* L. The ground flora of these forests is represented by *Eranthemum purpurascens* Wight ex Nees, *Desmodium* spp., *Curcuma* spp., *Zingiber* spp. and *Chlorophytum tuberosum* (Roxb.) Baker. Ground orchids like *Eulophia* spp., *Geodorum densiflorum* (Lam.) Schlecht. and *Habenaria* spp. are also common. In valleys and gorges, the forests are dominated by evergreen species like *Trewia nudiflora* L., *Diospyros malabarica* (Desr.) Kostel and *Ficus* spp., with thick undergrowth of ferns.

This group of forests has been further divided into two subgroups:

a. South Indian moist teak forests: These are found in Bori valley and on west of Pachmarhi plateau and characterized by high moist teak forests associated with *Terminalia alata* Heyne ex Roth, *Madhuca latifolia* (J. Koenig) Macbr. var. *longifolia* (Roxb.) Chevalier, *Bauhinia vahlii* Wight & Arnott, *Kydia calycina* Roxb., *Euphorbia hirta* L., *Cynodon dactylon* (L.) Pers., *Sida acuta* Burm. f. etc.

b. Slightly moist teak forests: These forests occur in the western part of Bori reserve. *Tectona grandis* L.f. is the dominant species here.

Tropical dry deciduous forests

These forests are met within northeastern part of the tiger reserve.

The common constituents here are tall trees of *Terminalia* spp., *Tectona grandis* L., *Pterocarpus marsupium* Roxb., *Cochlospermum religiosum* (L.) Alston, *Butea monosperma* (Lam.) Taub., *Lagerstroemia parviflora* Roxb., *Anogeissus latifolia* (Roxb. ex DC.) Wall. ex Geull & Perr, *A. pendula* Edgew., *Mitragyna parvifolia* (Roxb.) Korth., *Phyllanthus emblica* L., *Sterculia* spp., *Boswellia serrata* Roxb. ex Colebr., *Albizia* spp., *Hardwickia binata* Roxb., *Bauhinia* spp., *Aegle marmelos* (L.) Correa and *Acacia* spp. and a variety of smaller trees and shrubs like *Acacia* spp., *Gardenia* spp., *Grewia* spp., *Helicteres isora* L., *Holarrhena pubescens* (Buch.-Ham.) Wall. ex DC., *Wrightia* spp., *Caesaria tomentosa* Roxb., *Alangium salvifolium* (L. f.) Wang, *Nyctanthes arbor-tristis* L., *Capparis zeylanica* L., *Flacourtia indica* (Burm. f.) Merr., *Mimosa* spp., *Securinega virosa* (Roxb. ex Willd.) Baill. and *Woodfordia fruticosa* (L.) Kurz. Species like *Rhynchosia minima* (L.) DC., *Atylosia scarabaeoides* (L.) Benth., *Cocculus hirsutus* (L.) Diels., *Cissampelos pareira* L., *Ipomoea* spp., *Melothria maderaspatana* (L.) Cogn., *Momordica dioica* Roxb. ex Willd. and *Tinospora cordifolia* (Willd.) Miers. ex Hook. f. & Thomson are common plants in the category of climbers.

These forests are classified into two sub-types:

a. Southern tropical dry deciduous forests: The tree species *Boswellia serrata* Roxb. ex Colebr. is more conspicuous in these forests while *Anogeissus latifolia* (Roxb. *ex* DC.) Wall. ex Bedd. grows associated with *Teminalia alata* Heyne ex Roth.

The top canopy consists of *Terminalia alata* Heyne ex Roth, *Anogeissus latifolia* (Roxb. ex DC.) Wall. ex Bedd., *Madhuca longifolia* (J. Koenig) Macbr. var. *latifolia* (Roxb.) Chevalier, *Diospyros melanoxylon* Roxb., *Soymida febrifuga* (Roxb.) A. Juss., *Aegle marmelos* (L.) Correa, *Schleichera oleosa* (Lour.) Oken., *Buchanania lanzan* Spreng., *Miliusa tomentosa* (Roxb.) Sinclair, *Sterculia urens* Roxb., *Dalbergia paniculata* Roxb., *Phyllanthus emblica* L., *Hardwickia binata* Roxb., *Lagerstroemia parviflora* Roxb. whereas understorey comprises *Acacia catechu* (L. f.) Willd., *Ziziphus xylopyra* Willd., *Cassia fistula* L., *Acacia leucophloea* (Roxb.) Willd. etc. The undershrubs are represented by *Ziziphus rugosa* Lam., *Nyctanthes arbor-tristis* L., *Waltheria indica* L. etc. Common climbers are *Bauhinia vahlii* Wight & Arn., *Butea superba* Roxb., *Cuscuta reflexa* Roxb. etc. *Saccharum spontaneum* L. is the dominant grass in the forests.

This type is further divided into three categories:

i. Dry teak forests: These occur in parts of Pachmarhi wildlife sanctuary and are associated with *Diospyros melanoxylon* Roxb., *Butea monosperma* (Lam.) Taub., *Lantana camara* L., *Woodfordia fruticosa* (L.) Kurz, etc.

ii. Mixed deciduous forests: These are also found in Pachmarhi wildlife sanctuary and composed of *Chloroxylon swietenia* DC., *Buchanania lanzan* Spreng., *Manilkara hexandra* (Roxb.) Hubard, *Flacourtia indica* (Burm.) Merr., *Soymida febrifuga* (Roxb.) A. Juss., *Grewia tiliifolia* Vahl, etc.

b. Dry peninsular sal forests: The occurrence of Sal (*Shorea robusta* Roxb. ex Gaertn. f.) is ecologically the most unique feature of the Pachmarhi area and associated with *Pentanema indica* (L.) Ling, *Vernonia cinerea* (L.) Less, *Ageratum conyzoides* L., *Laggera alata* (D. Don) Schultz-Piper ex Oliver, *Dodonaea angustifolia* L. f., *Sophora interrupta* Bedd., *Rhus parviflora* Roxb. ex DC., *Heteropogon contortus* (L.) P. Beauv. ex Roem. & Schult., *Clematis triloba* Heyne ex Roth, *Bauhinia vahlii* Wight & Arn. etc.

Central Indian sub tropical hill forests

These are found on hilltop of Pachmarhi plateau. These forests are exposed and often with poor soil and comprises *Michelia champaca* L., *Syzygium cumini* (L.) Skeels, *Manilkara hexandra* (Roxb.)

Dubard, *Mangifera indica* L., *Salix tetrasperma* Roxb., *Dillenia* spp., *Mallotus philippensis* (Lam.) Muell. Arg. together with tree fern species *Alsophila* as a common element.

AQUATIC PLANTS

The undulating geography and deep gorges have resulted in the formation of several waterfalls, marshy places and perennial streams which are congenial places for the growth of aquatic plants. These can be classified into six categories:

i. Free floating hydrophytes: *Azolla pinnata* R. Br., *Eichhornia crassipes* (Mart.) Solrms and *Trapa natans* L. var. *bispinosa* (Roxb.) Makino.

ii. Suspended submerged hydrophytes: *Ceratophyllum demersum* L. and *Utricularia exoleta* R. Br.

iii. Anchored submerged hydrophytes: *Hydrilla verticillata* (L. f.) Royle, *Najas* sp. and *Vallisneria natans* (Lour.) Hara.

iv. Anchored hydrophytes with floating shoots: *Ipomoea aquatica* Forssk. and *Ludwigia adscendens* (L.) Hara.

v. Anchored hydrophytes with floating leaves: *Aponogeton natans* (L.) Engl. & K. Krause, *Marsilea minuta* L., *Monochoria vaginalis* (Burm. f.) Presl, *Nelumbo nucifera* Gaertn., *Nymphaea nouchali* Burm. and *Nymphoides indica* (L.) Kuntze.

vi. Emergent amphibious hydrophytes: *Aeschynomene indica* L., *Ammannia baccifera* L., *A. multiflora* Roxb., *Brachiaria reptans* (L.) Gardn. & Hubb., *Cyperus distans* L., *Echinochloa colonum* (L.) Link, *Enhydra fluctuans* Lour., *Eriocaulon cinereum* R. Br., *E. quinquangulare* L., *Fimbristylis tetragona* R. Br., *Hygrophila auriculata* (Schumach.) Heine, *Isoetes coromandelina* L. f., *Limnophila aromatica* (Lam.) Merr., *L. indica* (L.) Druce, *Lipocarpha chinensis* (Osbeck.) Kern, *Ludwigia octovalvis* (Jacq.) Raven, *L. perennis* L., *L. prostrata* Roxb., *Phragmites karka* (Retz.) Trin., *Polygonum barbatum* L., *P. dichotomum* Blume, *P. glabrum* Willd., *Rotala densiflora* (Roem. & Schult.) Koehne, *R. indica* (Willd.) Koehne and *R. rotundifolia* (Roxb.) Koehne.

ECONOMICALLY USEFUL PLANTS

Many plants of the Satpura Tiger Reserve have been used as a source of food, shelter, timber, clothing, medicine, fibre, gum, resin, and oil and for an array of other miscellaneous purposes. The list of some such useful plants has been provided below:

1. Timber (for construction work, poles, agricultural implements, furniture, railway sleepers, carts and instruments etc.)

Acacia leucophloea (Roxb.) Willd., *Acacia nilotica* ssp. *indica* (Benth.) Brenan, *Alangium salvifolium* (L. f.) Wang, *Albizia* spp., *Anogeissus latifolia* (Roxb. ex DC.) Wall. ex Bedd., *A. pendula* Edgew., *Anthocephalus chinensis* (Lam.) A. Rich. ex Wall, *Azadirachta indica* A. Juss., *Careya arborea* Roxb., *Cleistanthus collinus* (Roxb.) Benth. ex Hook., *Dalbergia latifolia* Roxb., *D. sissoo* Roxb., *Diospyros* spp., *Eucalyptus* spp., *Garuga pinata* Roxb., *Gmelina arborea* Roxb., *Haldina cordifolia* (Roxb.) Ridsdale, *Hardwickia binata* Roxb., *Kydia calycina* Roxb., *Lagerstroemia parviflora* Roxb., *Lannea coromandelica* (Houtt.) Merr., *Mangifera indica* L., *Michelia champaca* L., *Mitragyna parviflora* (Roxb.) Korth., *Ougeinia oojeinensis* (Roxb.) Hochr., *Prosopis cineraria* (L.) Druce, *Pterocarpus marsupium* Roxb., *Schleichera oleosa* (Lour.) Oken, *Schrebera swietenioides* Roxb., *Sterculia* sp., *Shorea robusta* Roxb. ex Gaertn. f., *Syzygium cumini* (L.) Skeels, *Tectona grandis* L.f., *Terminalia alata* Heyne ex Roth, *Trewia nudiflora* L. and *Ziziphus* spp.

2. Edible plants

i. Rhizomes/ Tubers (cooked)- *Curcuma* spp., *Dioscorea bulbifera* L., *D. pentaphylla* L., *Nymphoides indica* (L.) Kuntze and *Nymphaea nouchali* Burm. f.

ii. Leaves and tender shoots (cooked)- *Amaranthus* sp., *Basella alba* L., *Bauhinia* sp., *Cassia*

Forest Vegetation along the river Denwa

tora L., *Cleome gynandra* L., *Cocculus hirsutus* (L.) Diels, *Corchorus* sp., *Dendrocalamus strictus* (Roxb.) Nees, *Glossocardia bosvallea* (L. f.) DC., *Gnaphalium polycaulon* Presl, *Hibiscus radiatus* Cav., *H. sabdariffa* L., *Ipomoea, quamoclit* L., *Martynia annua* L., *Melochia corchorifolia* L., *Melothria heterophylla* (Lam.) Cogn., *Merremia emarginata* (Burm. f.) Hall. f., *Nymphoides indica* (L.) Kuntze, *Oxalis corniculata* L., *Phoenix acaulis* Roxb. ex Buch.-Ham., *Phyla nodiflora* (L.) E. Gmelin, *Polygonum* spp., *Rivea hypocrateriformis* (Desr.) Choisy and *Tribulus terrestris* L.

iii. Flowers (cooked)- *Bauhinia purpurea* L., *B. racemosa* Lam., *Celastrus paniculatus* Willd., *Hibiscus sabdariffa* L., *Madhuca longifolia* (J. Koenig) Macbr. var. *latifolia* (Roxb.) Chevalier, *Moringa oleifera* Lam., *Semecarpus anacardium* L. f. and *Woodfordia fruticosa* (L.) Kurz.

iv. Fruits (raw cooked or pickled)- *Abelmoschus esculentus* (L.) Moench., *Aegle marmelos* (L.) Correa, *Annona squamosa* L., *Artocarpus* spp., *Buchanania lanzan* Spreng., *Carissa* sp., *Catunaregam nilotica* (Stapf) Tirvengadum, *Dillenia pentagyna* Roxb., *Diospyros melanoxylon* Roxb., *Embelia basaal* (Roem. & Schult.) A. DC., *Feronia limonia* (L.) Swingle, *Ficus hispida* L. f., *F. racemosa* L., *Flacourtia indica* (Burm. f.) Merr., *Gmelina arborea* Roxb., *Grewia* spp., *Mangifera indica* L., *Manilkara hexandra* (Roxb.) Dubard, *Melothria heterophylla* (Lour.) Oken, *Momordica dioica* Roxb. ex Willd., *Moringa oleifera* Lam., *Phoenix acaulis* Roxb. ex Buch.-Ham., *Phyllanthus emblica* L., *Prosopis cineraria* (L.) Druce, *Spondias pinata* (L. f.) Kurz, *Syzygium cumini* (L.) Skeels, *Trapa natans* L. var. *bispinosa* (Roxb.) Makino and *Ziziphus mauritiana* Lam.

v. Seeds (cooked or roasted)- *Bauhinia vahlii* Wight & Arnott, *Cassia occidentalis* L., *Panicum sumatrense* Roth ex Roem. & Schult., *Paspaladium flavidium* (Retz.) A. Camus, *Paspalum scrobiculatum* L., *Pithecellobium dulce* (Roxb.) Benth., *Semecarpus anacardium* L. f., *Sterculia urens* Roxb., *Vigna*

trilobata (L.) Verdc, and *V. umbellata* (Thunb.) Ohwi & Ohashi.

3. Medicinal plants

The Satpura Tiger Reserve harbours a rich wealth of medicinal plants, which continues to be used for amelioration of people's sufferings. Some of the plants with established medicinal properties are given in Table-1.

Table 1: Medicinal plants of Satpura Tiger Reserve

Botanical name	Vern. name	Family	Habit	Parts used	Medicinal properties
Abrus precatorius L.	Ratti	Leguminasae	Climbing	Sd	Paste is applied in sciatica, stiffness of shoulder joints and paralysis.
Abutilon indicum (L.) Sweet	Kanghi	Malvaceae	Herb	Wp	Anthelmintic and inflammatory, in urinary troubles and as nerve tonic.
Acacia catechu (L. f.) Willd.	Khair	Leguminasae	Tree	Wd, Bk, Lf	Astringent, asthma, bronchitis, gonorrhoea.
A. farnesiana (L.) Willd.	Bilayati babool	Leguminasae	Tree	Rt. Bk, Lf	Tooothache, malarial fever, gonorrhoea.
A. leucophloea (Roxb.) Willd.	Safed kikar	Leguminasae	Tree	Bk	Ulcer, astringent.
A. nilotica (L.) Willd. ex Delile var. *indica* (Benth.) Brenan	Babool	Leguminasae	Tree	Bk	Asthma, dysentery, skin diseases, tooth and gum troubles.
Achyranthes aspera L.	Latjira	Amaranthaceae	Herb	Rt	Checks bleeding during delivery, toothache.
Adhatoda zeylanica Medik.	Adosa	Acanthaceae	Shrub	Lf. Rt	Asthma, bronchitis.
Aegle marmelos (L.) Correa	Bael	Rutaceae	Tree	Fr, Lf	Dysentery, gastric trouble and diabetes
Alangium salvifolium (L. f.) Wang.	Ankol	Alangiaceae	Tree	Bk, Lf	Reduces blood pressure and rheumatic pain.
Albizia lebbeck (L.) Benth.	Siris	Leguminasae	Tree	Sd, Bk	Gonorrhoea, diarrhoea and dysentery.
Alternanthera sessilis (L.) R.Br.	Guroo	Amaranthaceae	Herb	Lf	Malarial fever, diarrhoea, bone fracture.
Alysicarpus bupleurifolius (L.) DC.	-	Fabaceae	Herb	Wp	Fever.
Amaranthus spinosus L.	Kateli Chaulai	Amaranthaceae	Herb	Sd, Lf	Joint pain and bronchitis.
Andrographis paniculata (Burm. f.) Wall. ex Nees	Kalmegh	Acathaceae	Herb	Wp	Malarial fever, jaundice and colic pain.
Annona squamosa L.	Sharifa	Annonaceae	Shrub	Sd, Bk, Rt	Insecticidal and diarrhoea.
Anogeissus latifolia (Roxb. ex DC.) Wall. ex Bedd.	Dhawda	Combretaceae	Tree	Bk, gum	Colic pain, diarrhoea and leucorrhoea.
Anthocephalus chinensis (Lam.) A. Rich. ex Walp.	Kadam	Rubiaceae	Tree	Bk	Fever and dysentery.
Argemone mexicana L.	Bharkand	Papaveraceae	Herb	Sd, La	Asthma, gum trouble and skin diseases.
Argyeria nervosa (Burm. f.) Bojer	Samandar Ka pat	Convolvulaceae	Climber	Rt	Diabetes and ringworm.
Asparagus racemosus Willd.	Satavar	Liliaceae	Herb	Rt	Dyspepsia, nervous and rheumatic complaints.
Azadirachta indica A. Juss.	Neem	Meliaceae	Tree	Bk, Lf,	Skin troubles, antiseptic, decoction for ulcers and eczema, purgative.
Bacopa monnieri (L.) Penn.	Brahmi	Scrophulariaceae	Herb	Wp	Epilepsy, insanity, nervous disorders.
Baliospermum montanum (Willd.) Muell. Arg.	Danti	Euphorbiaceae	Undershrub	Rt, Lf, Sd	Jaundice, asthma, rheumatic pain.
Barleria cristata L.	Tandralu	Acanthaceae	Herb	Lf, Rt	Cough and inflammations.

Botanical name	Vern. name	Family	Habit	Parts used	Medicinal properties
B. prionitis L.	Katsareya	Acanthaceae	Herb	Lf, Rt	Catarrhal infections, toothache, boil and glandular swellings.
Bauhinia purpurea L.	Koliar	Caesalpiniaceae	Tree	Bk, Lf	Astringent, jaundice and wounds.
B. racemosa Lam.	Phalesa	Caesalpiniaceae	Tree	Bk, Lf	Astringent, dysentery, diarrhoea and malaria.
B. vahlii Wight & Arn.	Mahul	Caesalpiniaceae	Woody climber	Bk	Leprosy, malaria, piles and snakebite.
B. variegata L.	Kachnar	Caeslapiniaceae	Tree	Rt, Buds	Carminative and obesity, diarhoea, dysentery and piles.
Blumea lacera (Burm. f.) DC.	-	Asteraceae	Herb	Lf	Cuts and wounds and piles.
Boerhavia diffusa L.	Punarnawa	Nyctaginaceae	Herb	Rt	Jaundice and asthma.
Boswellia serrata Roxb. ex Colebr.	Salai	Burseraceae	Tree	Gum	Epilepsy, skin diseases and stomach complaints.
Buchanania lanzan Spreng.	Achar	Anacardiaceae	Tree	Bk, gum Sd	Bronchitis, cuts, diarrhoea, skin diseases.
Butea monsperma (Lam.) Taub.	Dhak	Fabaceae	Tree	Sd, Fl	Killing intestinal worms, contraceptive, gum, diabetes and diarrhoea.
Canscora decussata (Roxb.) Roem. & Schult.	Sanskhabati	Gentianaceae	Herb	Wp	Blood purifier and stomachache.
Careya arborea Roxb.	Kumbhi	Lecythidaceae	Tree	Bk	Blood dysentery, cuts and wounds and skin diseases.
Catunaregam spinosa (Thunb.) Tiruveng.	Mainphal	Rubiaceae	Tree	Fr, Rt	Ematic and malaria.
Cissampelos pareira L.	Akandi	Menispermaceae	Climber	Rt	Diarrhoea, urinary problems.
Cleome viscose L.	Hulhul	Capparaceae	Herb	Sd, Lf	Boils and diarrhoea.
Clerodendrum serratum (L.) Moon	Bharangi	Verbenaceae	Shrub	Rt	Malaria and snakebite.
Celastrus paniculatus Willd.	Malkangani	Celastraceae	Woody climber	Bk	Bone fracture, snakebite and gastric complaints.
Centella asiatica (L.) Urb.	Brahmi	Apiaceae	Herb	Lf	Brain tonic, leprosy and tuberculosis.
Cocculus hirsutus (L.) Diels	Jamiti ki bel	Menispermaceae	Herb	Lf	Conjunctivitis and fever.
Costus speciosus (J. Koenig) Sm.	Keokand	Costaceae	Herb	Rt	Asthma, dropsy and dysentery.
Cryptolepis buchnani Roem. & Schult.	Dudhi	Asclepiadaceae	Shrub	Rt	Stomach pain, malaria, epilepsy Schult.
Curculigo orchioides Gaertn.	Kali musli	Amaryllidaceae	Herb	Rt	Tonic, asthma and epilepsy.
Curcuma aromatica Salisb.	Banhaldi	Zingiberaceae	Herb	Rt	Easy delivery, killing intenstinal worms.
Cynodon dactylon (L.) Pers.	Doob	Poaceae	Herb	Rt, Lf	Cooling effect and urinary complaints.
Cyperus rotundus L.	-	Cyperaceae	Herb	Rt	Jaundice.
Desmodium gangeticum (L.) DC.	Salparni	Fabaceae	Shrub	Rt	Antidote to snakebite.
Diospyros melanoxylon Roxb.	Tendu	Ebenaceae	Tree	Fr	Germicidal.
Diplocyclos palmatus (L.) C. Jeffrey	Bankakra	Cucurbitaceae	Climber	Sd	Fertility in woman.
Eclipta prostrata (L.) L.	Bhangra	Asteraceae	Herb	Wp	Bronchitis and malarial fever.
Elephantopus scaber L.	Bis-hari	Asteraceae	Herb	Rt	Dysentery , dropsy and fever.
Embelia basaal (Roem. & Schult.) DC.	Barbang	Myrsinaceae	Small tree	Fr	Antibacterial, laxative and effective against worms.

Botanical name	Vern. name	Family	Habit	Parts used	Medicinal properties
Euphorbia hirta L.	Dudhi	Euphorbiaceae	Herb	Wp	Colic troubles, dysentery, cough and asthma, vermifuge.
Evolvulus alsinoides (L.) L.	Sankhphuli	Convolvulaceae	Herb	Lf	Bronchitis, fever and ulcer.
Ficus benghalensis L.	Bargad	Moraceae	Tree	Fr, Bk, Rt, La	Diabetes, diarrhoea and gum troubles.
Gloriosa superba L.	Kalihari	Liliaceae	Herb	Rt	Rheumatic pain and gonorrhoea.
Gymnema sylvestre (Retz.) R. Br. ex Schult.	Gurmar	Asclepiadaceae	Climber	Lf, Rt	Diabetes and urinary. complaints and stomachache.
Helicteres isora L.	Marorphali	Sterculiaceae	Shrub	Fr, Rt	Diarrhoea, asthma and colic pain.
Hemidesmus indicus (L.) R. Br.	Anant mul	Asclepiadaceae	Herb	Rt	Blood purifier, diarrhoea and skin diseases.
Holarrhena pubescens (Buch.-Ham.) Wall. ex G. Don	Kurchi	Apocynaceae	Tree	Bk, Sd	Tonic, febrifuge, diarrhoea, fever and jaundice.
Hygrophila auriculata (Schumach) Heine	Oont katela	Acanthaceae	Herb	Lf, Sd	Cough, urethral discharges and veneral diseases.
Hybanthus enneaspermus (L.) F.v. Muell.	Ratanpurus	Violaceae	Herb	Lf	Dysentery, impotency and liver complaints.
Ichnocarpus frutescens (L.) R. Br.	Dhimarbel	Apocynaceae	Shrub	Rt	Blood purifier and skin diseases.
Indoneesiella echioides (L.) Sreem.	Kusumpura	Acanthaceae	Herb	Wp	Antipyretic and jaundice.
Kydia calycina Roxb.	Barang	Malvaceae	Tree	Lf	Body pain, formation of saliva.
Lannea coromandelica (Houtt.) Merr.	Gunja	Anacardiaceae	Tree	Bk, Lf	Diarrhoea, toothache, sores and stomach disorder.
Lawsonia inermis L.	Mehndi	Lythraceae	Shrub	Rt	Jaundice.
Madhuca longifolia (J. Koenig) Macbr. var. *latifolia* (Roxb.) Chevalier	Mahua	Sapotaceae	Tree	Lf, Fl	Burns, scalds, cooling and antibacterial.
Mallotus philippensis (Lam.) Muell. Arg.	Sindoori	Euphorbiaceae	Tree	Fr, Bk	Bronchitis, jaundice, piles and abdominal pain.
Manilkara hexandra (Roxb.) Dubard	Khirni	Sapotaceae	Tree	St, Bk	Tonic and astrigent.
Melastoma malabathricum L.	Lalphool	Melastomataceae	Tree	Leaf Juice	Diarrhoea and dysentery.
Moringa oleifera Lam.	Munga	Moringaceae	Tree	Wp	Gastrointestinal trouble, dysentery and eczema.
Nyctanthes arbor-tristis L.	Harshingar	Oleaceae	Shrub	Bk, Lf	Malarial fever, sciatica pain and intestinal worm.
Oldenlandia corymbosa L.	Dhaman Paper	Rubiaceae	Herb	Bk	Fever.
Ougeinia oojeinensis (Roxb.) Hochr.	Tinsa	Fabaceae	Tree	Bk, Gum	Dysentery, diarrhoeam and febrifuge.
Phyllanthus emblica L.	Aonla	Euphorbiaceae	Tree	Fr	Bronchitis, diabetes and gastrointestinal trouble.
Pithecellobium dulce (Roxb.) Benth.	Jangle-Jalebi	Mimosaceae	Tree	Sd, Fl	Leprosy and cooling agent.
Plumbago zeylanica L.	Chitrak	Plumbaginaceae	Shrub	Rt	Toothache, piles and diarrhoea.
Pongamia pinnata (L.) Pierre	Karanj	Fabaceae	Tree	Sd	Bronchitis, fever, eczema and burns.

Botanical name	Vern. name	Family	Habit	Parts used	Medicinal properties
Pterocarpus marsupium Roxb.	Bijasal	Fabaceae	Tree	Bk, gum	Diabetes, cooling and diarrhoea.
Schleichera oleosa (Lour.) Oken.	Kusum	Sapindaceae	Tree	Bk, Sd C.l.il	Gout, burns, fever and skin diseaeses.
Solanum virginianum L.	Bhat Kattariya	Solanaceae	Herb	Wp	Spermatorrhoea.
Sphaeranathus indicus L.	Gorakh Mundi	Asteraceae	Herb	Wp	Piles.
Sterculia urens Roxb.	Kullu	Sterculiaceae	Tree	Rt	Bone dislocation.
Syzygium cumini (L.) Skeels	Jamun	Myrtaceae	Tree	Wp	Malarial fever.
Thalictrum foliolosum DC.	Pilzari	Ranunculaceae	Herb	Rt	Abdominal pain, boils, eye disorder and toothache.
Thespesia lampas (Cav.) Dalzell	Bankapas	Malvaceae	Shrub	Lf, Sd	Anti-inflammatory, Gonorrhoea.
Tinospora cordifolia (Willd.) Hook. f. & Thomson	Gilo	Menispermaceae	Woody climber	St, Bk	Tonic, antiperiodic and aphrodisiac.
Tribulus terrestris L.	Chota-gokharu	Zygophyllaceae	Herb	Lf, Fr	Mouth troubles, reduce inflammation, urinary complaints and impotency.
Urginea indica (Roxb.) Kunth	Jangli piyaz	Liliaceae	Herb	Bulb	Cardiotonic and diuretic.
Vetiveria zizanioides (L.) Nash	Khus	Poaceae	Herb	Oil, Rt	Epilepsy, fever and malarial fever.
Waltheria indica L.	Pittamara	Sterculiaceae	Herb	Wp	Pile complaints.
Woodfordia fruticosa (L.) Kurz	Dhamhlai	Lythraceae	Shrub	Fl	Cough and cold.

Abbreviations used : Bk= Bark; Rt= Root; St=Stem; Lf=Leaf; La=Latex; Fl = Flower; Sd=Seed; Fr= Fruit; Wp=Whole plant

4. Miscellaneous uses

A list of plants used for miscellaneous purposes is given below:

i. Bamboo sticks and poles: *Bambusa polymorpha* Munro and *Dendrocalamus strictus* (Roxb.) Nees.

ii. Baskets, hats and mats etc: *Dendrocalamus strictus* (Roxb.) Nees, *Diospyros melanoxylon* Roxb., *Indigofera cassioides* Rottl. ex DC., *Phoenix acaulis* Roxb. ex Buch.-Ham., *P. sylvestris* (L.) Roxb. and *Phragmites karka* (Retz.) Trin.

iii. Beverages and drinks: *Cassia occidentalis* L., *Madhuca longifolia* (J. Koenig) Macbr. var. *latifolia* (Roxb.) Chevalier, *Oryza sativa* L. and *Phoenix acaulis* Roxb. ex Buch.-Ham.

iv. Brooms: *Dendrocalamus strictus* (Roxb.) Nees, *Phoenix acaulis* Roxb. ex Buch.-Ham. *Sida acuta* Burm. f. and *Thysanolaena maxima* (Roxb.) Kuntze.

v. Dye: *Acacia catechu* (L. f.) Willd., *Butea monosperma* (Lam.) Taub., . *Curcuma* spp., *Lawsonia inermis* L., *Mallotus philippensis* (Lam.) Muell. Arg., *Nyctanthes arbor-tristis* L., *Pterocarpus marsupium* Roxb., *Woodfordia fruticosa* (L.) Kurz and *Wrightia arborea* (Dennst) Mabberley.

vi. Bidi rolling: Leaves of *Bauhinia vahlii* Wight & Arn. and *Diospyros melanoxylon* Roxb.

vii. Cotton: *Bombax ceiba* L.

viii. Fibre: *Abutilon persicum* (Burm. f.) Merr., *Bauhinia purpurea* L., *B. vahlii* Wight & Arnott, *Butea monosperma* (Lam.) Taub., *Calotropis gigantea* (L.) R. Br., *C. procera* (Aiton) R. Br., *Corchorus* spp., *Crotalaria juncea* L., *Eulaliopsis binata* (Retz.) Hubb., *Grewia* spp., *Helicteres isora* L., *Hibiscus radiatus* Cav., *H. sabdariffa* L., *Melochia corchorifolia* L., *Triumfetta rhomboidea* Jacq. and *Urena lobata* L.

ix. Floss (for stuffing pillows and seats): *Bombax ceiba* L., *Calotropis gigantea* (L.) R. Br., *C. procera* (Ait.) R. Br. and *Cochlospermum religiosum* (L.) Alston.

x. Gum: *Acacia nilotica* ssp. *indica* (Benth.) Brenam, *Anoegissus latifolia* (Roxb. ex DC.) Wall. ex Bedd., *Boswellia serrata* Roxb. ex Colebr., *Cochlospermum religiosum* (L.) Alston, *Lannea coromandelica* (Houtt.) Merr., *Sterculia urens* Roxb. and *Woodfordia fruticosa* (L.) Kurz.

xi. Insect repellent oil: Leaves of *Azadirachta indica* L. and *Cymbopogon martini* (Roxb.) Wats.

xii. Katha: Wood of *Acacia catechu* (L. f.) Willd.

xiii. Khus: Roots of *Vetiveria zizanioides* (L.) Nash.

xiv. Oil (varnishes, lubrication, tanning, soap, massaging and illumination etc.): *Argemone mexicana* L., *Boswellia serrata* Roxb. ex Colebr., *Buchnania lanzan* Spreng., *Caesaria graveolens* Dalz., *Celastrus paniculatus* Willd., *Jatropha curcas* L., *Madhuca longifolia* (J. Koenig) Macbr. var. *latifolia* (Roxb.) Chevalier, *Ricinus communis* L., *Schleichera oleosa* (Lour.) Oken., *Semecarpus anacardium* L. f., *Sterculia urens* Roxb. and *Ventilago denticulata* Willd.

xv. Paper pulp: *Boswellia serrata* Roxb. ex Colebr., *Dendrocalamus strictus* (Roxb.) Nees, *Eucalyptus* spp., *Kydia calycina* Roxb. and *Pterocarpus marsupium* Roxb.

xvi. Perfume: From essential oils of *Cymbopogon martini* (Roxb.) Wats, *Jasminum* spp., *Michelia champaca* L. and *Vetiveria zizanioides* (L.) Nash.

xvii. Platters and Bowls: Leaves of *Bauhinia vahlii* Wight & Arnott, *Butea monosperma* (Lam.) Taub., *Madhuca longifolia* (J. Koenig) Macbr. var. *latifolia* (Roxb.) Chevalier and *Shorea robusta* Roxb. ex Gaertn. f.

xviii. Thatching: *Oryza sativa* L., *Phoenix acaulis* Roxb. ex Buch.- Ham., *P. sylvestris* (L.) Roxb. and *Saccharum spontaneum* L.

xix. Weighing: Seeds of *Abrus precatorius* L. (Ratti).

FLORISTIC DIVERSITY

A total of 1288 species under 679 genera belonging to 168 families occur in the Satpura tiger reserve. Out of these 1181 species belong to angiosperms and 97 to pteridophytes (Table-2). A conspectus of families showing the number of genera and species in the Satpura tiger reserve is presented in Table- 3.

The ten dominant families showing maximum species diversity is given in Table-4. Poaceae is the dominant family comprising 145 species, followed by Fabaceae (120 spp.), Asteraceae (66 spp.), Cyperaceae (48 spp.), Euphorbiaceae (44 spp.), Acanthaceae (46 spp.), Scrophulariaceae (34 spp.), Orchidaceae and Lamiaceae (31 spp. each) and Rubiaceae (26 spp.).

The ten dominant families showing maximum generic diversity is presented by Table-5. Poaceae is again the dominant family comprising 72 genera, followed by Asteraceae (42 genera), Fabaceae (41 genera), Acanthaceae (24 genera), Rubiaceae (19 genera), Euphorbiaceae and Scrophulariaceae (18 genera each), Lamiaceae (16 genera), Orchidaceae (15 genera) and Asclepiadaceae (13 genera).

Among the ten dominant genera, the genus *Cyperus* shows maximum species diversity and represented by 30 species, followed by *Euphorbia* (18 spp.) , *Crotalaria* (15 spp.) etc. as shown in Table-6.

Table 2: Total number of species, genera and families reported from Satpura Tiger Reserve

Group	Families	Genera	Species
Angiosperms	132	626	1181
Dicots	108	480	877
Monocots	24	146	304
Gymnosperms	4	7	10
Pteridophytes	32	46	97
Total	**168**	**679**	**1288**

Table 3: Analysis of taxa of Angiosperms at Satpura Tiger Reserve, M.P.

Family	Genera	Species	Subspecies	Varieties
DICOTS				
Ranunculaceae	3	7	-	-
Dilleniceae	1	1	-	-
Magnoliaceae	2	2	-	-
Annonaceae	3	4	-	-
Menispermaceae	3	3	-	1
Berberidaceae	1	3	-	1
Nymphaeaceae	1	1	-	-
Papaveraceae	1	2	-	-
Capparaceae	4	7	-	-
Brassiacaceae	5	8	-	-
Violaceae	2	2	-	-
Flacourtiaceae	2	3	-	-
Cochlospermaceae	1	1	-	-
Polygalaceae	1	4	-	-
Caryophyllaceae	5	5	-	-
Tamaricaceae	1	2	-	-
Elatinaceae	1	1	-	-
Theaceae	1	1	-	-
Dipterocarpaceae	1	1	-	-
Malvaceae	9	21	1	-
Bomabacaceae	1	1	-	-
Sterculiaceae	7	8	-	-
Tiliaceae	3	16	-	-
Linaceae	2	3	-	-
Geraniaceae	1	1	-	-
Malpighiaceae	2	2	-	-
Zygophyllaceae	1	1	-	-
Oxalidaceae	2	6	-	-

Family	Genera	Species	Subspecies	Varieties
Balsaminaceae	1	3	-	-
Simaroubaceae	1	1	-	-
Balanitaceae	1	1	-	-
Rutaceae	5	8	-	-
Burseraceae	2	2	-	-
Meliaceae	5	5	-	-
Celastraceae	3	3	-	-
Rhamnaceae	4	9	-	-
Vitaceae	5	8	-	-
Leeaceae	1	3	-	-
Sapindaceae	4	4	-	-
Anacardiaceae	6	6	-	-
Moringaceae	1	1	-	-
Fabaceae	41	120	1	4
Caesalpiniaceae	7	21	-	-
Mimosaceae	8	21	-	-
Rosaceae	4	7	-	-
Saxifragaceae	1	1	-	-
Crassulaceae	1	1	-	-
Droseraceae	1	2	-	-
Campanulaceae	3	10	-	-
Myrtaceae	4	7	-	-
Lecythidaceae	1	1	-	-
Melastomaceae	3	3	-	-
Lythraceae	5	11	-	1
Onagraceae	1	4	-	-
Trapaceae	1	1	-	1
Passifloraceae	1	2	-	-
Cucurbitaceae	6	10	-	-
Begoniaceae	1	2	-	-
Cactaceae	1	2	-	-
Molluginaceae	2	3	-	-
Apiaceae	7	13	-	1
Araliaceae	1	1	-	-
Cornaceae	1	1	-	-
Rubiaceae	19	26	-	-
Asteraceae	42	66	-	2
Stylidiaceae	1	1	-	-
Campanulaceae	3	6	-	-
Plumbaginaceae	1	1	-	-
Primulaceae	2	3	-	-
Myrsinaceae	1	1	-	-
Sapotaceae	3	4	-	-

Family	Genera	Species	Subspecies	Varieties
Ebenaceae	1	1	-	-
Oleaceae	3	6	-	-
Apocynaceae	10	11	-	-
Asclepiadaceae	13	17	-	-
Buddlejaceae	1	2	-	-
Loganiaceae	2	2	-	-
Gentiancaeae	5	9	-	-
Menyanthaceae	1	1	-	-
Boraginaceae	7	15	-	1
Convolvulaceae	8	19	-	-
Solanaceae	6	13	-	-
Scrophulariaceae	18	34	-	-
Orobachaceae	1	1	-	-
Lentibulariaceae	1	7	-	1
Gesneriaceae	3	3	-	-
Bignoniaceae	8	8	-	-
Pedaliaceae	1	1	-	-
Marytinaceae	1	1	-	-
Acanthaceae	24	44	-	3
Verbenaceae	12	13	-	1
Lamiaceae	16	31	-	-
Nyctaginaceae	4	6	-	-
Amaranthaceae	10	13	-	2
Chenopodiaceae	1	2	-	-
Basellaceae	1	1	-	-
Polygonaceae	4	8	1	-
Aristolochiaceae	1	1	-	-
Lauraceae	2	2	-	-
Proteaceae	1	1	-	-
Loranthaceae	3	6	-	-
Santalaceae	1	1	-	-
Euphorbiaceae	18	50	-	1
Ulmaceae	2	3	-	-
Urticaceae	6	8	-	-
Moraceae	3	19	-	2
Salicaceae	1	1	-	-
Ceratophyllaceae	1	1	-	-
MONOCOT				
Hydrocharitaceae	2	2	-	-
Orchidaceae	15	31	-	1
Zingiberaceae	6	11	-	-
Costaceae	1	1	-	-
Cannaceae	1	1	-	-
Musaceae	2	2	-	-

Family	Genera	Species	Subspecies	Varieties
Strelitziaceae	1	1	-	-
Hypoxidaceae	2	3	-	-
Amaryllidaceae	1	1	-	-
Tacccaceae	1	1	-	-
Agavaceae	3	5	-	-
Sansevieriaceae	1	1	-	-
Dioscoreaceae	1	8	-	1
Liliaceae	8	10	-	1
Smilacaceae	1	1	-	-
Pontederiaceae	2	2	-	-
Commelinaceae	6	15	-	-
Arecaceae	1	3	-	-
Araceae	7	7	-	-
Najadaceae	1	1	-	-
Aponogetonaceae	1	1	-	-
Eriocaulaceae	1	6	-	-
Cyperaceae	9	48	-	1
Poaceae	72	145	-	1

Table 4: Ten dominant families showing species diversity

Family	Number of species
Poaceae	145
Fabaceae	120
Asteraceae	66
Cyperaceae	48
Acanthaceae	46
Euphorbiaceae	44
Scrophulariaceae	34
Orchidaceae	31
Lamiaceae	31
Rubiaceae	26

Table 5: Ten dominant families showing generic diversity

Family	Number of generac
Poaceae	72
Asteraceae	42
Fabaceae	41
Acanthaceae	24
Rubiaceae	19
Euphorbiaceae	18
Scrophulariaceae	18
Lamiaceae	16
Orchidaceae	15
Asclepiadaceae	13

Table 6: Ten dominant genera showing species diversity

Genus	Number of species
Cyperus	38
Euphorbia	18
Crotalaria	15
Ficus	14
Dalbergia	13
Eragrostis	12
Indigofera	10
Alysicarpus	10
Acacia	10
Lindernia	10

Table 7: Some rare and threatened plants from Satpura Tiger Reserve

Botanical name	Family	Status
Abrus pulchellus Wall. ex Thwaites	Leguminasae	Rare
Acacia donaldi Haines	Mimosaceae	Rare
Antidesma meansu Miq. ex Tul.	Euphorbiaceae	Rare
Argostemma courtallense Arnott	Rubiaceae	Rare
Argyreia nervosa (Burm. f.) Bojer	Convolvulaceae	Rare
Begonia malabarica Lam.	Begoniaceae	Rare
Berberis asiatica Roxb. ex DC.	Berberidaceae	Threatened
B. hainesii Ahrendt var. *hainesii* Ahrendt	Berberidaceae	Rare
Brachiaria deflexa (Schum.) C.E. Hubb. ex Robyns	Poaceae	Rare
Breea arvensis (L.) Less.	Asteraceae	Rare
Breynia retusa (Dennst.) Alston	Euphorbiaceae	Rare
Bupleurum plantaginifolium Wight	Apiaceae	Rare
Caesalpinia decapetala (Roth) Alston	Leguminasae	Rare
Cajanus heynei (Wight & Arn.) Maesen	Leguminasae	Threatened
Ceropegia oculata Hook f.	Asclepiadaceae	Rare
Corallocarpus epigaeus (Rottl. & Willd.) Hook. f.	Cucurbitaceae	Rare
Crotalaria triquetra Dalz.	Leguminasae	Rare
Cynoglossum wallichii G. Don	Boraginaceae	Rare
Cyperus polystachyos Rottb.	Cyperaceae	Rare
Dipterancanthus patulus (Jacquem) Nees	Acanthaceae	Rare
Drosera burmanii Vahl	Droseraceae	Rare
D. indica L.	Droseraceae	Rare
Dysolobium grande (Wall. ex Benth.) Prain	Leguminasae	Rare
Ecbolium viride (Forssk.) Alston	Acanthaceae	Rare

Rare/Threatended plants of the Area

The Satpura Tiger Reserve comprises a large number of rare/threatened plants. These species occur in deep gorges, rock crevices, near waterfalls, humid and shady places, slopes of hills and several places (Table 7).

Botanical Name	Family	Status
Elatostema surculosum Wight	Urticaceae	Rare
Eigeron kumaonaensis (Vierh.) Wendlbo	Asteraceae	Rare
Eriocaulon oryzetorum Mart.	Eriocaulaceae	Rare
Euphorbia caducifolia Haines	Euphorbiaceae	Rare
Eurya nitida Korth.	Theaceae	Rare
Ficus cupulata Haines	Moraceae	Rare
Geranium mascatense Boiss.	Geraniaceae	Rare
Hoya wightii Hook.	Asclepiadaceae	Rare
Impatiens inconspicua Benth. ex Wight & Arn.	Balsaminaceae	Rare
Indigofera hochstetteri Baker	Leguminosae	Rare
Ischaemum duthiei Stapf ex Bor	Poaceae	Rare
Liecanthus peduncularis (Wall. ex Royle) Wedd.	Urticaceae	Rare
Leea compactiflora Kurz	Leeaceae	Rare
Lepidagathis cuspidata Nees	Acanthaceae	Rare
Lindernia viscosa (Hornem.) Merr.	Scrophulariaceae	Rare
Lysimachia candida Lindl.	Primulaceae	Rare
Manisuris clarkei (Hack.) Bor	Poaceae	Rare
Pycnoyclea glauca Lindl.	Apiaceae	Rare
Rhamnus triqueter (Wall.) Lawson	Rhamnaceae	Rare
Sauromatum venosum (Ait.) Schott	Araceae	Rare
Senecio bombayensis Balakr.	Asteraceae	Threatened
Smithia pycnantha Benth. ex Baker	Leguminosae	Threatened
S. blanda Wall. ex Wight & Arn.	Leguminosae	Rare
S. seaforthianum Andr.	Solanaceae	Rare
Solanum dulcamara L.	Solanaceae	Rare
Striga densiflora (Benth.) Benth.	Scrophulariaceae	Rare
Strobilanthes walkeri Arnott ex Nees	Acanthaceae	Rare
Tripogon lisboae Stapf	Poaceae	Rare
Utricularia pubescens Sm.	Utriculariaceae	Rare

ENDEMIC SPECIES

Two species and a variety found to be endemic in Pachmarhi wild life sanctuary of Satpura Tiger Reserve are *Berberis hainesii* Ahrendt var. *hainesii* Ahrendt, *B. hainesii* Ahrendt var. *brevifoilipes* Ahrendt and *Ficus cupulata* Haines.

THREATS AND CONSERVATION

Several natural and biotic factors have been found to be responsible for the eradication of many species from the forests and, Satpura Tiger Reserve is not an exception. If these factors are not talked, they may lead to serious consequences.

The area enjoys the presence of deep gorges having many waterfalls, marshy places, perennial streams and hills at various elevations and provide suitable environment for luxuriant growth of ferns, orchids, bryophytes and many tiny herbs having immense ecological as well as economic value. Localities such as Jalgali, Jambudweep, Beefall, Sunderkund, Vanshree Vihar Handikho, Apsara Vihar, Big fall, Little fall, Dutches fall, Bade Mahadeo, Jatashankar, Chote Mahadeo, Panarpani, Tridhara etc. may be considered as gene bank of rare

species. The tourists specially the university group students and local medicinal plant collectors play a big role in exploiting such rare and important species in the area. Thus, there is an urgent need for their *in-situ* conservation and cultivation in existing conditions for their propagation.

The topography of the area harbours a number of medicinal plants. Due to biotic interference and physical removal by local medicinal practitioners and traders these plants now have become rare. It is now essential to have *in-situ* and *ex-situ* conservation of these medicinal plants and maintain the traditional knowledge base of the local practitioners.

The grassy patches (meadows/open glades) present in Pachmarhi sanctuary is a unique natural gift to the area. Due to human interference and proliferation of *Lantana camara,* the very existence of the meadows is under threat and it needs conservation.

Several exotic plants such as *Lantana camara* L., *Parthenium hysterophorus* L., *Duranta repens* L., *Ageratum conyzoides* L., *Elephantopus scaber* L. etc. (some of them are noxious weeds) are found in a well-established stage in this reserve. The invasion of some weeds has resulted in the replacement of many indigenous species. Therefore, there is an urgent need for eradication and mopping operation of these weeds.

Apart from above factors responsible for degradanig flora, the growth of tourism has resulted in nagative impacts like pollution of water at tourist's sports, vandalism, littering and probems of garbage disposal. Therefore, it is necessary to regulate such activities.

Further, the poaching of the wild life is another major problem in the area. The animals are killed by using poison in their food chain and villagers use various kinds of trap to grap the wild life.

There are many rare and endangered species which may be conserved in botanical gardens (*ex-situ* conservation) and re-introduced in their natural habitats afterwards. Greater emphasis should be given for *in-situ* conservation of flora and fauna as it provides ample opportunity to the individual species to interact, compete, evolve and survive with other species in nature.

Besides, environmental education and checking forest fires, the identification and documentation of species belonging to different categories of threat, is therefore, imperative for evolving any effective conservation strategy.

ENUMERATION

RANUNCULACEAE

Clematis gouriana Roxb. ex DC.
C. roylei Rehder
C. smilacifolia Wall.
C. triloba Heyne ex Roth
C. wightiana Wall.
Naravelia zeylanica (L.) DC.
Thalictrum foliolosum DC.

DILLENIACEAE

Dillenia pentagyna Roxb.

MAGNOLIACEAE

Magnolia grandiflora L.
Michelia champaca L.

ANNONACEAE

Annona squamosa L.
Miliusa tomentosa (Roxb.) Sinclair
M. velutina (Dunal) Hook. f. & Thomson
Polyalthia longifolia (Sonner.) Thwaites

MENISPERMACEAE

Cissampelos pareira L. var. **hirsuta** (Buch.-Ham. ex DC.) Forman
Cocculus hirsutus (L.) Diels
Tinospora cordifolia (Willd.) Miers ex Hook. f. & Thomson

BERBERIDACEAE

Berberis asiatica Roxb. ex DC.
B. hainesii Ahrendt
B. hainesii Ahrendt var. **brevifilipes** Ahrendt
B. lyceum Royle

NYMPHAEACEAE

Nymphaea nouchali Burm. f.

PAPAVERACEAE

Argemone mexicana L.
A. ochroleuca Sweet

BRASSICACEAE

Brassica campestris L.
B. napus L.
Cardamine hirsutea L.
C. scutata Thunb.
C. trichocarpa Hochst. ex A. Rich.
Cochlearia cochlearioides (Roth) Santapau & Maheshw.
Coronopus didymus (L.) Sm.
Rorippa indica (L.) Hiern

CAPPARACEAE

Capparis zeylanica L.
Cleome gynandra L.
C. monophylla L.
C. simplicifolia (Camb.) Hook. f. & Thomson
C. viscosa L.
Crateva unilocularis Buch. - Ham.
Maerua oblongifolia (Forssk.) A. Rich.

VIOLACEAE

Hybanthus enneaspermus (L.) F. Muell.
Viola betonicifolia Sm.

COCHLOSPERMACEAE

Cochlospermum religiosum (L.) Alston

FLACOURTIACEAE

Casearia graveolens Dalzell
C. tomentosa Willd.
Flacoutia indica (Burm. f.) Merr.

POLYGALACEAE

Polygala arvensis Willd.
P. elongata Klein ex Willd.
P. erioptera DC.
P. persicariifolia DC.

CARYOPHYLLACEAE

Drymaria cordata (L.) Willd. ex Roem. & Schult. ssp. **diandra** (Blume) J.A. Duke
Polycarpea corymbosa (L.) Lam.
Polycarpon prostratum (Fork.) Aschrse. & Schweinf.
Spergula arvensis L.
Vaccaria pyramidata Medik.

TAMARICACEAE

Tamarix aphylla (L.) Karst
T. ericoides Rottler ex Willd.

ELATINACEAE

Bergia ammanioides Roxb.

THEACEAE

Eurya nitida Korth.

DIPTEROCARPACEAE

Shorea robusta Gaertn. f.

MALVACEAE

Abelmoschus esculentus (L.) Moench.
Abutilon indicum (L.) Sweet
A. hirtum (Lam.) Sweet
A. persicum (Burm. f.) Merr.
Hibiscus lobatus (J.A. Murr.) Kuntze
H. panduriformis Burm. f.
H. sabdariffa L.
H. syriacus L.
H. vitifolius L.
Kydia calycina Roxb.
Malvastrum coromandelianum (L.) Garcke
Pavonia zeylanica (L.) Cav.
Sida acuta Burm. f.
S. alba L.
S. cordata (Burm. f.) Borss.-Walk.
S. cordifolia L.
S. mysorensis Wight & Arn.
S. rhombifolia L.
Thespesia lampas (Cav.) Dalzell & Gibson
Urena lobata L.
U. lobata L. ssp. **sinuata** (L.) Borss.-Walk.
U. repanda Roxb.

BOMBACACEAE

Bombax ceiba L.

STERCULIACEAE

Eriolaena candollei Wall.
Firmiana colorata (Roxb.) R. Br.
Helicteres isora L.
Melochia corchorifolia L.
Pterospermum acerifolium (L.) Willd.
Sterculia urens Roxb.
S. villosa Roxb. ex Sm.
Waltheria indica L.

TILIACEAE

Corchorus aestuans L.
C. capsularis L.
C. fascicularis Lam.
C. olitorius L.
C. trilocularis L.
Grewia elastica Royle
G. flavescens Juss.
G. helicterifolia Wall. ex G. Don
G. rothii DC.
G. subinaequalis DC.
G. tiliifolia Vahl
Triumfetta annua L.
T. pentandra A. Rich.
T. pilosa Roth
T. rhomboidea Jacquem.
T. rotundifolia Lam.

LINACEAE

Linum mysurense Heyne ex Benth.
L. usitatissimum L.
Reinwardtia indica Dumort.

MALPIGHIACEAE

Aspidopterys glabriuscula (Wall.) Juss.
Hiptage benghalensis (L.) Kurz

GERANIACEAE

Geranium mascatense Boiss.

ZYGOPHYLLACEAE

Tribulus terrestris L.

OXALIDACEAE

Biophytum petersianum G. Klotz
B. reinwardtii (Zucc.) G. Klotz
B. sensitivam (L.) DC.
Oxalis corniculata L.
O. corymbosa DC.
O. richardiana Babu

BALSAMINACEAE

Impatiens balsamina L.
I. inconspicua Benth. ex Wight & Arn.
I. klenii Wight & Arn.

RUTACEAE

Aegle marmelos (L.) Corrêa
Chloroxylon swietenia DC.
Citrus limenttioides Tanaka
C. limona (L.) Burm. f.
C. medica L.
Feronia limonia (L.) Swingle
Murraya koenigii (L.) Spreng.
M. paniculata (L.) Jack

SIMAROUBACEAE

Ailanthus excelsa Roxb.

BALANITACEAE

Balanites aegyptiaca (L.) Delile

BURSERACEAE

Boswellia serrata Roxb. ex Colebr.
Garuga pinnata Roxb.

MELIACEAE

Azadirachta indica A. Juss.
Melia azedarach L.
Soymida febrifuga (Roxb.) A. Juss.
Swietenia mahagoni (L.) Jacquem.
Toona ciliata Roem.

CELASTRACEAE

Cassine glauca (Rottb.) Kuntze
Celastrus paniculatus Willd.
Maytenus senegalensis (Lam.) Exell.

RHAMNACEAE

Helinus lanceolatus Brandis
Rhamnus triqueter (Wall.) M.A. Lawson
R. wightii Wight & Arn.
Ventilago denticulata Willd.
Ziziphus mauritiana Lam.
Z. nummularia (Burm. f.) Wight & Arn.
Z. oenoplia (L.) Mill.
Z. rugosa Lam.
Z. xylopyrus (Retz.) Willd.

VITACEAE

Ampelocissus latifolia (Roxb.) Planch.
A. tomentosa (Heyne ex Roth) Planch.
Cayratia pedata (Lam.) Juss. ex Gagnep.
C. trifolia (L.) Domin
Cissus quadrangularis L.
C. repanda Vahl
Tetrastigma laucostaphylum (Dennst.) Alston ex Mabb.
Vitis vinifera L.

LEEACEAE

Leea asiatica (L.) Ridsdale
L. compactiflora Kurz
L. macrophylla Roxb. ex Hornem.

SAPINDACEAE

Cardiospermum halicacabum L.
Dodonaea angustifolia L.f.
Sapindus emarginatus Vahl
Schleichera oleosa (Lour.) Oken.

ANACARDIACEAE

Buchanania lanzan Spreng.
Lannea coromandelica (Houtt.) Merr.
Mangifera indica L.
Rhus parviflora Roxb. ex DC.
Semecarpus anacardium L.f.
Spondias pinnata (L.f.) Kurz

MORINGACEAE

Moringa oleifera Lam.

LEGUMINASAE-PAPILIONOIDEAE

Abrus precatorious L.
A. pulchellus Wall. ex Thwaites
Aeschynomene indica L.
Alysicarpus bupleurifolius (L.) DC.
A. bupleurifolius (L.) DC. var. **gracilis** (Edgew.) Baker
A. glumaceus (Vahl) DC.
A. hamosus Edgew.
A. heneanus Wight & Arn.
A. longifolius (Rottl. ex Spreng.) Wight & Arn.
A. monilifer (L.) DC.
A. rugosus (Willd.) DC.
A. scariosus Graham ex Thwaites
A. tetragonolobus Edgew.
A. vaginalis (L.) DC.
A. vaginalis (L.) DC. var. **nummularifolia** (DC.) Miq.
Arachis hypogea L.
Argyrolobium flaccidum (Royle) Jaub. & Spach
Atylosia scarabaeoides (L.) Benth.
A. volubilis (Blanco) Gamble
Butea monosperma (Lam.) Taub.
B. superba Roxb.
Cajanus heynei (Wight & Arn.) Maesen
Calpurnea aurea (W.T. Ait.) Benth.
Cicer arietinum L.
Clitoria annua J. Grajan
C. ternatea L.
Crotalaria albida Heyne ex Roth
C. juncea L.
C. linifolia L.f.
C. medicaginea Lam.
C. mysorensis Roth
C. nana Burm. f.
C. orixensis Rottl. ex Willd.
C. prostrata Rottl. ex Willd.
C. pusilla Heyne ex Roth
C. retusa L.
C. sessiliflora L.
C. spectabilis Roth
C. trifoliastrum Willd.
C. triquetra Dalzell
C. umbellata Wight ex Wight & Arn.

Cullen corylifolia (L.) Medik.
Dalbergia lanceolaria L.f.
D. latifolia Roxb.
D. laxiflorum DC.
D. microphyllum (Thunb.) DC.
D. motorium (Houtt.) Merr.
D. paniculata Roxb.
D. pulchellum (L.) Benth.
D. ritchei Sanjappa
D. rotundifolium Baker
D. sissoo Roxb.
D. triflorum (L.) DC.
D. velutinum (Willd.) DC.
D. volubilis Roxb.
Desmodium dichotomum (Willd.) DC.
D. ferrugineum Wall. ex Thwaites
D. gangeticum (L.) DC.
D. heterocarpon (L.) DC.
Eleiotis monophylla (Burm. f.) DC.
Erythrina stricta Roxb.
E. suberosa Roxb.
Flemingia bracteata (Roxb.) Wight
F. fruticulosa Wall. ex Benth.
F. macrophylla (Willd.) Kuntze ex Merr.
F. nana Roxb.
F. semialata Roxb. ex Ait.
F. stricta Roxb.
Galactia tenuiflora (Klein ex Willd.) Wight & Arn.
G. tenuiflora (Klein ex Willd.) var. **villosa** (Wight & Arn.) Benth.
Indigofera astragalina DC.
I. cassioides Rottl. ex DC.
I. cordifolia Heyne ex Roth
I. glandulosa Wendl.
I. hochstetteri Baker
I. linifolia (L.f.) Retz.
I. linifolia (L.f.) Retz.
I. nummularifolia (L.) Livera ex Alston
I. tinctoria L.
I. trifoliata L.
I. trita L.f.
I. trita L.f. ssp. **subulata** (Vahl ex Poir.) Ali
Lablab purpureus (L.) Sweet
Lathyrus sativus L.
Lens culinaris Medik.
Macrotyloma uniflorum (Lam.) Verdc.
Melilotus indica (L.) All.
Millettia extensa (Benth.) Baker
Mucuna pruriens (L.) DC.
Ougeinia oojeinensis (Roxb.) Hochr.
Pongamia pinnata (L.) Pierre
Pterocarpus marsupium Roxb.
Pueraria tuberosa (Roxb. ex Willd.) DC.
Rhynchosia bracteata Benth. ex Baker
R. capitata DC.
R. minima (L.) DC.
R. rothii Benth. ex Aitch.
Sesbania bispinosa (Jacq.) Wight
S. cannabina (Retz.) Poir.
S. grandiflora (L.) Poir.
Shuteria vestita Wight & Arn.
Smithia bigemina Dalzell
S. blanda Wall. ex Wight & Arn.
S. ciliata Royle
S. conferta Sm.
S. pycnantha Benth. ex Baker
Sophora interrupta Bedd.
Tephrosia purpurea (L.) Pers.
T. strigosa (Dalzell) Santapau & Meheshw.
T. villosa (L.) Pers.
Teramnus labialis (L.f.) Spreng.
T. mollis Benth.
Uraria alopecuroides (Roxb.) Wight
U. picta (Jacq.) Dsev.
U. rufescens (DC.) Schindl.
Vigna dalzellina (Kuntze) Verdc.
V. mungo (L.) Hepper
V. radiata (L.) Wilczek
V. sublobata (Roxb.) Babu & S. Sharma
V. trilobata (L.) Verdc.
V. umbellata (Thunb.) Ohwi & Ohashi
V. unguiculata (L.) Walp.
V. vexillata (L.) A. Rich.
Zornia gibbosa Span.

LEGUMINOSAE-CAESALPINIOIDEAE

Bauhinia malabarica Roxb.
B. purpurea L.
B. racemosa Lam.

B. semla Wunderlin
B. vahlii Wight & Arn.
B. variegata L.
Caesalpinia bonduc (L.) Roxb.
C. decapetala (Roth) Alston
Cassia absus L.
C. auriculata L.
C. fistula L.
C. mimosoides L.
C. nodosa Roxb. ex Buch.-Ham.
C. occidentalis L.
C. pumila Lam.
C. tora L.
Delonix elata (L.) Gamble
D. regia (Bojer ex Hook.) Rafin.
Hardwickia binata Roxb.
Peltophorum pterocarpum (DC.) Backer ex K. Heyne
Tamarindus indica L.

LEGUMINOSAE-MIMOSOIDEAE

Acacia auriculiformis A. Cunn. ex Benth.
A. caesia (L.) Willd.
A. catechu (L.f.) Willd.
A. chundra (Roxb. ex Rottl.) Willd.
A. donaldi Haines
A. leucophloea (Roxb.) Willd.
A. nilotica (L.) Willd. ex Delite ssp. **indica** (Benth.) Brenan
A. pennata (L.) Willd.
A. sinuata (Lour.) Merill
A. torta (Roxb.) Craib
Albizia lebbeck (L.) Benth.
A. odoratissima (L.f.) Benth.
A. procera (Roxb.) Benth.
Dichrostachys cinerea (L.) Wight & Arn.
Leucaena laucocephala (Lam.) de Wit
Mimosa hamata Willd.
M. himalayana Gamble
M. pudica L.
Neptunia triquetera Benth.
Pithecellobium dulce (Roxb.) Benth.
Prosopis cineraria (L.) Druce

ROSACEAE

Malus sylvestris (L.) Mill.
Potentilla supina L.
Prunus armeniaca L.
P. cerasus L.
P. domestica L.
P. persica (L.) Batsch.
Rubus ellipticus Sm.

SAXIFRAGACEAE

Bergenia ciliata (Haw.) Sternb.

CRASSULACEAE

Kalanchoe pinnata (Lam.) Pers.

DROSERACEAE

Drosera burmanii Vahl
D. indica L.

COMBRETACEAE

Anogeissus acuminata (Roxb. ex DC.) Guill. & Perr.
A. latifolia (Roxb. ex DC.) Wall. ex Guill. & Perr.
A. pendula Edgew.
A. sericea Brandis
Combretum albidum G. Don
Terminalia alata Heyne ex Roth
T. arjuna (Roxb. ex DC.) Wight & Arn.
T. bellirica (Gaertn.) Roxb.
T. chebula Retz.
T. crenulata Roth

MYRTACEAE

Callistemon citrinus (Curtis) Stapf
C. lanceolatus DC.
Eucalyptus citriodora Hook.
E. globulus Labill.
Syzygium cumini (L.) Skeels
S. heyneanum Wall. ex Wight & Arn.

LECYTHIDACEAE

Careya arborea Roxb.

MELASTOMATACEAE

Melastoma malabathricum L.
Osbeckia muralis Naud.
Sonerila tenera Royle

LYTHRACEAE

Ammannia baccifera L.
A. baccifera L. var. **aegyptiaca** (Willd.) Koehne
A. multiflora Roxb.
Lagerstroemia parviflora Roxb.
L. reginae Roxb.
Lawsonia inermis L.
Rotala densiflora (Roth ex Roem. & Schult.) Koehne
R. indica (Willd.) Koehne
R. mexicana Cham. & Schleicht.
R. rotundifolia (Roxb.) Koehne
R. serpyllifolia (Roth.) Bremek.
Woodfordia fruticosa (L.) Kurz

ONAGRACEAE

Ludwigia adscendens (L.) Hara
L. hyssopifolia (G. Don) Exell
L. octovalvis (Jacq.) Raven
L. perennis L.

TRAPACEAE

Trapa natans L. var. **bispinosa** (Roxb.) Makino

PASSIFLORACEAE

Passiflora edulis Sims
P. foetida L.

CUCURBITACEAE

Brynopsis laciniosa (L.) Naud.
Cucumis melo L.
C. sativus L.
Diplocyclos palmatus (L.) C. Jeffrey
Momordica charantia L.
M. dioica Roxb. ex Willd.
Melothria leiosperma (Wight & Arn.) Cogn.
M. heterophylla (Lour.) Cogn.
M. maderaspatana (L.) Cogn.
Trichosanthes bracteata (Lam.) Voigt

BEGONIACEAE

Begonia malabarica Lam.
B. picta Sm.

CACTACEAE

Opuntia elatior Mill.

MOLLUGINACEAE

Glinus lotoides L.
G. oppositifolius (L.) DC.
Mollugo pentaphylla L.

APIACEAE

Bupleurum mueronatum Wight & Arn.
B. plantaginifolium Wight
Centella asiatica (L.) Urban
Hydrocotyle sibthorpioides Lam.
Pimpinella bracteata Haines
P. diversifolia DC.
P. heyneana (DC.) Wall. ex Kurz
P. wallichiana (Hohen.) Gandhi
Pycnocycla glauca Lindl.
Sanicula elata Buch. Ham. ex D. Don
Trachyspermum ammi (L.) Sprague
T. roxburghianum (DC.) Craib

ARALIACEAE

Schefflera venulosa (Wight & Arn.) Harms

CORNACEAE

Alangium salvifolium (L.f.) Wang.

RUBIACEAE

Anthocephalus chinensis (Lam.) A. Rich. ex Walp.
Argostemma sarmentosum Wall.
Catunaregam nilotica (Stapf) Tirveng.
C. spinosa (Thunb.) Tirveng.
Cephalanthus tetrandra (Roxb.) Ridsdale & Baker f.
Coffea arabica L.
Dentella repens (L.) J.R. Forst. & G. Forst.
Gardenia latifolia Ait.
G. resinifera Roth
G. turgida Roxb.
Haldina cordifolia (Roxb.) Ridsdale
Hymenodictyon orixense (Roxb.) Mabb.
Ixora pavetta Andrews
Knoxia sumatrensis (Retz.) DC.
Kohautia gracilis (Wall.) DC.
Mitragyna parvifolia (Roxb.) Korth.

Neanotis calycina (Hook. f.) Lewis
Oldenlandia affinis (Roem. & Schult.) DC.
O. corymbosa L.
O. diffusa (Willd.) Roxb.
O. herbacea (L.) Roxb.
Spermacoce hispida L.
S. pusilla Wall.
Spermadictyon suaveolens Roxb.
Thecagonum ovatifolium (Cav.) Babu
Wendlandia heynei (Roem. & Schult.) Sant. & Merch.

ASTERACEAE

Acanthospermum hispidum DC.
Adenostemma lavenia (L.) Kuntze
Ageratum conyzoides L.
Artemisia japonica Thunb.
A. nilagirica (C.B. Clarke) Pampan.
Bidens biternata (Lour.) Merr. & Sherff.
Blainvillea acmella (L.) Philipson
Blumea balsamifera (L.) DC.
B. bifoliata (L.) DC.
B. lacera (Burm.f.) DC.
B. membranacea Wall. ex DC.
B. oxyodonta DC.
B. virens DC.
Blumeopsis flava (DC.) Gagnep.
Caesulia axillaris Roxb.
Centipeda minima (L.) R. Br.
Chrysanthemum coronarium L.
Conyza bonariensis (L.) Cronquist
C. canadensis (L.) Cronquist
C. leucantha (D. Don) Ludlow & Raven
C. stricta Willd.
Cyathocline purpurea (Buch.-Ham. ex D. Don) Kuntze
Echinops echinatus Roxb.
Eclipta prostrata (L.) L.
Elephantopus scaber L.
Emilia sonchifolia (L.) DC.
Galinsoga parviflora Cav.
Glossocardia bosvallea (L.f.) DC.
Gnaphalium indicum (Klein ex Willd.) C.B. Clarke
G. pensylvanicum Willd.
G. polycaulon Pers.
G. pulvinatum Delile
Grangea maderaspatana (L.) Poir.
Guizotia abyssinica (L.f.) Cass.
Lagascea mollis Cav.
Laggera alata (D. Don) Schultz-Bip. ex Oliver
Launaea procumbens (Roxb.) Ramayya & Rajagopal
Oligochaeta ramosa (Roxb.) Wagenitz
Parthenium hysterophorus L.
Pentanema cernua (Dalzell) Ling
P. indica (L.) Ling
Pulicaria angustifolia DC.
P. foliolosa DC.
P. wightiana (DC.) C.B. Clarke
Senecio bombayensis Balakr.
S. edgeworthii Hook. f.
S. nudicaulis Buch.-Ham. ex D. Don
S. wightii (DC.) Benth. ex C.B. Clarke
Sigesbeckia orientalis L.
Sonchus brachyotus DC.
S. oleraceus L.
Sphaeranthus indicus L.
Spilanthes paniculata Wall. ex DC.
Synedrella nodiflora (L.) Gaertn.
Tagetes erecta L.
T. patula L.
Tridax procumbens L.
Vernonia aspera Buch.-Ham.
V. cinerea (L.) Less.
V. divergens (Roxb.) Edgew.
V. setigera Arn.
Wedelia montana var. **wallichii** (Less.) H. Koyama
W. urticaefolia DC. var. **wightii** DC.
Xanthium indicum Koen.

STYLIDIACEAE

Stylidium tenellum Sw.

CAMPANULACEAE

Campanula benthamii Wall. ex DC.
Lobelia alsinoides Lam.
L. heyneana Roem. & Schult.
L. nicotianifolia Roth ex Roem. & Schult.
Wahlenbergia crenata (Roem. & Schult.) Tyrn.

W. marginata (Thunb.) DC.

PLUMBAGINACEAE

Plumbago zeylanica L.

PRIMULACEAE

Anagallis arvensis L.
A. pumila Sw.
Lysimachia candida Lindl. ssp. **obovata** (Buch.-Ham. ex Hook. f.) Kunth

MYRSINACEAE

Embelia basaal (Roem. & Schult.) A. DC.

SAPOTACEAE

Madhuca longifolia (J. Koenig) Macbr. var. **latifolia** (Roxb.) Chevalier
Manilkara hexandra (Roxb.) Dubard
M. zapota (L.) P. Royen
Mimusops elengi L.

EBENACEAE

Diospyros melanoxylon Roxb.

OLEACEAE

Jasminum arborescens Roxb.
J. grandiflorum L.
J. officinale L.
J. roxburghianum Wall. ex C.B. Clarke
J. sambac (L.) Aiton
Nyctanthes arbor-tristis L.
Schrebera swietenioides Roxb.

APOCYNACEAE

Carissa congesta Wight
Catharanthus pusillus (Murr.) G. Don
Holarrhena pubescens (Buch.-Ham.) Wall. ex G. Don
Ichnocarpus frutescens (L.) R. Br.
Thevetia peruviana (Pers.) K. Schum.
Vallaris solanacea (Roth) Kuntze
Wrightia arborea (Dennst.) Mabb.
W. tinctoria R. Br.

ASCLEPIADACEAE

Asclepias curassavica L.
Calotropis gigantea (L.) R. Br.
C. procera (Aiton) R. Br.
Ceropegia hirsuta Wight & Arn.
C. macrantha Wight
Cryptolepis buchananii Roem. & Schult.
Gymnema hirsutum Wight & Arn.
G. sylvestre (Retz.) R. Br. ex Schult.
Hemidesmus indicus (L.) R. Br.
Holostemma ada-kodien Schult.
Hoya wightii Hook. f.
Leptadenia pyrotechnica (Forssk.) Decne.
L. reticulata (Retz.) Wight & Arn.
Marsdenia tenacissima (Roxb.) Moon
Telosma pallida (Roxb.) Craib
Tylophora fasciculata Buch.-Ham. ex Wight

LOGANIACEAE

Mitreola petiolata (J.F. Gmel.) Torrey. & A. Gray
Strychnos potatorum L.f.

BUDDLEJACEAE

Buddleja asiatica Lour.
B. madagascariensis Lam.

GENTIANACEAE

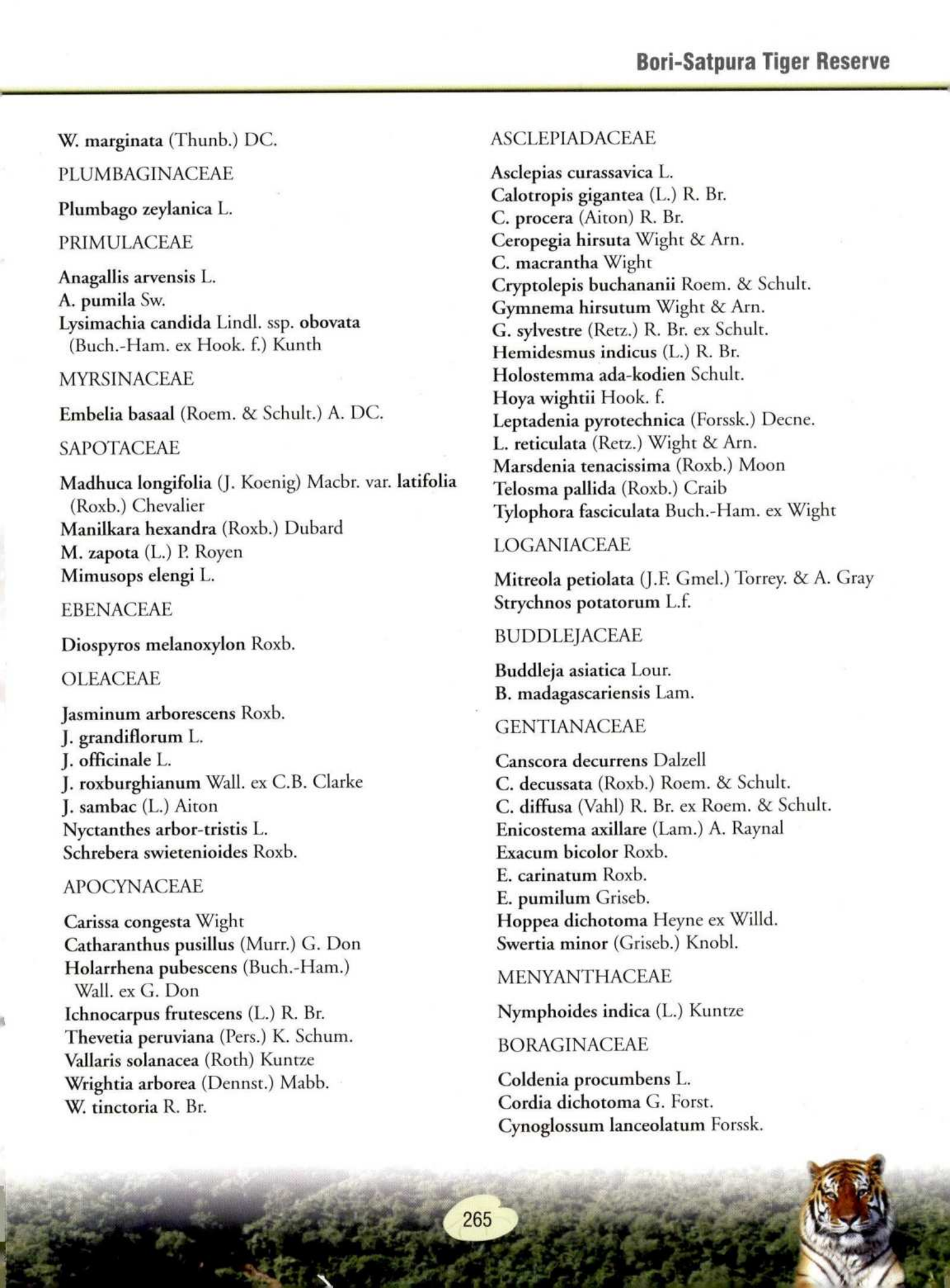
Canscora decurrens Dalzell
C. decussata (Roxb.) Roem. & Schult.
C. diffusa (Vahl) R. Br. ex Roem. & Schult.
Enicostema axillare (Lam.) A. Raynal
Exacum bicolor Roxb.
E. carinatum Roxb.
E. pumilum Griseb.
Hoppea dichotoma Heyne ex Willd.
Swertia minor (Griseb.) Knobl.

MENYANTHACEAE

Nymphoides indica (L.) Kuntze

BORAGINACEAE

Coldenia procumbens L.
Cordia dichotoma G. Forst.
Cynoglossum lanceolatum Forssk.



C. wallichii G. Don. var. **glochidiatum** (Wall. ex Benth.) Kazmi
C. zeylanicum (Vahl ex Horn.) Thunb. ex Lehm.
Ehretia canarensis (C.B. Clarke) Gamble
E. laevis Roxb.
Heliotropium indicum L.
H. marifolium Retz.
H. ovalifolium Forssk.
H. strigosum Willd. ssp. **brevifolium** (Wall.) Kazmi
H. strigosum Willd. ssp. **strigosum**
H. supinum L.
Rotula aquatica Lour.
Trichodesma indicum (L.) R. Br. ex Lehm.
T. zeylanicum (Burm. f.) R. Br.

CONVOLVULACEAE

Argyreia involucrata C. B. Clarke
A. kleiniana (Roem. & Schult.) Raizada
A. nervosa (Burm. f.) Bojer
A. sericea Dalzell & Gibson
A. strigosa (Roth) Roberty
Convolvulus prostratus Forssk.
Cuscuta reflexa Roxb.
Evolvulus alsinoides (L.) L.
Ipomoea cairica (L.) Sweet
I. eriocarpa R. Br.
I. hederifolia L.
I. nil (L.) Roth
I. obscura (L.) Ker-Gawl.
I. pestigridis L.
I. purpurea (L.) Roth
I. quamoclit L.
Jacquemontia paniculata (Burm. f.) Hall. f.
Merremia tridentata (L.) Hall.f.
Rivea hypocrateriformis (Desr.) Choisy

SOLANACEAE

Capsicum frutescens L.
Datura innoxia Mill.
D. metel L.
Nicandra physalodes (L.) Scop.
Nicotiana plumbaginifolia Viv.
N. tabacum L.
Physalis minima L.
Solanum dulcamara L.
S. incanum L.
S. nigrum L.
S. seaforthianum Andr.
S. torvum Sw.
S. virginianum L.

SCROPHULARIACEAE

Adenosma indianum (Lour.) Merr.
Alectra thomsoni Hook. f.
Bacopa monnieri (L.) Wettst.
B. procumbens (Mill.) Greenm.
Buchnera hispida Buch.-Ham. ex D. Don
Centranthera nepalensis D.Don
Kickxia incana (Wall.) Pennell
K. ramosissima (Wall.) Janchen
Limnophila aromatica (Lam.) Merr.
L. connata (Buch.-Ham. ex D. Don) Hand.-Mazz.
L. indica (L.) Druce
L. rugosa (Roth) Merr.
Lindenbergia indica (L.) Vatke
Lindernia caespitosa (Blume) Panigrahi
L. ciliata (Colsm.) Pennell
L. crustacea (L.) F. Muell.
L. hookeri (C.B. Clarke ex Hook. f.) Wettst.
L. hyssopioides (L.) Haines
L. nummularifolia (D. Don) Wettst.
L. parviflora (Roxb.) Haines
L. procumbens (Krock.) Borbas.
L. sessiliflora (Benth.) Wettst.
L. viscosa (Hornem.) Boldingh
Mazus pumilus (Burm.f.) Steenis
Russelia equisetiformis Schlechtend. & Cham.
Scoparia dulcis L.
Sopubia delphinifolia (L.) G. Don
Stemodia viscosa Roxb.
Striga angustifolia (D. Don) Saldanha
S. asiatica (L.) Kuntze
S. gesnerioides (Willd.) Vatke
Sutera dissecta (Delile) Walp.
Verbascum chinense (L.) Santapau
Veronica anagallis-aquatica L.

OROBANCHACEAE

Orobanche aegyptiaca Pers.

LENTIBULARIACEAE

Utricularia arenaria A.DC.
U. caerulea L. var. **graminifolia** (Vahl) Bhattacharyya
U. exoleta R. Br.
U. pubescens Sm.
U. scandens Benj.
U. striatula Sm.
U. uliginosa Vahl

GESNERIACEAE

Chirita bifolia D. Don
Didymocarpus pygmaea C. B. Clarke
Epithema carnosum (G. Don) Benth.

BIGNONIACEAE

Dolichandrone falcata (Wall. ex DC.) Seem.
Millingtonia hortensis L.f.
Oroxylum indicum (L.) Venen.
Radermachera xylocarpa (Roxb.) K. Schum.
Spathodea campanulata P. Beauv.
Stereospermum chelonoides (L.f.) DC.
Tabebuia rosea (Bertol.) DC.
Tecoma stans (L.) Juss. ex Kunth

PEDALIACEAE

Sesamum indicum L.

MARTYNIACEAE

Martynia annua L.

ACANTHACEAE

Adhatoda zeylanica Medik.
Andrographis paniculata (Burm.f.) Wall. ex Nees
Barleria cristata L.
B. gibsoni Dalzell
B. montana Nees
B. prionitis L.
Blepharis maderaspatensis (L.) Heyne ex Roth
B. repens (Vahl) Roth
Carvia callosa (Nees) Bremek.
Dicliptera roxburghiana Nees
D. verticillata (Forssk.) C. Christensen
Dipteracanthus cernuus (Roxb.) Santapau
D. prostratus (Poir.) Nees
D. suffruticosus (Roxb.) Voigt
Ecbolium viride (Forssk.) Alston
Eranthemum purpurascens Wight ex Nees
Gendarussa vulgaris Nees
Haplanthodes verticillatus (Roxb.) Majumdar
Hemigraphis latebrosa (Heyne ex Roth) Nees
Hygrophila auriculata (Schum.) Heine
H. polysperma (Roxb.) T. Anderson
H. serpyllum (Nees) T. Anderson
Indoneesiella echioides (L.) Sreem.
Justicia betonica L.
J. diffusa Willd.
J. diffusa Willd. var. **hedyotifolia** (Nees) C.B. Clarke
J. latispica Gamble
J. neesii Raman.
J. procumbens L.
J. prostrata (C.B. Clarke) Gamble
J. quinqueangularis Koenig ex Roxb. var. **peploides** (Nees) C.B. Clarke
J. quinqueangularis Koenig ex Roxb. var. **quinqueangularis**
J. simplex D. Don
Lepidagathis cristata Willd.
L. cuspidata Nees
L. fasciculata (Retz.) Nees
Nelsonia canescens (Lam.) Spreng.
Nilgirianthus campanulatus (Wight) Bremek.
N. heyneanus (Nees) Bremek.
Perilepta auriculata (Nees) Bremek.
Peristrophe paniculata (Forssk.) Brummitt
Petalidium barlerioides (Roth) Nees
Rungia pectinata (L.) Nees
R. repens (L.) Nees
Strobilanthes asperrimus Nees
S. walkeri Arn. ex Nees

Thunbergia alata Bojer ex Sims
T. laevis Nees

VERBENACEAE

Citharexylum spinosum L.
Clerodendrum serratum (L.) Moon
C. viscosum Vent.
Duranta repens L.
Gmelina arborea Roxb.
Holmskioldia sanguinea Retz.
Lantana camara L. var. **aculeata** (L.) Moldenke
L. indica Roxb.
Phyla nodiflora (L.) Greene
Premna barbata Wall. ex Schauer
Pygmaeopremna herbacea (Roxb.) Moldenke
Stachytarpheta jamaicensis (L.) Vahl
Tectona grandis L.f.
Vitex negundo L.

LAMIACEAE

Acrocephalus hispidus (L.) Nicolson & Sivad.
Anisochilus carnosus (L.f.) Wall. ex Benth.
A. eriocephalus Benth.
Anisomeles indica (L.) Kuntze
Colebrookea oppositifolia Sm.
Hyptis suaveolens (L.) Poit.
Lamium amplexicaule L.
Lavandula bipinnata (Roth) Kuntze
Leonotis nepetifolia (L.) R. Br.
Leucas biflora (Vahl) R. Br.
L. cephalotes (J. Koenig ex Roth) Spreng.
L. lanata Wall. ex Benth.
L. martinicensis (Jacquem) R. Br.
L. mollissima Wall. ex Benth.
L. montana (Roth) Spreng.
L. stricta Heyne ex Benth.
L. zeylanica (L.) R. Br.
Micromeria biflora (Buch.-Ham. ex D. Don) Benth.
Nepeta graciliflora Benth.
N. hidostana (Heyne ex Roth) Haines
Ocimum canum Sims
O. tenuiflorum L.
Orthosiphon rubicundus (D. Don) Benth.
O. thymiflorus (Roth) V.D. Sleerson
Plectranthus mollis (Aiton) Spreng.
P. rugosus Benth.
Pogostemon benghalense (Burm. f.) Kuntze
P. paniculatus (Willd.) Benth.
P. pubescens Benth.
P. purpurascens Dalzell
Salvia plebeia R. Br.

NYCTAGINACEAE

Boerhavia diffusa L.
B. procumbens Banks ex Roxb.
Bougainvillea glabra Choisy
B. spectabilis Willd.
Commicarpus chinensis (L.) Heimerl
Mirabilis jalapa L.

AMARANTHACEAE

Achyranthes aspera L. var. **argentea** (Thwaites) Hook.f.
A. aspera L. var. **porphyristachya** (Wall. ex Miq.) Hook. f.
A. bidentata Blume
Aerva lanata (L.) Juss. ex Schult.
A. sanguinolenta (L.) Blume
Allmania nodiflora (L.) R. Br. ex Wight
Alternanthera sessilis (L.) R. Br. ex DC.
Amaranthus spinosus L.
A. viridis L.
Celosia argentea L.
Digera muricata (L.) Mart.
Gomphrena celosioides Mart.
Pupalia lappacea (L.) Juss.
Trichuriella monsoniae (L.f.) Bennet

CHENOPODIACEAE

Chenopodium album L.
C. murale L.

BASELLACEAE

Basella alba L.

POLYGONACEAE

Antigonon leptopus Hook. & Arn.

Muehlenbeckia platyclada (F. Muell. ex Hook.) Meisn.
Polygonum barbatum L.
P. dichotomum Blume
P. glabrum Willd.
P. nepalense Meisn.
P. plebeium R. Br.
Rumex dentatus L. ssp. **klotzschianus** (Meisn.) Reichb. f.

ARISTOLOCHIACEAE

Aristolochia bracteolata Lam.

PIPERACEAE

Piper longum L.

LAURACEAE

Cinnamomum tamala T. Nees
Litsea glutinosa (Lour.) Robinson

PROTEACEAE

Grevillea robusta A. Cunn. ex R. Br.

LORANTHACEAE

Dendrophthoe falcata (L.f.) Etting.
Loranthus budleioides Desr.
L. cordifolius Wall.
L. philippensis Cham. & Schlechtend.
Viscum articulatum Burm. f.

SANTALACEAE

Osyris quadriparitita Slazm. ex Decne.

EUPHORBIACEAE

Acalypha indica L.
A. wilkesiana Muell. Arg.
Antidesma acidum Retz.
A. ghaesembilla Gaertn.
A. menasu Miq. ex Tul.
Baliospermum montanum (Willd.) Muell. Arg.
Breynia retusa (Dennst.) Alston
B. vitis-idaea (Burm.f.) C. Fischer
Bridelia retusa (L.) Spreng.
Cleistanthus collinus (Roxb.) Benth. ex Hook. f.
Drypetes roxburghii (Wall.) Hurusawa
Euphorbia antiquorum L.
E. caducifolia Haines
E. chamaesyce L.
E. cristata Heyne ex Roth
E. dracunculoides Lam.
E. heterophylla L.
E. heyneana Spreng.
E. hirta L.
E. hypericifolia L.
E. monophylla Heyne ex Roth
E. milii Desmoul
E. neriifolia L.
E. nivula Buch.-Ham.
E. perbracteata Gage
E. pulcherrima Willd. ex Klotzsch
E. pycnostegia Boiss.
E. pycnostegia Boiss. var. **zornioides** (Boiss.) Santapau
E. thymifolia L.
E. tirucalli L.
Glochidion johnstonei Hook.f.
G. velutinum Wight
Homonoia riparia Lour.
Jatropha curcas L.
J. gossypifolia L.
J. integerrima Jacq.
Mallotus philippensis (Lam.) Muell. Arg.
Phyllanthus amarus Schumach. & Thonn.
P. emblica L.
P. maderaspatensis L.
P. virgatus G. Forst.
Ricinus communis L.
Sauropus quadrangularis Müll. Arg.
Sebastiania chamaelea (L.) Müll. Arg.
Securinega leucopyrus (Willd.) Müll. Arg.
S. virosa (Roxb. ex Willd.) Baill.
Tragia plukenetii R. R. Sm.

URTICACEAE

Boehmeria macrophylla Hornem.
B. scabrella Gaud.
Elatostema surculosum Wight
Girardinia diversifolia (Link) Friis

Laportea interrupta (L.) Chew.
Lecanthus peduncularis (Wall. ex Royle) Wedd.
Pouzolzia zeylanica (L.) Benn.

ULMACEAE

Holoptelea integrifolia (Roxb.) Planch.
Trema orientalis (L.) Blume
T. politoria Planch.

MORACEAE

Artocarpus heterophyllus Lam.
Ficus arnottiana (Miq.) Miq.
F. benghalensis L.
F. carica L.
F. cupulata Haines
F. exasperata Vahl
F. fruticosa Roxb.
F. hispida L.f.
F. microcarpa L.f.
F. mollis Vahl
F. racemosa L.
F. religiosa L.
F. rumphii Blume
F. tinctoria G. Forst. ssp. **gibbosa** (Blume) Corner
F. tinctoria G. Forst. ssp. **parasitica** (Willd.) Corner
F. virens Dryander
Morus alba L.

SALICACEAE

Salix tetrasperma Roxb.

CERATOPHYLLACEAE

Ceratophyllum demersum L.

MONOCOTS

HYDROCHARITACEAE

Hydrilla verticillata (L.f.) Royle
Vallisneria natans (Lour.) Hara

ORCHIDACEAE

Aerides maculosum Lindl.
A. multiflorum Roxb.
A. odoratum Lour.
Dendrobium crepidatum Lindl.
D. herbaceum Lindl.
Epipactis veratrifolia Boiss.
Eulophia explanata Lindl.
E. herbacea Lindl.
Geodorum densiflorum (Lam.) Schlechter
Goodyera procera (Ker-Gawl.) Hook.
Habenaria digitata Lindl.
H. foliosa A. Rich. var. **foetida** (Blatt. & McCann) Bennet
H. grandifloriformis Blatt. & McCann
H. plantaginea Lindl.
H. roxburghii Nicolson
Liparis atropurpurea Lindl.
Malaxis acuminata D. Don
M. latifolia Sm.
M. mackinnonii (Duthie) Ames
M. rheedii Sw.
Nervilia aragoana Gaud.
N. prainiana (King & Pant.) Seidenf. & Smitin.
Peristylus constrictus (Lindl.) Lindl.
P. goodyeroides (D. Don) Lindl.
P. lawii Wight
P. stocksii (Hook. f.) Kraenzl.
Phaius tancarvilleae (Banks ex L. Her.) Blume
Platanthera susannae (L.) Lindl.
Rhynchostylis retusa (L.) Blume
Vanda tessellata (Roxb.) Hook. ex G. Don
V. testacea (Lindl.) Reichb. f.

ZINGIBERACEAE

Alpinia calcarata Roscoe
Amomum dealbatum Roxb.
Curcuma amada Roxb.
C. aromatica Salisb.
C. decipiens Dalzell
Globba marantina L.
Hedychium coronarium J. Koenig
Zingiber zerumbet (L.) Roscoe ex Sm.

COSTACEAE

Costus speciosus (J. Koenig) Sm.

MUSACEAE

Ensete superbum (Roxb.) Cheesman

Musa paradisiaca L.

STRELITZIACEAE

Ravenala madagascariensis Sonn.

CANNACEAE

Canna coccinea Mill.

HYPOXIDACEAE

Curculigo crassifolia (Baker) Hook. f.
C. orchioides Gaertn.
Hypoxis aurea Lour.

AMARYLLIDACEAE

Crinum defixum Kar-Gawl.

AGAVACEAE

Agave angustifolia Haw.
A. cantula Roxb.
Cordyline terminalis Kunth
Dracaena concinna Kunth
D. elliptica Thunb.

TACCACEAE

Tacca leontopetaloides (L.) Kuntze

SANSEVIERIACEAE

Sansevieria zeylanicum (L.) Willd.

DIOSCOREACEAE

Dioscorea belophylla (Prain) Voigt ex Haines
D. bulbifera L.
D. hispida Dennst.
D. oppositifolia L.
D. pentaphylla L. var. **communis** Prain & Burkill
D. pubera Blume
D. tomentosa J. Koenig ex Spreng.
D. wightii Hook. f.

LILIACEAE

Aloe vera (L.) Burm.f.
Asparagus racemosus Willd.
Asphodelus tenuifolius Cav.
Chlorophytum arundinaceum Baker
C. laxum R. Br.
C. tuberosum (Roxb.) Baker
Gloriosa superba L.
Iphigenia indica (L.) A. Gray
Scilla hyacinthina (Roth) Macbr.
Urginea indica (Roxb.) Kunth

SMILACACEAE

Smilax perfoliata Lour.

PONTEDERIACEAE

Eichhornia crassipes (Mart.) Solms
Monochoria vaginalis (Burm. f.) K. Presl

COMMELINACEAE

Commelina attenuata Koenig ex Vahl
C. benghalensis L.
C. diffusa Burm.f.
C. erecta L.
C. hasskarlii C.B. Clarke
C. longifolia Lam.
C. paludosa Blume
C. suffruticosa Blume
Cyanotis arachnoidea C.B. Clarke
C. cristata (L.) D. Don
Floscopa scandens Lour.
Murdannia nudiflora (L.) Brenan
M. spirata (L.) Brückner
Rhoeo spathacea (Sw.) W.T. Stearn
Zebrina pendula Schnizl

ARECACEAE

Phoenix acaulis Buch.-Ham. ex Roxb.
P. loureirii Kunth
P. sylvestris (L.) Roxb.

ARACEAE

Amorphophallus bulbifer (Roxb.) Blume
Arisaema tortuosum (Wall.) Schott
Colocasia esculenta (L.) Schott
Plesmonium margaritiferum (Roxb.) Schott
Remusatia vivipara (Roxb.) Schott
Sauromatum venosum (Aiton) Schott
Typhonium trilobatum (L.) Schott

NAJADACEAE

Najas graminea Delile

APONOGETONACEAE

Aponogeton natans (L.) Engl. & K. Krause

ERIOCAULACEAE

Eriocaulon cinereum R. Br.
E. longicuspis Hook. f.
E. oryzetorum Mart.
E. parviflorum (Fyson) Ansari & N.P. Balakr.
E. quinquangulare L.
E. xeranthemum Mart.

CYPERACEAE

Bulbostylis barbata (Rottb.) C.B. Clarke
Carex cruciata Wahlenb.
C. filicina Nees
Cyperus alulatus Kern
C. brevifolius (Rottb.) Hassk.
C. compactus Retz.
C. compressus L.
C. cuspidatus Kunth
C. cyperinus (Retz.) Valck.-Suring.
C. cyperoides (L.) Kuntze
C. difformis L.
C. distans L.f.
C. dubius Rottb.
C. esculentus L.
C. exaltatus Retz.
C. flavidus Retz.
C. imbricatus Retz.
C. iria L.
C. kyllingia (Rottb.) Endl.
C. leucocephalus Retz.
C. niveus Retz.
C. nutans Vahl var. **eleusinoides** (Kunth) Haines
C. pangorei Rottb.
C. paniceus (Rottb.) Boeck.
C. pilosus Vahl
C. polystachyos Rottb.
C. pulchellus R. Br.
C. pumilus L.
C. pygmaeus Rottb.
C. rotundus L.
C. squarrosus L.
C. tenuispica Steud.
C. triceps Endl.
Eleocharis atropurpurea (Retz.) J. & K. Presl
Fimbristylis bisumbellata (Forssk.) Bubani
F. dichotoma (L.) Vahl
F. falcata (Vahl) Kunth
F. littoralis Gaud.
F. ovata (Burm.f.) Kern
F. tetragona R. Br.
F. tomentosa R. Br.
Lipocarpha chinensis (Osbeck) Kern
Rhynchospora rugosa (Vahl) Gale
Scirpus squarrosus L.
Scleria levis Retz.
S. lithosperma (L.) Sw.
S. parvula Steud.
S. tessellata Willd.

POACEAE

Alloteropsis cimicina (L.) Stapf
Apluda mutica L.
Aristida adscensionis L.
A. depressa Retz.
A. setacea Retz.
Arthraxon hispidus (Thunb.) Makino
A. lancifolius (Trin.) Hochst.
A. meeboldii Stapf
A. prionodes (Steud.) Dandy
A. quartinianus (A. Rich.) Nash
Arundinella pumila (Hochst. ex A. Rich.) Steud.
A. setosa Trin.
Bambusa arundinacea (Retz.) Willd.
Bothriochloa glabra (Roxb.) A. Camus
B. intermedia (R.Br.) A. Camus
B. kuntzeana (Hack.) Henr.
B. pertusa (L.) A. Camus
Brachiaria deflexa (Schum.) C.E. Hubb. ex Robyns
B. ramosa (L.) Stapf
B. reptans (L.) Gard. & C.E. Hubb.
Capillipedium assimile (Steud.) A. Camus
Cenchrus ciliaris L.
Chionachne koenigii (Spreng.) Thwaites
Chloris barbata Sw.

C. dolichostachya Lag.
C. virgata Sw.
Chrysopogon polyphyllus (Hack. ex Hook. f.) Blatt. & Mc Cann
Coix aquatica Roxb.
C. gigantea J. Koenig ex Roxb.
C. lacryma-jobi L.
Cymbopogon martinii (Roxb.) Wats.
Cynodon dactylon (L.) Pers.
Cyrtococcum oxyphyllum (Steud.) Stapf
Dactyloctenium aegypticum (L.) P. Beauv.
Dendrocalamus strictus (Roxb.) Nees
Desmostachya bipinnata (L.) Stapf
Dichanthium annulatum (Forssk.) Stapf
D. aristatum (Poir.) C.E. Hubb.
D. caricosum (L.) A. Camus
Diectomis fastigiata (Sw.) Kunth
Digitaria ciliaris (Retz.) Keeler
D. longiflora (Retz.) Pers.
D. setigera Roth ex Roem. & Schult.
D. stricta Roth ex Roem. & Schult.
D. ternata (A. Rich.) Stapf ex Dyer
Dimeria connivens Hack.
D. ornithopoda Trin.
Echinochloa colonum (L.) Link
E. crusgalli (L.) P. Beauv.
Eleusine indica (L.) Gaertn.
Eragrostiella bifaria (Vahl) Bor
E. brachyphylla (Stapf) Bor
E. nardoides (Trin.) Bor
Eragrostis atrovirens (Desf.) Trin. ex Steud.
E. cilianensis (All.) Vignolo ex F.T. Huble
E. coarctata Stapf
E. diarrhena (Schult.) Steud.
E. gangetica (Roxb.) Steud.
E. japonica (Thunb.) Trin.
E. nutans (Retz.) Nees ex Steud.
E. tenella (L.) P. Beauv. ex Roem. & Schult.
E. tenuifolia (A. Rich.) Steud.
E. tremula (Lam.) Hochst. ex Steud.
E. unioloides (Retz.) Nees ex Steud.
E. viscosa (Retz.) Trin.
Eulalia trispicata (Schult.) Henr.
Eulaliopsis binata (Retz.) Hubb.
Garnotia tenella (Arnott ex Miq.) Jan.
Hackelochloa granularis (L.) Kuntze
Hemarthria compressa (L. f.) R. Br.
Heteropogon contortus (L.) P. Beauv. ex Roem. & Schult.
Hygroryza aristata (Retz.) Nees ex Wight & Arn.
Imperata cylindrica (L.) P. Beauv. var. **major** (Nees) C.E. Hubb. ex Hubb. & Vaughan
Isachne globosa (Thunb.) Kuntze
Ischaemum duthiei Stapf ex Bor
I. indicum (Houtt.) Merr.
I. semisagittatum Roxb.
Iseilema laxum Hack.
I. prostratum (L.) Anders.
Manisuris clarkei (Hack.) Bor
M. forficulata Fisch.
Melanocenchris jacquemontii Jaub. & Spach
Michrochloa indica (L.f.) P. Beauv.
Microstegium petiolare (Trin.) Bor
Narenga prophyrocoma (Hance) Bor
Oplismenus burmannii (Retz.) P. Beauv.
O. compositus (L.) P. Beauv.
Oropetium roxburghianum (Steud.) S.M. Phillips
Oryza sativa L.
Panicum brevifolium L.
P. notatum Retz.
P. paludosum Roxb.
P. psilopodium Trin.
P. sumatrense Roth ex Roem. & Schult.
P. trypheron Schult.
Paspalidium flavidum (Retz.) A. Camus
Paspalum orbiculare G. Forst.
P. scrobiculatum L.
P. vaginatum Sw.
Pennisetum hohenackeri Hochst. ex Steud.
P. hordeoides (Lam.) Steud.
P. orientale Rich.
P. pedicellatum Trin.
P. polystachyon (L.) Schult.
P. setosum (Sw.) L.C. Rich.
Perotis indica (L.) Kuntze
Phragmites karka (Retz.) Trin. ex Steud.

Tamarix ericoides

Pogonatherum paniceum (Lam.) Hack.
Pseudopogonatherum contortum (Brongn.) A. Camus
Pseudosorghum fasciculare (Roxb.) A. Camus
Rhynchelytrum repens (Willd.) C.E. Hubb.
R. villosum (Part.) Chiov.
Rottboellia exaltata L.f.
R. myurus Benth.
Saccharum spontaneum L.
Sacciolepis indica (L.) A. Chase
S. myosuroides (R. Br.) A. Camus
Schizachyrium exile (Hochst.) Stapf
Setaria barbata (Lam.) Kunth
S. glauca (L.) P. Beuav.
S. homonyma (Steud.) Choiv.
S. intermedia Roem. & Schult.
S. italica (L.) P. Beauv.
Sorghum halepense (L.) Pers.
S. miliaceum (Roxb.) Snowden
S. nitidum (Vahl) Pers.
Spodiopogon rhizophorus (Steud.) Pilger
Sporobolus capillaris Miq.
S. coromandelinus (Retz.) Kunth
S. elongatus R. Br.
S. fertilis (Steud.) W. D. Clayton
S. indicus (L.) R. Br.
S. piliferus (Trin.) Kunth
S. tenuissimus (Schrank) Kuntze
Themeda quadrivalvis (L.) Kuntze
T. triandra Forssk.
Thysanolaena maxima (Roxb.) Kuntze
Tripogon bromoides Roem. & Schult.
T. capillatus Jaub. & Spach.
T. lisboae Stapf
Triticum aestivum L.
Urochloa panicoides P. Beuav.
Vetiveria zizanioides (L.) Nash
Zea mays L.

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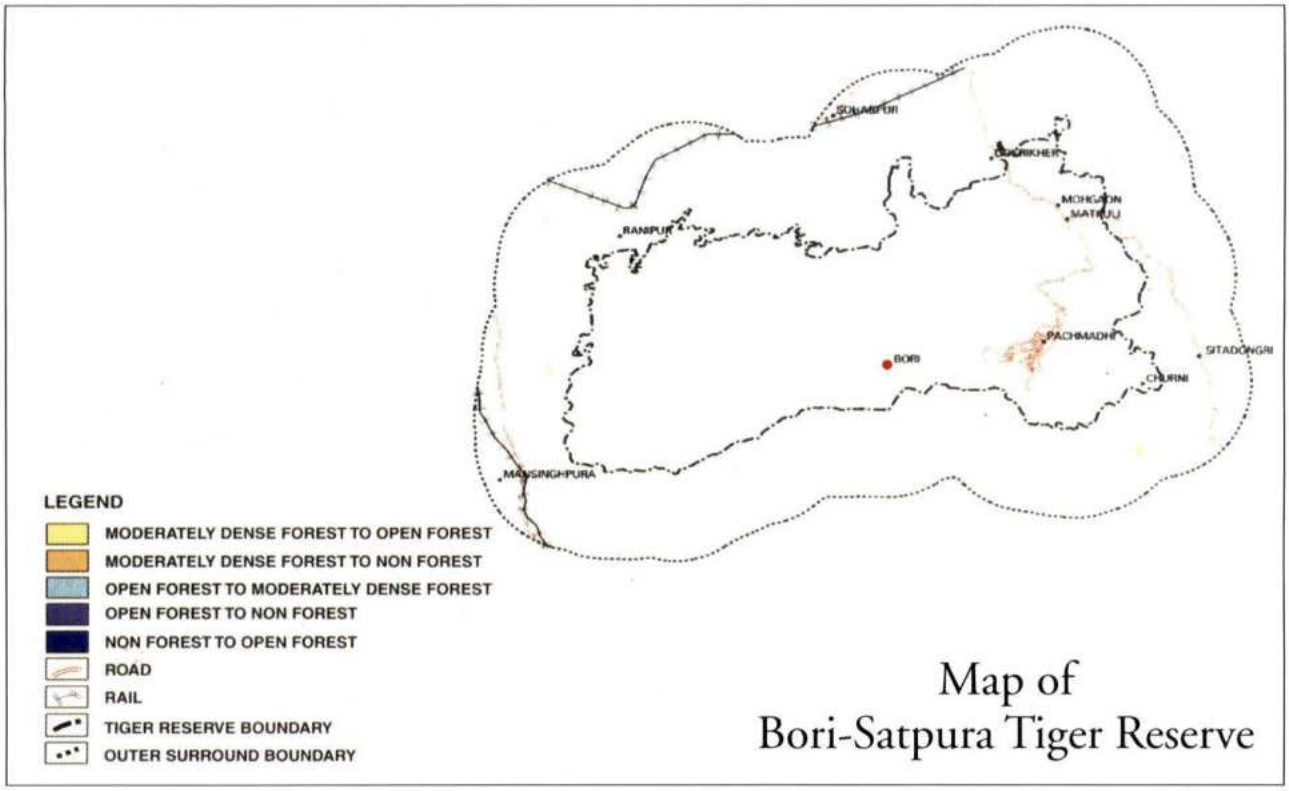

Map of
Bori-Satpura Tiger Reserve

SALIENT FEATURES

The Satpura hill range is one of the major geographical plateaus of India. The Dhoopgarh peak (1352 m above msl) located at Pachmarhi hill station is the highest point in the Satpura hill range. The TR consists of hill ranges, valleys, plains, deep gorges and water bodies providing a variety of habitats for different kinds of wildlife. The TR forms a junction of different forest types occurring in the State. The area is also rich in bio-cultural diversity. This TR consists of the following three units:

1.	Bori WLS	485.72 km^2
2.	Satpura NP	524.37 km^2
3.	Pachmarhi WLS	417.78 km^2
4.	Total	1427.87 km^2

The Tiger Reserve is located between 22° 15' and 22° 45' N latitudes and 77° 54' and 78° 34' E longitudes. Pachmarhi is an important hill station of the state and is located within the area of Pachmarhi WLS. The area is important from the stand point of bio-aesthetic, cultural and social values. The access to the area is easy, the reserve is easily approachable by road from Bhopal (210 km), Jabalpur (240 km), Chhindwara (85 km) and Nagpur (250 km). Pipariya (52 km) and Itarsi are the nearest railhead and rail junction respectively. The Pachmarhi town is accessible all the year round, but the interior areas are approachable only during the fair weather.

During the year 1818, the area saw the advent of British rule. In the year 1861, the forest Department was set up in the central provinces under Captain GF Pearson of the Madras Army, with Captain J. Forsyth of Bengal staff Corps, as one of his assistants. In 1862, the forest Department of the central provinces started in a building named Bison Lodge in Pachmarhi. The original house no longer exists, but at the same spot, another building has been constructed, which is also called Bison lodge and has been converted into a forest museum under the Satpura NP.

The Pachmarhi plateau enjoys a moderate climate during the summer, heavy rains and cloudy climate

during the rainy season and cold climate during the winters. The Bori area receives about 2000 mm rain fall, while some of the plateau area receives only 1200 mm rainfall annually.

Flora

Satpura TR is bestowed with biological diversity of different forest types ranging from dry thorn forest to tropical dry deciduous, moist deciduous and semi evergreen forests. There is a considerable variation in the vegetation due to immense heterogeneity of soil, geology, temperature and moisture conditions. The forests may be broadly classified into (i) tropical dry deciduous (ii) tropical moist deciduous and (iii) sub-tropical forests. On the basis of composition, three major types are identified viz Teak, Sal and mixed forests. These were already discussed in preceding pages.

Fauna

Satpura Tiger Reserve is traditionally rich area in wildlife. Upto about 19th century, the area hea had a rich population of major animals like panthers, tiger, elephants, bison, wild buffaloes and barasingha. But fast deterioration of wildlife habitat led to the disappearance of many of these species, most of the areas of Satpura Tiger Reserve are covered with dense forests. However, there are several open patches and grasslands providing ideal habitat for the wild animals.

Tiger, the main species is found in the Tiger Reserve in good numbers but remains confined in good forest areas. Panthers are found all over the reserve. Gaurs the largest herbivore, are in large number but are largely localized in moist and semi-moist forests of Bori WLS and Satpura NP. Sambar, Chital, barking deer, chin Kara and mouse deer are distributed all over the reserve. Chausingha or four horned antelope and nilgai are found throughout the area. However, the sighting of barking deer and four horned antelope are not common. Nilgai are found concentrated in drier parts of the Reserve. Sloth bear is also frequently seen in forests rich in fruit trees particularly mahua, tendu and achar. These animals are more frequently seen in Sonbhadravalley. Langurs are common throughout the Reserve. Rhesus monkeys are localized at Pachmarhi particularly close to habitation. Wild dog or dhole and wolf are also found in the Reserve. Civet, common fox, jackal and jungle cat are found throughout the Reserve. Wild boars are seen in plenty throughout the Reserve. Giant squirrels and flying squirrels are also seen in the Reserve. Giant squirrels are found all along the nala and rivers around Pachmarhi, Bori, Dhain and Churna. Among reptiles, cobra, Russel viper, python, chameleon and common Indian monitor are found in large numbers throughout the Park. Crocodiles are also found in water bodies of the Reserve.

Water bodies of the Reserve are rich in fish fauna, The fish fauna include *Notopterus notopterous, Catla catla, Labeo rohita, Cirrhnus mrigala, C. reba, Rita rita,* and several others. There are other amphibia like frogs, toads, etc. Which have not been properly studied

The avi-fauna of the Reserve have not been systematically studied. A large number of birds are found in the area. Some common species include jungle fowls, quails, partridges, pigeons, doves, parakeets, bee eaters, king fishers, wood peakers, owls, warblers myna, munia, bulbull, paradise fly catcher, sparrows, egrets, vultures, falcon, eagle and several others. The Reserve is an ideal place for the bird watchers. Several water birds are also seen in water bodies of the Reserve. A large variety of butterflies, moths and other insects are seen in the TR.

Kanha Tiger Reserve

Anand Kumar & KP Singh
Botanical Survey of India, Central Circle, Allahabad

Kanha Tiger Reserve, established in 1974, lies between lat. 22°01' - 22°28' N and long. 80°26' - 81°04' E in Mandla and Balaghat districts in the state of Madhya Pradesh. The total area of the reserve is 1,945 sq km comprising 940 sq km of core area and 1,005 sq km of buffer zone. The tiger reserve lies in the east of the centre of the Central Indian highlands which stretch across Madhya Pradesh from west to east and cradles in the Maikal branch of the Satpura hills. The hills have upper steep slopes to narrow and wide valleys of varying dimensions at base, but hill- tops are flat. The altitude varies from 450 to 950 m. December and January are the coldest months of the year whereas May and June are the hottest months when temperature reaches up to 43°C. The area experiences premonsoon shower in the middle of June and monsoon from July to October. The average annual rainfall is about 160 cm. Due to high annual rainfall coupled with high relative humidity and broad topographic features the tiger reserve harbours dense and luxuriant growth of the flora, typical of tropical type.

VEGETATION

Vegetation of the Kanha Tiger Reserve may be classified as follows as per Maheshwari (1964) and Lal & al. (1986):

Sal forests

These forests are confined to low hills, lower slopes of higher hills and valleys. *Shorea robusta* Roxb. ex Gaertn. f. (Sal) is the dominant species in these forests. Top storey comprises of *Shorea robusta* Roxb. ex Gaertn. f., *Syzygium cumini* (L.) Skeels, *Pterocarpus marsupium* Roxb., *Terminalia alata* Heyne ex Roth, *T. arjuna* (Roxb. ex DC.) Wight & Arnott, *Haldina cordifolia* (Roxb.) Ridsdale and *Anogeissus latifolia* (Roxb. ex DC.) Wall. ex Guill. & Perr. In under storey *Miliusa tomentosa* (Roxb.) Finet & Gagnep., *Semecarpus anacardium* L. f., *Mallotus philippensis* (Lam.) Muell. Arg., *Kydia calycina* Roxb., *Emblica officinalis* Gaertn., *Dillenia aurea* J.E. Smith, *Bauhinia racemosa* Lam., *Glochidion velutinum* Wight, *Schleichera oleosa* (Lour.) Oken.,*Diospyros melanoxylon* Roxb., *Lagerstroemia parviflora* Roxb., *Chloroxylon swietenia* DC. and *Woodfordia fruticosa* (L.) Kurz are present. Important species found in undergrowth are *Flemingia semialata* Roxb. ex Ait. f., *F. strobilifera* (L.) Ait. & Ait. f., *F. prostrata* Roxb., *Crotalaria bialata* Schrank., *Clerodendrum serratum* (L.) Moon, *Elephantopus scaber* L., *Knoxia sumatrensis* (Retz.) DC., *Curculigo orchioides* Gaertn., *Asparagus racemosus* Willd., *Commelina longifolia* Lam., *C. suffruticosa* Blume, *Phoenix acaulis* Buch.- Ham. ex Roxb., *Desmodium motorium* (Houtt.) Merr., *D. pulchellum* (L.) Benth., *D. laxiflorum* DC., *D. velutinum* (Willd.) DC., *Oplismenus burmannii* (Retz.) P. Beauv. and *Chrysopogon fulvous* (Spreng.) Chiov. Lianas and climbers are few, and are represented mainly by *Butea superba* Roxb. ex Willd., *Bauhinia vahlii* Wight & Arn., *Vallaris solanacea* (Roth) Kuntze, *Ventilago denticulata* Willd., *Ziziphus rugosa* Lam., *Ampelocissus tomentosa* (Heyne ex Roth) Planch., *Smilax zeylanica* L., *Canavalia gladiata*

deciduous forest

(Jacq.) DC., *Dioscorea bulbifera* L. and *D. pentaphylla* L. A few species of orchids, viz., *Oberonia falconeri* Hook. f., *Eulophia nuda* Lindl., *Habenaria commelinifolia* (Roxb.) Wall. ex Lindl., *Vanda tessellata* (Roxb.) Hook. ex G. Don, *V. testacea* (Lindl.) Reichb. f. and *Malaxis rheedii* Sw. as well as parasites such as *Aeginetia indica* L. and *Dendrophthoe falcata* (L. f.) Etting. also occur in these forests.

Southern tropical moist deciduous forests

These forests are found in sheltered valleys where soil depth is more and moisture content is high. Top storey is 30 to 35 m high and is constituted by *Bridelia retusa* (L.) Spreng., *Pterocarpus marsupium* Roxb., *Ficus arnottiana* (Miq.) Miq., *Stereospermum chelonoides* (L. f.) DC., *Grewia tiliifolia* Vahl, *Gmelina arborea* Roxb., *Schleichera oleosa* (Lour.) Oken., *Terminalia alata* Heyne ex Roth, *T. chebula* Retz. and *Haldina cordifolia* (Roxb.) Ridsdale. Under storey is mainly represented by *Trema orientalis* (L.) Blume, *Dendrocalamus strictus* (Roxb.) Nees, *Cassia fistula* L., *Miliusa tomentosa* (Roxb.) Finet & Gagnep., *Madhuca longifolia* (J. Koenig) Macbr. var. *latifolia* (Roxb.) Chevalier, *Careya arborea* Roxb., *Semecarpus anacardium* L. f., *Garuga pinnata* Roxb., *Mallotus philippensis* (Lam.) Muell. Arg., *Butea monosperma* (Lam.) Taub., *Diospyros melanoxylon* Roxb., *Lagerstroemia parviflora* Roxb., *Kydia calycina* Roxb., *Eriolaena hookeriana* Wight & Arn., *Ixora pavetta* Andr., *Ougeinia oojeinensis* (Roxb.) Houchr. and *Woodfordia fruticosa* (L.) Kurz. Undergrowth in these forests is comparatively dense and comprises of *Perilepta auriculata* (Nees) Bremek., *Triumfetta pilosa*

Roth, *Colebrookea oppositifolia* Sm., *Nelsonia canescens* (Lam.) Spreng., *Cynoglossum lanceolatum* Forssk., *Pogostemon benghalense* (Burm. f.) Kuntze, *Phoenix acaulis* Buch.- Ham. ex Roxb., *Helicteres isora* L., *Phyllanthns airy - shawii* Brunel ex Roux., *Petalidium barlerioides* (Roth) Nees, *Indigofera cassioides* Rottler ex DC., *Grewia hirsuta* Vahl and *Hemigraphis latebrosa* (Heyne ex Roth) Nees. Common climbers and lianas in such forests are *Millettia extensa* (Benth.) Baker, *Olax scandens* Roxb., *Butea superba* Roxb., *Ventilago denticulata* Willd., *Bauhinia vahlii* Wight & Arn. and *Smilax zeylanica* L. A few orchids such as *Habenaria commelinifolia* (Roxb.) Wall. ex Lindl., *H. marginata* Colebr., *Vanda testacea* (Lindl.) Reichb. f., *V. tessellata* (Roxb.) Hook. ex G. Don and *Oberonia falconeri* Hook. f. and parasites such as *Cuscuta chinensis* Lam. and *Dendrophthoe falcata* (L. f.) Etting. are also represented in these forests.

Dendrophthoe falcata

Southern tropical dry deciduous forests

These forests are restricted to upper hill slopes and flat hill- tops. Top canopy is not dense, and small (12 to 20 m high) deciduous trees such as *Lannea coromandelica* (Houtt.) Merr., *Boswellia serrata* Roxb. ex Colebr., *Aegle marmelos* (L.) Correa, *Sterculia urens* Roxb., *Radermachera xylocarpa* (Roxb.) K. Schum., *Diospyros melanoxylon* Roxb., *Butea monosperma* (Lam.) Taub., *Emblica officinalis* Gaertn., *Buchnania lanzan* Spreng., *Madhuca longifolia* (J. Koenig) Macbr. var. *latifolia* (Roxb.) Chevalier and *Cassia fistula* L. are usually met. Shrubs are mainly represented by *Murraya paniculata* (L.) Jack, *Euphorbia nivula* Buch.- Ham. and *Carissa spinarum* L. Climbers are few in number, viz., *Acacia pennata* (L.) Willd., *Cryptolepis buchanani* Roem. & Schult., *Hemidesmus indicus* (L.) R. Br. and *Ventilago denticulata* Willd. Parasites like *Dendrophthoe falcata* (L. f.) Etting., *Loranthus philippensis* Cham. & Schlechtend and *Viscum articulatum* Burm. f. are conspicuous especially in summer season. Ground flora is sparse and mainly constituted by *Oldenlandia corymbosa* L., *Spermacoce pusilla* Wall., *S. hispida* L., *Ageratum conyzoides* L., *Blumea lacera* (Burm. f.) DC., *Launea procumbens* (Roxb.) Ramayya & Rajagopal, *Tridax procumbens* L., *Aristida setacea* Retz., *Bothriochloa pertusa* (L.) A. Camus, *Chloris dolichostachya* Lag., *C. virgata* Sw., *Dichanthium annulatum* (Forssk.) Stapf, *Eragrostis tenella* (L.) P. Beauv. ex Roem. & Schult., *Imperata cylindrica* (L.) P. Beauv. var. *major* Hubb. ex Hubb. & Vaughan, *Iseilema laxum* Hack., *Paspalidium flavidium* (Retz.) A. Camus and *Setaria intermedia* Roem. & Schult.

Pine plantation

Pinus longifolia Roxb. has been extensively planted in Supkhar, and its dense growth gives the appearance of forest. Pine trees are up to 40 m high. *Colebrookea oppositifolia* Sm. and *Chloroxylon sweitenia* DC. grow abundantly in these plantations. Ground flora is very poor.

Grasslands

These are found in lower part of valleys, on alluvial soil of streams and on flat hill- tops. In lower part of valleys excellent growth of grasses is seen. The main species of these grasses are *Apluda mutica* L., *Bothriochloa intermedia* (R. Br.) A. Camus, *B. kuntzeana* (Hack.) Henr., *Capillipedium parvifolium* R. Br., *Chionachne koenigii* (Spreng.) Thwaites, *Coix lacryma-jobi* L., *Cymbopogon martinii* (Roxb.) Wats., *Dichanthium caricosum* (L.) A. Camus, *Eulaliopsis binata* (Retz.) Hubb., *Heteropogon contortus* (L.) P. Beauv. ex Roem. & Schult., *Iseilema anthephoroides* Hack., *I. laxum* Hack., *Panicum notatum* Retz., *Pennisetum hohenackeri* Hochst. ex Steud., *Pogonantherum paniceum* (Lam.) Hack., *Sorghum nitidum* (Vahl) Pers., *Themeda laxa* (Anderss.) A. Camus, *T. triandra* Forssk. and *T. quadrivalvis* (L.) Kuntze. In alluvial soil along the banks of streams tall growth of grasses, viz., *Apluda mutica* L., *Chionachne koenigii* (Spreng.) Thwaites, *Coix aquatica* Roxb., *Eragrostis namaquensis* Schrad. var. *diplachnoides* (Steud.) W.D. Clayton, *Heteropogon contortus* (L.) P. Beauv. ex Roem. & Schult., *Ischaemum rugosum* Salisb., *Ophiuros megaphyllus* Stapf ex Haines, *Pennisetum pedicellatum* Trin., *Phragmites karka* (Retz.) Trin. ex Steud., *Polypogon monspeliensis* (L.) Desf. *Rottboellia cochinchinenses* (Lour.) W.D. Clayton, *Sacharum spontaneum* L., *Sorghum halepense* (L.) Pers., *Thelepogon elegans* Roth ex Roem. & Schult., *Thysanolaena maxima* (Roxb.) Kuntze and *Vetiveria zizanioides* (L.) Nash is met. However, on hill- tops the growth of grasses is low but diversity of species is comparatively high and mainly comprises *Alloteropsis cimicina* (L.) Stapf, *Aristida setacea* Retz., *Arthraxon lancifolius* (Trin.) Hochst., *Bothriochloa pertusa* (L.) A. Camus, *Chloris virgata* Sw., *Chrysopogon fulvus* (Spreng.) Chiov., *Desmostachys bipinnata* (L.) Stapf, *Dichanthium annulatum* (Forssk.) Stapf, *Digitaria ciliaris* (Retz.) Keeler, *Eragrostiella bifaria* (Vahl) Bor, *Hackelochoa granularis* (L.) Kuntze, *Heteropogon contortus* (L.) P. Beauv. ex Roem. & Schult, *Iseilema prostratum* (L.) Anders., *Oplismenus burmannii* (Retz.) P. Beauv., *Setaria pumila* (Poir.) Roem. & Schult. and *Themeda laxa* (Anders.) A. Camus.

Gloriosa superba

AQUATIC VEGETATION

Due to presence of variety of aquatic habitats like rivers, streams, ponds and tanks diversity of aquatic species is fairly high in the tiger reserve. The aquatic plants may be grouped into following categories on the basis of their habitat:

a. **Along river and stream banks:** Species like *Terminalia arjuna* (Roxb. ex DC.) Wight & Arn., *Toona ciliata* M. Roem., *Salix tetrasperma* Roxb., *Ficus semicordata* Buch.- Ham. ex Sm., F. *hispida* L. f., *F. racemosa* L., *Homonoia riparia* Lour., *Rotula aquatica* Lour., *Polygonum barbatum* L., *P. glabrum* Willd., *P. hydropiper* L., *P. serrulatum* Lag., *Pouzolzia pentandra* (Roxb.) Benn., *Centella asiatica* (L.) Urban, *Crinum defixum* Ker-Gawl.,

Micromeria capitellata Benth., *Nepeta hindostana* (Heyne ex Roth) Haines, *Ludwigia perennis* L., *Grangea maderaspatana* (L.) Poir., *Sphaeranthus indicus* L., *Coldenia procumbens* L., *Limnophila indica* (L.) Druce, *Veronica anagallis-aquatica* L., *Hygrophila serpyllum* (Nees) T. Anderson, *Salvia plebeia* R. Br., *Cyperus alulatus* Kern, *C. compressus* L., *C. difformis* L., *C. exaltatus* Retz., *C. iria* L., *C. pygmaeus* Rottb., *Fimbristylis ferruginea* (L.) Vahl, *F. miliacea* (L.) Vahl, *Phragmites karka* (Retz.) Trin. ex Steud., *Eragrostis namaquensis* Schrad. var. *diplachnoides* (Steud.) W.D. Clayton, *Thysanolaena maxima* (Roxb.) Kuntze, etc. are generally found.

b. **In ponds and tanks and their vicinity:** Large number of aquatic plants are found, for example, *Nelumbo nucifera* Gaertn., *Nymphaea nouchali* Burm. f., *Nymphoides hydrophylla* (Lour.) Kuntze, *N. indica* (L.) Kuntze, *Hygrorhiza aristata* (Retz.) Nees ex Wight & Arn., *Aeschynomene indica* L., *Sesbania bispinosa* (Jacq.) W.F. Wight, *Ammannia baccifera* L., *Ludwigia octovalvis* (Jacq.) Raven, *Hydrocotyle sibthorpioides* Lam., *Microcarpaea minima* (J. Koenig ex Retz.) Merr., *Utricularia exoleta* R. Br., *Justicia quinqueangularis* Koenig ex Roxb., *Polygonum glabrum* Willd., *P. limbatum* Meisn., *Blyxa echinosperma* (C.B. Clarke) Hook. f., *Hydrilla verticillata* (L. f.) Royle, *Lagarosiphon alternifolia* (Roxb.) Druce, *Vallisneria natans* (Lour.) Hara, *Najas graminea* Delile, *Aponogeton natans* (L.) Engl. & K. Krause, *Eleocharis dulcis* (Burm. f.) Hensch., *Scirpus latriflorus* J.F. Gmelin, and *Vetiveria zizanioides* (L.) Nash.

c. **In marshy habitats :** Diversity of aquatic plants is much higher. Some prominent species growing in these habitats are *Hypericum japonicum* Thunb. ex Murray, *Aeschynomene indica* L., *Smithia conferta* Sm., *Drosera burmanni* Vahl, *D. indica* L., *Ammannia baccifera* L., *A. multiflora* Roxb., *Rotula aquatica* Lour., *Glinus lotoides* L., *G. oppositifolia* (L.) A. DC., *Centella asiatica* (L.) Urban, *Caesulia axillaris* Roxb., *Gnaphalium polycaulon* Pers., *G. luteo-album* L., *Lobelia alsinoides* Lam., *L. heyneana* Roem. & Schult., *Wahlenbergia marginata* (Thunb.) DC., *Lysimachia candida* Lindl., *Coldenia procumbens* L., *Bacopa monnieri* (L.) Wettst., *Dopatrium junceum* (Roxb.) Buch. - Ham. ex Benth., *Lindernia hyssopioides* (L.) Haines, *L. nummularifolia* (D. Don) Wettst., *Mazus pumilus* (Burm. f.) Steenis, *Mimulus strictus* Benth., *Hygrophila auriculata* (Schumach.) Heine, *H. serpyllum* (Nees) T. Anderson, *Justicia quinqueangularis* Koenig ex Roxb., *Rungia repens* (L.) Nees, *Psilotrichum ferrugineum* (Roxb.) Moq., *Polygonum plebeium* R. Br., *Monochoria vaginalis* (Burm. f.) K. Presl, *Murdannia vaginatum* (Burm. f.) K. Presl, *Tonningia axillaris* (L.) Kuntze, *Eriocaulon quinquangulare* L., *Cyperus alulatus* Kern, *C. brevifolius* (Rottb.) Hassk., *C. compressus* L., *C. iria* L., *C. sanguinolentus* Vahl, *C. triceps* Endl., *Fimbristylis dichotoma* (L.) Vahl, *Fuirena ciliaris* (L.) Roxb., *Panicum psilopodium* Trin. and *Sacciolepis indica* (L.) Chase.

FLORISTIC DIVERSITY

The status and analysis of various families of pteridophytes and angiosperms occurring in the tiger reserve have been presented in tables I and II respectively. The pteridophytes are represented by 9 families comprising of 11 genera and 17 species. Whereas, the angiosperms comprises 705 species under 439 genera belonging to 109 families. The families of pteridophytes have arranged in alphabetical order while those of angiosperms are in accordance with the Bentham & Hooker's system of classification (1862- 1883) with slight modifications as per recent trends.

Table III depicts that out of 109 families of angiosperms in the tiger reserve, 87 families belong to dicotyledons (80%) while 22 families

Sal forest

belong to monocotyledons (20%). Out of total 439 genera, 329 genera are of dicotyledons (74.94%), whereas 110 genera are of monocotyledons (25.06%). Similarly, out of total 705 species, 512 species belong to dicotyledons (72.62%), and 193 species to monocotyledons (27.38%). Analysis of data also indicates that proportion of monocotyledons to dicotyledons in respect of families is 1:4, genera is 1:2.99 and species is 1: 2.65.

Analysis of species in ten dominant families of the tiger reserve and their percentage has been provided in table IV. The dominant families are Poaceae (99 spp.), Fabaceae (58 spp.), Asteraceae (48 spp.), Cyperaceae (35 spp.), Acanthaceae (29 spp.), Euphorbiaceae (25 spp.), Scrophulariaceae (23 spp.), Rubiaceae (22 spp.), Lamiaceae (21 spp.) and Caesalpiniaceae (16 spp.).

Analysis of ten families dominant in respect to the number of genera and their percentage in the tiger reserve has been given in table V. Family Poaceae has maximum number of 62 genera followed by Asteraceae (32 genera), Fabaceae (26 genera), Rubiaceae (16 genera), Lamiaceae (16 genera), Scrophulariaceae (15 genera), Acanthaceae (14 genera), Euphorbiaceae (14 genera), Apocynaceae (10 genera) and Cyperaceae (9 genera).

Dominant genera showing maximum species diversity (7 or more species) are shown in table VI. *Cyperus* L. is the dominant genus with 18 species, followed by *Ficus* L. (11 spp.), *Crotalaria* L. (10 spp.), *Cassia* L. (9 spp.), *Blumea* DC. and *Lindernia* All. (8 spp. each), *Desmodium* Desv., *Flemingia* Roxb. ex Ait. & Ait. f., *Euphorbia* L. and *Fimbristylis* Vahl (7 spp. each).

Table I: A conspectus of families of pteridophytes showing number of genera and species in Kanha Tiger Reserve

Family	Genera	Species
Adiantaceae	2	4
Athyriaceae	2	2
Dryopteridaceae	1	1
Equisetaceae	1	2
Marsileaceae	1	1
Ophioglossaceae	1	4
Parkeriaceae	1	1
Schizaeaceae	1	1
Selaginellaceae	1	1

Table II: A conspectus of families of angiosperms showing number of genera and species in Kanha Tiger Reserve

Family	Genera	Species
Ranunculaceae	1	1
Dilleniaceae	1	1
Annonaceae	1	2
Menispermaceae	1	1
Nymphaeaceae	2	2
Papaveraceae	1	1
Cochlospermaceae	1	1
Flacourtiaceae	2	3
Polygalaceae	2	3
Caryophyllaceae	1	1
Portulacaceae	1	1
Hypericaceae	1	1
Dipterocarpaceae	1	1
Malvaceae	6	11
Bombacaceae	1	1
Sterculiaceae	6	6
Tiliaceae	3	11
Malpighiaceae	1	1
Oxalidaceae	2	3
Balsaminaceae	1	2
Rutaceae	5	6
Simaroubaceae	1	1
Balanitaceae	1	1
Ochnaceae	1	1
Burseraceae	2	2
Meliaceae	2	2
Olacaceae	2	2
Celastraceae	2	2
Rhamnaceae	2	5
Vitaceae	2	3
Leeaceae	1	1
Sapindaceae	2	2
Anacardiaceae	4	4
Moringaceae	1	1
Fabaceae	26	58
Caesalpiniaceae	4	16
Mimosaceae	3	5
Rosaceae	1	1
Droseraceae	1	2
Crassulaceae	1	1
Combretaceae	3	6
Myrtaceae	3	4
Lecythidaceae	1	1
Melastomataceae	2	2
Lythraceae	4	7
Onagraceae	1	3
Cucurbitaceae	6	7
Cactaceae	1	1
Molluginaceae	2	3
Apiaceae	5	8
Araliaceae	1	1
Rubiaceae	16	22
Asteraceae	32	48
Stylidiaceae	1	1
Lobeliaceae	1	2
Campanulaceae	2	2
Plumbaginaceae	1	1
Primulaceae	2	2
Myrsinaceae	1	1

Family	Genera	Species
Sapotaceae	1	1
Ebenaceae	1	2
Oleaceae	2	4
Apocynaceae	10	10
Asclepiadaceae	7	8
Gentianaceae	4	6
Boraginaceae	8	11
Convolvulaceae	6	12
Cuscutceae	1	1
Solanaceae	4	6
Scrophulariaceae	15	23
Orabanchaceae	1	1
Lentibulariaceae	1	1
Bignoniaceae	4	4
Pedaliaceae	2	2
Acanthaceae	14	29
Verbenaceae	8	10
Lamiaceae	16	21
Nyctaginaceae	2	3
Amaranthaceae	8	9
Polygonaceae	3	8
Proteaceae	1	1
Loranthaceae	3	3
Euphorbiaceae	14	25
Ulmaceae	2	2
Urticaceae	4	4

Family	Genera	Species
Moraceae	2	12
Salicaceae	1	1
Hydrocharitaceae	4	5
Orchidaceae	8	11
Zingiberaceae	3	5
Costaceae	1	1
Musaceae	1	1
Amaryllidaceae	1	2
Hypoxidaceae	1	1
Taccaceae	1	1
Dioscoreaceae	1	5
Liliaceae	4	5
Smilacaceae	1	1
Pontederiaceae	1	2
Commelinaceae	4	9
Juncaceae	1	1
Arecaceae	1	‘1
Araceae	2	2
Alismataceae	1	1
Najadaceae	1	1
Apogetonaceae	1	2
Eriocaulaceae	1	2
Cyperaceae	9	35
Poaceae	62	99

Table III: Number and percentage of families, genera and species of angiosperms

Group	Families		Genera		Species	
	No.	% of total	No.	% of total	No.	% of total
Dicotyledons	87	79.82	329	74.94	512	72.62
Monocotyledons	22	20.18	110	25.06	193	27.38
Total	**109**		**439**		**705**	

Table IV: Ten dominant families of angiosperms showing maximum species diversity

Family	No. of species	Percentage of total species
Poaceae	99	14.04
Fabaceae	58	8.23
Asteraceae	48	6.81
Cyperaceae	35	4.96
Acanthaceae	29	4.11
Euphorbiaceae	25	3.55
Scrophulariaceae	23	3.26
Rubiaceae	22	3.12
Lamiaceae	21	2.98
Caesalpiniaceae	16	2.27

Table V: Ten families dominant in number of genera

Family	No. of genera	Percentage of total genera
Poaceae	62	14.12
Asteraceae	32	7.29
Fabaceae	26	5.92
Rubiaceae	16	3.64
Lamiaceae	16	3.64
Scrophulariaceae	15	3.42
Acanthaceae	14	3.19
Euphorbiaceae	14	3.19
Apocynaceae	10	2.28
Cyperaceae	9	2.05

Table VI: Dominant genera showing maximum species diversity

Genera	Family	No. of species
Cyperus	Cyperaceae	18
Ficus	Moraceae	11
Crotalaria	Fabaceae	10
Cassia	Caesalpiniaceae	9
Blumea	Asteraceae	8
Lindernia	Scrophulariaceae	8
Desmodium	Fabaceae	7
Flemingia	Fabaceae	7
Justicia	Acanthaceae	7
Euphorbia	Euphorbiaceae	7
Fimbristylis	Cyperaceae	7

ECONOMIC PLANTS

A large number of economic plants are found in the tiger reserve due to its rich and varied phytodiversity. These plants can be grouped into the following categories on the basis of their utility:

1. **Timber:** *Acacia catechu* (L. f.) Benth., *Albizia lebbeck* (L.) Benth., *A. odoratissima* (L. f.) Benth., *Anogeissus latifolia* (Roxb. ex DC.) Wall. ex Guill. & Perr., *Azadirachta indica* A. Juss., *Cassia fistula* L., *Chloroxylon swietenia* DC., *Dalbergia latifolia* Roxb., *D. sissoo* Roxb., *Diospyros melanoxylon* Roxb., *Ficus benghalensis* L., *Garuga pinnata* Roxb., *Gmelina arborea* Roxb., *Grewia tiliifolia* Vahl, *Haldina cordifolia* (Roxb.) Ridsdale, *Hymenodictyon orixense* (Roxb.) Mabberley, *Kydia calycina* Roxb., *Lannea coromandelica* (Houtt.) Merr., *Madhuca longifolia* (J. Koenig) Macbr. var. *latifolia* (Roxb.) Chevalier, *Mangifera indica* L., *Miliusa tomentosa* (Roxb.) Finet & Gagnep., *Mitragyna parvifolia* (Roxb.) Korth., *Ougeinia oojeinensis* (Roxb.) Hochr., *Pongamia pinnata* (L.) Pierre, *Pterocarpus marsupium* Roxb., *Radermachera xylocarpa* (Roxb.) K. Schum., *Stereospermum chelonoides* (L. f.) DC., *Schleichera oleosa* (Lour.) Oken, *Syzygium cumini* (L.) Skeels, *Tamarindus indica* L., *Tectona grandis* L. f., *Terminalia alata* Heyne ex Roth, *T. arjuna* (Roxb. ex DC.) Wight & Arn., *T. bellirica* (Gaertn.) Roxb. and *Toona ciliata* M. Roem. .

2. **Tannin:** *Acacia pennata* (L.) Willd., *Albizia lebbeck* (L.) Benth., *Bauhinia vahlii* Wight & Arn., *Casearia elliptica* Willd., *Cassia fistula* L., *Dalbergia latifolia* Roxb., *Cassine glauca* (Rottb.) Kuntze, *Emblica officinalis* Gaertn., *Lagerstroemia parviflora* Roxb., *Mitragyna parvifolia* (Roxb.) Korth., *Nyctanthes arbor-tristis* L., *Ougeinia oojeinensis* (Roxb.) Hochr., *Pongamia pinnata* (L.) Pierre, *Salix tetrasperma* Roxb., *Schleichera oleosa* (Lour.) Oken., *Securinega virosa* (Roxb. ex Willd.) Baill., *Shorea robusta* Roxb. ex Gaertn. f., *Syzygium cumini* (L.) Skeels, *Tamarindus indica* L., *Terminalia alata* Heyne ex Roth, *T. arjuna* (Roxb. ex DC.) Wight & Arn., *T. bellirica* (Gaertn.) Roxb., *Trema orientalis* (L.) Blume and *Woodfordia fruticosa* (L.) Kurz.

3. **Fibre:** *Abelmoschus crinitus* Wall., *Bauhinia racemosa* Lam., *B. vahlii* Wight & Arn., *Corchorus olitorius* L., *Cryptolepis buchanani* Roem. & Schult., *Ficus semicordata* Buch.- Ham. ex Sm., *Grewia tiliifolia* Vahl, *Kydia calycina* Roxb., *Millettia extensa* (Benth.) Benth. ex Baker, *Mitragyna parvifolia* (Roxb.) Korth., *Pongamia pinnata* (L.) Pierre, *Sida acuta* Burm. f., *S. cordifolia* L., *S. rhombifolia* L., *Sterculia urens* Roxb., *Trema orientalis* (L.) Blume, *Triumfetta pilosa* Roth, *T. rhomboidea* Jacq., *Urena lobata* L. and *Ventilago denticulata* Willd.

4. **Dye:** *Acacia catechu* (L. f.) Willd., *Butea monosperma* (Lam.) Taub., *Catunaregam spinosa* (Thunb.) Trivengadum, *Hymenodictyon orixense* (Roxb.) Mabberley, *Lannea coromandelica* (Houtt.) Merr., *Nyctanthes arbor-tristis* L., *Petrocarpus marsupium* Roxb., *Schleichera oleosa* (Lour.) Oken., *Syzygium cumini* (L.) Skeels, *Woodfordia fruticosa* (L.) Kurz and *Wrightia tinctoria* R. Br.

5. **Paper:** *Boswellia serrata* Roxb. ex Colebr., *Bothriochloa intermedia* (R. Br.) A. Camus, *Butea monosperma* (Lam.) Taub., *Cyperus exaltatus* Retz., *Dendrocalamus strictus* (Roxb.) Nees, *Ficus benghalensis* L., *Gmelina arborea* Roxb., *Haldina cordifolia* (Roxb.) Ridsdale, *Heteropogon contortus* (L.) P. Beauv. ex Roem. & Schult, *Imperata cylindrica* (L.) P. Beauv., *Kydia calycina* Roxb., *Lannea coromandelica* (Houtt.) Merr., *Phragmites karka* (Retz.) Trin. ex Steud., *Saccharum spontaneum* L., *Sterculia urens* Roxb., *Themeda quadrivalvis* (L.) Kuntze, *T. triandra* Forssk. and *Trema orientalis* (L.) Blume.

6. **Gum:** *Acacia catechu* (L. f.) Willd., *Aegle marmelos* (L.) Correa, *Anogeissus latifiolia* (Roxb.

ex DC.) Wallich ex Guill. & Perr., *Boswellia serrata* Roxb. ex Colebr., *Buchnania lanzan* Spreng., *Butea monosperma* (Lam.) Taub., *B. superba* Roxb. ex Willd., *Cochlospermum religiosum* (L.) Alston, *Cassine glauca* (Rottb.) Kuntze, *Gardenia gummifera* L. f., *G. resinifera* Roth, *Lannea coromandelica* (Houtt.) Merr., *Moringa oleifera* Lam., *Ougeinia oojeinensis* (Roxb.) Hochr., *Pterocarpus marsupium* Roxb., *Securinega virosa* (Roxb. ex Willd.) Baill., *Semecarpus anacardium* L. f., *Shorea robusta* Roxb. ex Gaertn. f., *Sterculia urens* Roxb., *Terminalia alata* Heyne ex Roth and *T. bellirica* (Gaertn.) Roxb.

7. **Fish poison:** *Casearia elliptica* Willd., *Cleistanthus collinus* (Roxb.) Benth. ex Hook. f., *Catunaregam spinosa* (Thunb.) Tirvengadum, *C. nilotica* (Stapf) Tirvengadum, *Millettia extensa* (Benth.) Benth. ex Baker, *Ougeinia oojeinensis* (Roxb.) Hochr., *Phyllanthus urinaria* L., *Polygonum hydropiper* L. and *Pongamia pinnata* (L.) Pierre.

8. **Thatching:** *Bauhinia vahlii* Wight & Arn., *Desmostachya bipinnata* (L.) Stapf, *Echinocnhloa stagnina* (Retz.) P. Beauv., *Eulalia trispicata* (Schult.) Henr., *Narenga porphyrocoma* (Hance) Bor, *Phoenix acaulis* Buch.- Ham. ex Roxb., *Phragmites karka* (Retz.) Trin. ex Steud., *Saccharum spontaneum* L., *Securinega virosa* (Roxb. ex Willd.) Baill. *Themeda quadrivalvis* (L.) Kuntze, *T. triandra* Forssk. and *Vetiveria zizanioides* (L.) Nash.

9. **Broom:** *Aristida setacea* Retz., *Eulalia trispicata* (Schult.) Henr., *Pennisetum hohenackeri* Hochst. ex Steud., *Phoenix acaulis* Buch.- Ham. ex Roxb., *Phragmites karka* (Retz.) Trin. ex Steud., *Sorghum nitidum* (Vahl) Pers. and *Thysanolaena maxima* (Roxb.) Kuntze.

10. **Basket, mat and hat:** *Apluda mutica* L., *Dendrocalamus strictus* (Roxb.) Nees, *Eleusine indica* (L.) Gaertn., *Ichnocarpus frutescens* (L.) R. Br., *Phragmites karka* (Retz.) Trin. ex Steud., *Rottboellia cochinchinensi* (Lour.) W.D. Clayton, *Scirpus lateriflorus* J.F. Gmelin, *Vallaris solanacea* (Retz.) Kuntze, *Vetiveria zizanioides* (L.) Nash and *Vitex negundo* L.

11. **Floss:** *Bombax ceiba* L., *Cochlospermum religiosum* (L.) Alston, *Calotropis gigantea* (L.) R. Br. and *C. procera* (Ait.) R. Br.

12. **Beverage:** *Madhuca longifolia* (J. Koenig) Macbr. var. *latifolia* (Roxb.) Chevalier and *Syzygium cumini* (L.) Skeels.

13. **Colchicine:** *Gloriosa superba* L. and *Iphigenia indica* (L.) A. Gray.

14. **Edible:**

    a. **Tubers or rhizomes:** *Colocasia esculenta* (L.) Schott, *Curcuma neilgherrensis* Wight, *Costus speciosus* (J. Koenig) Sm., *Dioscorea alata* L., *D. bulbifera* L., *D. pentaphylla* L., *Nelumbo nucifera* Gaertn., *Nymphaea nouchali* Burm. f., *Orthosiphon rubicundus* (D. Don) Benth. and *Pueraria tuberosa* (Roxb. ex Willd.) DC.

    b. **Leaves and young shoots:** *Abelmoschus moschatus* Medik., *Achyranthes aspera* L., *Alternanthera sessilis* (L.) R. Br. ex DC., *Antidesma acidum* Retz., *A. ghaesembilla* Gaertn., *Bauhinia malabarica* Roxb., *Celosia argentea* L., *Emilia sonchifolia* (L.) DC., *Glinus lotoides* L., *Gnaphalium polycaulon* Pers., *Holarrhena pubescens* (Buch.- Ham.) Wall. ex G. Don., *Hygrophila salicifolia* (Vahl) Nees, *Ipomoea eriocarpa* R. Br., *I. quamoclit* L., *Leucas mollissima* Wall. ex Benth., *Limnophila indica* (L.) Druce, *Mollugo pentaphylla* L., *Portulaca oleracea* L., *Olax scandens* Roxb., *Oxalis corniculata* L., *Polygonum glabrum* Willd., *P. limbatum* Meisn., *P. plebeium* R. Br., *Solanum nigrum*

Dendrocalamus strictus Courtesy : S.K. Srivastava

L., *Vallisneria natans* (Lour.) Hara and *Vernonia cinerea* (L.) Less.

c. **Flowers:** *Boswellia serrata* Roxb. ex Colebr., *Dioscorea pentaphylla* L., *Indigofera cassioides* Rottler ex DC., *Madhuca longifolia* (J. Koenig) Macbr. var. *latifolia* (Roxb.) Chevalier, *Moringa oleifera* Lam., *Pavetta tomentosa* Roxb. ex Sm., *Pterocarpus marsupium* Roxb., *Vallaris solanacea* (Roxb.) Kuntze and *Wrightia tinctoria* R. Br.

d. **Fruits:** *Antidesma acidum* Retz., *A. ghaesembilla* Gaertn., *Bridelia retusa* (L.) Spreng., *Canavalia gladiata* (Jacq.) DC., *Carissa spinarum* L., *Diospyros melanoxylon* Roxb., *Emblica officinalis* Gaertn., *Ficus semicordata* Buch.- Ham. ex Sm., *F. hispida* L. f., *Flacourtia indica* (Burm. f.) Merr., *Garuga pinnata* Roxb., *Grewia hirsuta* Vahl, G. *rothii* DC., *G. tiliifolia* Vahl, *Madhuca longifolia* (J. Koenig) Macbr. var. *latifolia* (Roxb.) Chevalier, *Mangifera indica* L., *Moringa oleifera* Lam., *Mucuna pruriens* (L.) DC., *Olax nana* Wall. ex Benth., *Pavetta tomentosa* Roxb. ex Sm., *Phoenix acaulis* Buch.- Ham. ex Roxb., *Polygonum glabrum* Willd., *Radermachera xylocarpa* (Roxb.) K. Schum., *Schleichera oleosa* (Lour.) Oken., *Semecarpus anacardium* L. f., *Syzygium cumini* (L.) Skeels, *Tamarindus indica* L., *Trema orientalis* (L.) Blume and *Vigna umbellata* (Thunb.) Ohwi & Ohashi.

e. **Seeds:** *Bambusa arundinacea* (Retz.) Willd., *Buchanania lanzan* Spreng., *Coix lacryma-jobi* L., *Dactyloctenium aegypticum* (L.) P. Beauv., *Echinochloa stagnina* (Retz.) P. Beauv., *Eleusine indica* (L.) Gaertn., *Ipomoea eriocarpa* R. Br., *Ischaemum rugosum* Salisb., *Jasminum arborescens* Roxb., *Nelumbo nucifera* Gaertn., *Paspalidium flavidium* (Retz.) A. Camus, *Paspalum scrobiculatum* L., *Portulaca oleracea* L., *Sterculia urens* Roxb. and *Tamarindus indica* L.

15. **Oil:**

a. **Essential oil:** *Abelmoschus moschatus* Medik., *Aegle marmelos* (L.) Correa, *Artemisia nilagirica* (C.B. Clarke) Pamp, *Blumea lacera* (Burm. f.) DC., *Cymbopogon martinii* (Roxb.) Wats., *Lavandula bipinnata* (Roth) Kuntze, *Murraya paniculata* (L.) Jack, *Nelumbo nucifera* Gaertn., *Nepeta hindostana* (Heyne ex Roth) Haines, *Pogostemon benghalense* (Burm. f.) Kuntze, *Pterocarpus marsupium* Roxb., *Vetiveria zizanioides* (L.) Nash and *Vitex negundo* L.

b. **Edible oil:** *Bombax ceiba* L., *Buchanania lanzan* Spreng., *Butea monosperma* (Lam.) Taub., *Madhuca longifolia* (J. Koenig) Macbr. var. *latifolia* (Roxb.) Chevalier, *Schleichera oleosa* (Lour.) Oken., *Shorea robusta* Roxb. ex Gaertn.f. and *Ventilago denticulata* Willd.

In addition, a large number of plants have medicinal properties and are used for treatment of various ailments. Some such species along with their uses and part used are provided in table VII.

WILD RELATIVES OF CROP PLANTS

Kanha Tiger Reserve is rich in wild relatives of crop plants. These are: *Coix aquatica* Roxb., C. *lacryma-jobi* L., *Chionachme koenigii* (Spreng.) Thwaites, *Panicum psilopodium* Trin., *Setaria pallide-fusca* (Schumach.) Stapf & Hubb., *S. tomentosa* (Roxb.) Kunth and *Eleusine indica* (L.) Gaertn. among cereals and millets; *Cajanus scarabaeoides* (L.) du Petit- Thou., *Mucuna pruriens* (L.) DC. and *Vigna umbellata* (Thunb.) Ohwi & Ohashi among legumes; *Aegle marmelos* (L.) Correa, *Emblica officinalis* Gaertn., *Phoenix acaulis* Buch.-Ham. ex Roxb., *Syzygium cumini* (L.) Skeels, *Ziziphus mauritiana* Lam., *Z. nummularia* (Burm. f.) Wight & Arn., *Z. rugosa* Lam. and *Z. xylopyra* (Retz.) Willd. among fruits; *Abelmoschus moschatus* Medik., *Dioscorea alata* L., *Momordica dioica* Roxb. ex Willd., *Solanum violaceum* Ortega and *Trichosanthes bracteata* (Lam.) Voigt. among vegetables; *Sesamum indicum* L., among oil seeds; *Crotalaria retusa* L. and *Urena lobata* L. among fibre types, and *Curcuma neilgherrensis* Wight among spices and condiments.

Table VII: Medicinal plants

Botanical name	Part/s used	Medicinal use/s
Abelmoschus crinitus Wall.	Plant	Dysentery
A. moschatus Medik.	Seeds	Nervous disorders, hysteria, tonic
Abrus precatorius L.	Root and leaf	Cough and cold
Achyranthes aspera L.	Plant	Dropsy, piles and snake bite
Adhatoda zeylanica Medik.	Leaf	Cough, fever and bronchitis
Aegle marmelos (L.) Correa	Bark Leaf Fruits	Fever Diabetes Diarrhoea and dysentery
Aerva lanata (L.) Juss. ex Schult.	Plant	Cough and diabetes
Ajuga bracteosa Wall. ex Benth.	Plant	Gout and rheumatism
Alternanthera sessilis (L.) R. Br. ex DC.	Leaf	Night blindness
Ampelocissus tomentosa (Heyne ex Roth) Planch.	Root	Inflammation
Artemisia nilagirica (C.B. Clarke) Pamp	Leaf	Asthma
Asparagus racemosus Willd.	Root	Tonic and diuretic

Botanical name	Part/s used	Medicinal use/s
Bacopa monnieri (L.) Wettst.	Plant	Nervous disoders, epilepsy and insanity
	Leaf	Diuretic
Baliopsermum montanum (Willd.) Muell. Arg.	Root and seed	Constipation
Bauhinia racemosa Lam.	Bark	Diarrhoea and dysentery
	Leaf	Malaria
B. variegata L.	Root	Obesity
	Bark	Leprosy
Bidens pilosa L.	Leaf	Ear and eye ailments
	Seeds	Worms
Boerhaavia diffusa L.	Root	Asthma, jaundice and stomach disorders
Bombax ceiba L.	Root	Impotency
	Bark	Tonic
Boswellia serrata Roxb. ex Colebr.	Gum	Diarrhoea and dysentery
Butea monosperma (Lam.) Taub.	Gum	Diarrhoea
B. superba Roxb. ex Willd.	Seed	Intestinal worms
Cardiospermum halicacabum L.	Root	Lumbago and rheumatism
Careya arborea Roxb.	Bark	Fever and pox
	Flower	Cough and cold
Casearia elliptica Willd.	Bark	Dropsy
Cassia fistula L.	Leaf	Skin diseases
	Fruit	Constipation
Catunaregam spinosa (Thunb.) Trivengadum	Bark	Rheumatism and fever
	Fruit	Dysentery and intestinal worms
Celastrus paniculatus Willd.	Seed	Rheumatism, gout, leprosy and paralysis
Centella asiatica (L.) Urban	Plant	Leprosy
	Leaf	Syphilis and to increase memory
Centipeda minima (L.) A. Br. & Aschers.	Plant	Toothache
	Leaf	Cold
Cissampelos pareira L.	Root	Dyspepsia and dropsy
	Leaf	Itch
Clerodendrum serratum (L.) Moon	Root	Bronchitis
Cochlospermum religiosum (L.)	Gum	Tonic, cough and gonorrhoea

Botanical name	Part/s used	Medicinal use/s
Commelina benghalensis L.	Plant	Dropsy
Costus speciosus (J. Koenig) Sm.	Rhizome	Intestinal worms and snake bite
Curculigo orchioides Gaertn.	Rhizome	Impotency, tonic, piles, jaundice and asthma
Cymbopogon martinii (Roxb.) Wats.	Leaf-oil	Lambago and joints pain
Desmodium gangeticum (L.) DC.	Root	Tonic, fever, cough, vomiting
Dioscorea bulbifera L.	Rhizome	Piles and syphilis
Elephantopus scaber L.	Plant Root Leaf	Malaria and elephantiasis Diarrhoea and dysentery Eczema
Emblica officinalis Gaertn.	Fruit	Anaemia, jaundice, tonic and constipation
Eulophia nuda Lindl.	Tubers	Bronchitis and tumour
Ficus racemosa L.	Root Latex	Dysentery and diabetes Diarrhoea and piles
Flemingia macrophylla (Willd.) Kuntze ex Merr.	Root	Inflammation and ulcers
F. strobilifera (Willd.) Kuntze ex Merr.	Root	Sleeplessness, hysteria and epilepsy
Gloriosa superba L.	Rhizome	Piles, Leprosy, ulcers, intestinal worms, gonorrhoea and abortion
Gmelina arborea Roxb.	Root Leaf Fruit	Fever, indigestion, gout and weakness Ulcers Fever
Gnaphalium luteo-album L.	Leaf	Gout
Grangea maderspatana (L.) Poir.	Leaf	Earache
Helicteres isora L.	Root, Brak and Fruit	Diarrhoea and dysentery
Heliotropium indicum L.	Plant Leaf	Snake bite, rheumatism and ulcers Fever
Hemidesmus indicus (L.) R. Br.	Root	Fever, rheumatism, leucorrhoea, syphilis, kidney gravel and general debility

Botanical name	Part/s used	Medicinal use/s
Holarrhena pubescnes (Buch.-Ham.) Wall. ex G. Don	Root	Diarrhoea, dysentery, piles and colitis
Holoptelea integrifolia (Roxb.) Planch.	Bark	Rheumatism
Hydrocotyle sibthorpioides Lam.	Plant	Rheumatism, syphilis, pulmonary and digestive complaints
Ichnocarpus frutescens (L.) R. Br.	Root Stem	Fever, diabetes and kidney stone Headache and fever
Ipomoea eriocarpa R. Br.	Plant	Headache, rheumatism, leprosy, epilepsy and ulcers
Ixora pavetta Andr.	Bark Flowers	Tonic Whooping cough
Jasminum multiflorum (Burm. f.) Andr.	Root Leaf	Snake bite Ulcers
Justicia betonica L.	Plant Leaf	Diarrhoea Boils
Laggera alata (D. Don) Sch.-Bip ex Oliver	Leaf	Wounds and cuts
Leucas cephalotes (Koenig ex Roth) Spreng.	Flower	Cough and cold
Madhuca longifolia (J. Koenig)	Root	Ulcers
Macbr. var. *latifolia* (Roxb.) Chevalier	Bark Flower Seed	Diabetes and rheumatism Cough, insomnia and tonic Piles, headache and constipation
Mitragyna parvifolia (Roxb.) Korth.	Root and bark	Fever and colitis
Mucuna pruriens (L.) DC.	Root Fruit Seed	Dropsy, elephantiasis, kidney and liver diseases Impotency Tonic
Nelsonia canescens (Lam.) Spreng. *Nelumbo nucifera* Gaertn.	Leaf Rhizome Flowers Seed	Fever Skin diseases Diarrhoea and dysentery Indigestion and colitis
Ocimum canum Sims.	Leaf Seed	Cold, bronchitis and skin diseases Urinary problems

Botanical name	Part/s used	Medicinal use/s
Oldenlandia corymbosa L.	Plant	Fever, jaundice and depression
Polygonum barbatum L.	Root	Ulcers
	Seed	Colitis and debility
P. plebeium R. Br.	Plant	Pneumonia
	Root	Bowel complaints
Pongamia pinnata (L.) Pierre	Bark	Piles and beri-beri
	Twig	Toothache
	Leaf	Cough, diarrhoea, gonorrhoea and leprosy
	Flower	Diabetes
Pterocarpus marsupium Roxb.	Wood	Diabetes
	Gum	Diarrhoea and dysentery
	Leaf	Sores and boils
	Flower	Fever
Pueraria tuberosa (Roxb. ex Willd.) DC.	Root	Fever and rheumatism
Radermachera xylocarpa (Roxb.) K. Schum.	Root	Cuts and wounds
	Fruit	Snake bite
Salix tetrasperma Roxb.	Leaf	Epilepsy, piles and bladder stones
Schefflera venulosa (Wight & Arn.) Harms.	Root	Dropsy
	Twig	Toothache
Scoparia dulcis L.	Plant	Diarrhoea, dysentery and anaemia
	Leaf	Bronchitis, fever and kidney stone
Semecarpus anacardium L. f.	Fruit	Asthma, epilepsy, rheumatism, intestinal worms and psoriasis
Shorea robusta Roxb. ex Gaertn. f.	Gum	Dysentery, gonorrhoea and impotency
Sida cordifolia L.	Root	Sciatica, urinary diseases, gonorrhoea and debility
	Leaf	Dysentery, fever and ulcers
S. rhombifolia L.	Root	Leucorrhoea and rheumatism
	Leaf	Bronchitis
Sphaeranthus indicus L.	Plant	Liver and gastric complaints
	Root	Cough, chest pain and bowel complaints
	Flower	Tonic
Syzygium cumini (L.) Skeels	Bark	Dysentery, dyspepsia and colitis

Botanical name	Part/s used	Medicinal use/s
	Fruit	Colitis
	Seed	Diabetes
Terminalia arjuna (Roxb. ex DC.) Wight & Arn.	Bark	Hypertension, cardiac tonic, dysentery and liver cirrhosis
	Leaf	Earche
T. bellirica (Gaertn.) Roxb.	Fruit	Piles, dropsy, headache, leprosy and constipation
T. chebula Retz.	Fruit	Constipation, toothache, ulcers and asthma
Tridax procumbens L.	Leaf	Diarrhoea, dysentery and haemorrhage
Uraria picta (Jacq.) Desv. ex DC.	Root	Cough, fever, gonorrhoea, impotency and heart ailments
Vallaris solanacea (Roth) Kuntze	Latex	Sores and wounds
Vanda tessellata (Roxb.) Hook. ex G. Don	Plant	Sciatica
	Root	Bronchitis, rheumatism and tuberculosis
	Leaf	Fever
Vitex negundo L.	Root	Fever, cough, pain, intestinal worms and debility
	Leaf	Arthritis, rheumatism, sprains, leprosy and fever

RARE PLANTS AND THEIR CONSERVATION

Rare plants, especially for the state of Madhya Pradesh, present in the tiger reserve are *Acrocephalus verbenifolius* Watt ex Mukherjee (Lamiacaeae), *Combretum nanum* Buch.- Ham. ex D. Don (Combretaceae), *Cyperus melanospermus* (Nees) Valck. (Cyperaceae), *Dipteracanthus beddomei* (C.B. Clarke) Santapau (Acanthaceae), *Drosera burmanni* Vahl (Droseraceae), *Eriosema himalaicum* Ohashi (Fabaceae), *Ficus beddomei* King (Moraceae), *Flemingia prostrata* Roxb. (Fabaceae), *Grewia sapida* Roxb. ex DC. (Tiliaceae), *Indigofera hamiltonii* Graham ex Duthie & Prain (Fabaceae), *Ochna pumila* Buch.- Ham. ex DC. (Ochnaceae), *Olax nana* Wall. ex Benth. (Olacacaeae).

Due to rich floristic diversity coupled with presence of rare plants as well as wild relatives of crop plants, the reserve area which is presently under "Project Tiger" should be declared as a Biosphere Reserve for better management. Concerted efforts should also be made for proper management and *ex-situ* conservation of the rare plants. Biotic interference in form of large number of tourists also has adverse impact on the flora and it needs to be mitigated to improve overall biodiversity of the tiger Reserve.

ENUMERATION

PTERIDOPHYTES

ADIANTACEAE

Adiantum L.
A. caudatum L.
A. incisum Forssk.
A. philippense L.
Cheilanthes Sw.
C. farinosa (Forssk.) Kaulf.

ATHYRIACEAE

Athyrium Roth
A. hohenackerianum Moor
Diplazium Sw.
D. esculentum (Retz.) Sw.

DRYOPTERIDACEAE

Dryopteris Adans.
D. prolifera (Retz.) Chr.

EQUISETACEAE

Equisetum L.
E. debile Roxb.
E. diffusum D. Don

MARSILEACEAE

Marsilea L.
M. minuta L.

OPHIOGLOSSACEAE

Ophioglossum L.
O. costatum R. Br.
O. gramineum Willd.
O. nudicaule L. f.
O. reticulatum L.

PARKERIACEAE

Ceratopteris Brong.
C. thalictroides (L.) Brong.

SCHIZAEACEAE

Lygodium Sw.
L. flexuosum (L.) Sw.

SELAGINELLACEAE

Selaginella P. Beauv.
S. repanda (Desv. ex Poir.) Spring

ANGIOSPERMS

RANUNCULACEAE
Clematis L.
C. gouriana Roxb. ex DC.

DILLENIACEAE

Dillenia L.
D. aurea Sm.

ANNONACEAE

Miliusa Leschen. ex DC.
M. tomentosa (Roxb.) Finet & Gagnep.
M. velutina (Dunal) Hook. f. & Thomson

MENISPERMACEAE

Cissampelos L.
C. pareira L. var
hirsuta (Buch.-Ham. ex DC.) Forman

NYMPHAEACEAE

Nelumbo Adans.
N. nucifera Gaertn.
Nymphaea L., *nom. cons.*
N. nouchali Burm. f.

PAPAVERACEAE

Argemone L.
A. mexicana L.

COCHLOSPERMACEAE

Cochlospermum Kunth ex DC., nom. cons.
C. religiosum (L.) Alston

FLACOURTIACEAE

Casearia Jacq.
C. elliptica Willd.
Flacourtia Commerson ex L'Hérit.
F. indica (Burm. f.) Merr.
F. montana Graham

POLYGALACEAE

Polygala L.

Polygala elongata Klein
P. furcata Royle
Salomonia Lour., *nom. cons.*
S. ciliata (L.) DC.

CARYOPHYLLACEAE

Polycarpon L.
P. prostratum (Forssk.) Aschers. & Schweinf.

PORTULACACEAE

Portulaca L.
P. oleracea L.

HYPERICACEAE

Hypericum L.
H. laxum (Blume) Koidzumi

DIPTEROCARPACEAE

Shorea Roxb. ex Gaertn. f.
S. robusta Roxb. ex Gaertn. f.

MALVACEAE

Abelmoschus Medik.
A. crinitus Wall.
A. moschatus Medik.
Abutilon ramosum (Cav.) Guill. & Perr.
Hibiscus L., *nom. cons.*
H. lobatus (Murray) Kuntze
Kydia Roxb.
K. calycina Roxb.
Sida L.
S. acuta Burm. f.
S. cordata (Burm. f.) Borss.
S. cordifolia L.
Sida rhombifolia L.
S. spinosa L.
Thespesia Soland. ex Corrêa, *nom. cons.*
T. lampas (Cav.) Dalz. & Gibs.
Urena L.
U. lobata L.
subsp. **sinuata** (L.) Borss.

BOMBACACEAE

Bombax L., *nom. cons.*
B. ceiba L.

STERCULIACEAE

Eriolaena DC.
E. hookeriana Wight & Arn.
Firmiana Marsili
F. colorata (Roxb.) R. Br.
Helicteres L.
H. isora L.
Melochia L.
M. corchorifolia L.
Sterculia L.
S. urens Roxb.
Waltheria L.
W. indica L.

TILIACEAE

Corchorus L.
C. aestuans L.
C. olitorius L.
C. trilocularis L.
Grewia L.
G. hirsuta Vahl
G. rothii DC.
G. sapida Roxb. ex DC.
G. subinaequalis DC.
G. tiliifolia Vahl
Triumfetta L.
T. annua L.
T. pilosa Roth
T. rhomboidea Jacq.

MALPIGHIACEAE

Hiptage Gaertn., *nom. cons.*
H. benghalensis (L.) Kurz

OXALIDACEAE

Biophytum DC.
B. reinwardtii (Zucc.) Klotzsch
B. sensitivum (L.) DC.
Oxalis L.
O. corniculata L.

BALSAMINACEAE

Impatiens L.
I. balsamina L.
I. minor (DC.) Bennet

RUTACEAE

Aegle Corrêa, *nom. cons.*
A. marmelos (L.) Corrêa
Chloroxylon DC., *nom. cons.*
C. swietenia DC.
Citrus L.
C. aurantifolia (Christm. & Panz.) Swingle
C. aurantium L.
Limonia L.
L. acidissima L.
Murraya J. Koenig ex L., *orth. et nom. cons.*
M. paniculata (L.) Jack.

SIMAROUBACEAE

Ailanthus Desf., *nom. cons.*
A. excelsa Roxb.

BALANITACEAE

Balanites Delile, *nom. cons.*
B. aegyptiaca (L.) Delile

OCHNACEAE

Ochna L.
O. pumila Buch.-Ham. ex DC.

BURSERACEAE

Boswellia Roxb. ex Colebr.
B. serrata Roxb. ex Colebr.
Garuga Roxb.
G. pinnata Roxb.

MELIACEAE

Azadirachta A. Juss.
A. indica A. Juss.
Toona (Endl.) M. Roem.
T. ciliata M. Roem.

OLACACEAE

Olax L.
O. nana Wall. ex Benth.
O. scandens Roxb.

CELASTRACEAE

Cassine L.
C. glauca (Rottb.) Kuntze
Celastrus L.
C. paniculatus Willd.

RHAMNACEAE

Ventilago Gaertn.
V. denticulata Willd.
Ziziphus Tourn. ex Mill.
Z. mauritiana Lam.
Z. nummularia (Burm. f.) Wight & Arn.
Z. rugosa Lam.
Z. xylopyra (Retz.) Willd.

VITACEAE

Ampaleocissus Planch., *nom. cons.*
A. tomentosa (Heyne ex Roth) Planch.
Cayratia Juss., *nom. cons.*
C. auriculata (Wall.) Gamble
C. trifolia (L.) Domin

LEEACEAE

Laea D. van Royen ex L., *nom. cons.*
L. asiatica (L.) Ridsdale

SAPINDACEAE

Cardiospermum L.
C. halicacabum L.
Schleichera Willd. *nom. cons.*
S. oleosa (Lour.) Oken.

ANACARDIACEAE

Buchanania Spreng.
B. lanzan Spreng.
Lannea A. Rich., *nom. cons.*
L. coromandelica (Houtt.) Merr.
Mangifera L.
M. indica L.
Semecarpus L. f.
S. anacardium L. f.

MORINGACEAE

Moringa Adans.
M. oleifera Lam.

FABACEAE

Abrus Adans.
Abrus precatorius L.

Aeschynomene L.
Aeschynomene indica L.
Alysicarpus Neck. ex Desv., *nom. cons.*
A. bupleurifolius (L.) DC.
A. rugosus (Willd.) DC.
A. vaginalis (L.) DC.
Atylosia Wight & Arn.
A. volubilis (Blanco) Gamble
Butea Roxb. ex Willd. *nom. cons.*
B. monosperma (Lam.) Taub.
B. superba Roxb.
Cajamus DC.
C. scarabaeoides (L.) du Petit.-Thou.
Canavalia DC., *nom. cons.*
C. gladiata (Jacq.) DC.
Cicer L.
C. arietinum L.
Crotalaria L.
C. albida Heyne ex Roth
C. bialata Schrank.
C. calycina Schrank.
C. linifolia L. f.
C. medicaginea Lam.
var. **neglecta** (Wight & Arn.) Baker
C. mysorensis Roth
C. prostrata Rottler
C. retusa L.
C. sericea Retz.
Dalbergia L. f., *nom. cons.*
D. latifolia Roxb.
D. paniculata Roxb.
D. sissoo Roxb.
Desmodium Desv., *nom. cons.*
D. gangeticum (L.) DC. var. **gangeticum**
var. **maculatum** (L.) Baker
D. heterocarpon (L.) DC.
D. laxiflorum DC.
D. motorium (Houtt.) Merr.
D. pulchellum (L.) Benth.
D. triflorum (L.) DC.
Eriosema (DC.) G. Don, *nom. cons.*
E. himalaicum Ohashi
Erythrina L.
Erythrina suberosa Roxb.
Flemingia Roxb. ex Aiton & Ait. f., *nom. cons.*
F. bracteata (Roxb.) Wight
F. macrophylla (Willd.) Kuntze ex Merr.
F. nana Roxb.
F. prostrata Roxb.
F. semialata Roxb. ex Ait. f.
F. stricta Roxb.
F. strobilifera (L.) Aiton & Ait. f.
Indigofera L.
I. astragalina DC.
I. cassioides Rottler ex DC.
I. hamiltonii Graham ex Duthie & Prain
I. linifolia (L. f.) Retz.
Millettia Wight & Arn., *nom. cons.*
M. auriculata Baker ex Brandis
Mucuna Adans., *nom. cons.*
M. pruriens (L.) DC.
Pongamia Vent., *nom. cons.*
P. pinnata (L.) Pierre
Pterocarpus Jacq., *nom. cons.*
P. marsupium Roxb.
Pueraria DC.
P. tuberosa (Roxb. ex Willd.) DC.
Sesbania Scop., *nom. cons.*
S. bispinosa (Jacq.) W.F. Wight
Smithia Ait., *nom. cons.*
S. conferta Sm.
Tephrosia Pers., *nom. cons.*
T. purpurea (L.) Pers.
Uraria Desv.
U. lagopodioides (L.) Desv.
U. picta (Jacq.) Desv.
Vigna Savi
V. radiata (L.) Wilczek
V. umbellata (Thunb.) Ohwi & Ohashi
Zornia J.F. Gmelin
Z. gibbosa Span.

CAESALPINIACEAE

Bauhinia L.
B. racemosa Lam.
B. retusa Buch.-Ham.
B. tomentosa L.
B. vahlii Wight & Arn.
Caesalpinia L.

C. decapetala (Roth) Alston
Cassia L., *nom. cons.*
C. absus L.
C. auriculata L.
C. fistula L.
C. mimosoides L.
C. occidentalis L.
C. pumila Lam.
C. siamea Lam.
C. sophera L.
C. tora L.
Tamarindus L.
T. indica L.

MIMOSACEAE

Acacia Mill.
A. catechu (L. f.) Willd.
A. pennata (L.) Willd.
Albizia Durazz.
A. lebbeck (L.) Benth.,
A. odoratissima (L. f.) Benth.
Samanea (DC.) Merr.
S. saman (Jacq.) Merr.

ROSACEAE

Rosa L.
R. chinensis Jacq.

DROSERACEAE

Drosera L.
D. burmanni Vahl
D. indica L.

CRASSULACEAE

Kalanchoe Adans.
K. pinnata (Lam.) Pers.

COMBRETACEAE

Anogeissus (DC.)Guill., Perr. & A. Rich.
A. latifolia (Roxb. ex DC.)
Wall. ex Guill. & Perr.
Combretum Loefl., *nom. cons.*
C. nanum Buch.-Ham. ex D. Don
Terminalia L., *nom. cons.*
T. alata Heyne ex Roth
T. arjuna (Roxb. ex DC.) Wight & Arn.
T. bellirica (Gaertn.) Roxb.
T. chebula Retz.

MYRTACEAE

Eucalyptus L'Hérit.
E. sp.
Psidium L.
P. guajava L.
Syzygium Gaertn., *nom. cons.*
S. cumini (L.) Skeels
S. fruticosum (L.) Gaertn.

LECYTHIDACEAE

Careya Roxb., *nom. cons.*
C. arborea Roxb.

MELASTOMATACEAE

Osbeckia L.
O. chinensis L.
Sonerila Roxb., *nom. cons.*
S. tenera Royle

LYTHRACEAE

Ammannia L.
A. baccifera L.
A. multiflora Roxb.
Lagerstroemia L.
L. parviflora Roxb.
Rotala L.
R. mexicana Cham. & Schlecht.
R. rotundifolia (Roxb.) Koehne
R. serpyllifolia (Roth) Bremek.
Woodfordia fruticosa (L.) Kurz

ONAGRACEAE

Ludwigia L.
L. octovalvis (Jacq.) Raven
L. perennis L.
L. prostrata Roxb.

CUCURBITACEAE

Coccinia Wight & Arn.
C. grandis (L.) Voigt
C. L.
Cucumis callosus (Rottler) Cogn.
Diplocyclos (Endl.) Post & Kuntze

Emblica officinalis Courtesy : S.K. Srivastava

D. palmatus (L.) Jeffrey
Melothria maderaspatana (L.) Cogn.
Trichosanthes L.
T. bracteata (Lam.)Voigt

CACTACEAE

Opuntia Mill.
O. monacantha Haw.

MOLLUGINACEAE

Glinus L.
G. lotoides L.
G. oppositifolius (L.) A. DC.
Mollugo L.
M. pentaphylla L.

APIACEAE

Bupleurum L.
B. mucronatum Wight & Arn.
Centella L.
C. asiatica (L.) Urban
Hydrocotyl L.
H. sibthorpioides Lam.
Peucedanum L.
Peucedanum dhana Buch.-Ham. var. **dalzellii** C.B. Clarke
P. nagpurense (C.B. Clarke) Prain
Pimpinella L.
P. diversifolia DC.
P. heyneana (DC.) ex Kurz
P. wallichiana (Miq. ex Hohenck.) Gandhi

ARALIACEAE

Schefflera J.R. Forst. & G. Forst., *nom. cons.*
S. venulosa (Wight & Arn.) Harms

RUBIACEAE

Anthocephalus A. Rich. *emend.* Haviland
A. chinensis (Lam.) A. Rich. ex Walp.
Catunaregam Wolf
C. spinosa (Thunb.) Tirvengadum
C. uliginosa (Retz.) Sivarajan
Gardenia J. L. Ellis, *nom. cons.*
G. gummifera L. f.
G. latifolia Aiton
G. resinifera Roth
G. turgida Roxb.
Haldina Ridsdale
H. cordifolia (Roxb.) Ridsdale
Hedyotis L.
H. gracilis Wall.
H. pinifolia Wall. ex G. Don
Hymenodictyon Wall., *nom. cons.*
H. orixense (Roxb.) Mabberley
Ixora L.
I. arborea Roxb. ex Sm.
Knoxia L.
K. sumatrensis (Retz.) DC.
Mitragyna Korth., *nom. cons.*
M. parvifolia (Roxb.) Korth.
Oldenlandia L.
O. affinis (Roem. & Schult.) DC.
O. corymbosa L.
Pavetta L.
P. tomentosa Roxb. ex Sm.
Spermacoce L.
S. hispida L.
S. pusilla Wall.
Spermadictyon Roxb.
S. suaveolens Roxb.
Thecagonum Babu
T. ovatifolium (Cav.) Babu
Wendlandia Bartl. ex DC., *nom. cons.*
W. heynei (Roem. & Schult.)
Sant. & Merch.

ASTERACEAE

Acanthospermum Schrank
A. hispidum DC.
Adenostemma J.R. Forst. & G. Forst.
A. lavenia (L.) Kuntze
Ageratum L.
A. conyzoides L.
Amberboa (Pers.) Less., *nom. cons.*
A. ramosa (Roxb.) Jafri
Artemisia L.
A. nilagirica (C.B. Clarke) Pamp.
A. parviflora Buch.-Ham.
Bidens L.
B. biternata (Lour.) Merr. & Sherff
B. pilosa L.
Blainvillea Cass.
B. acmella (L.) Philipson
Blumea DC., *nom. cons.*
B. eriantha DC.
B. fistulosa (Roxb.) Kurz
B. lacera (Burm. f.) DC.
var. **glandulosa** Hook. f.
var. **lacera**
B. malcolmii (C.B. Clarke) Hook. f.
B. membranacea DC.
B. mollis (D. Don) Merr.
B. oxyodonta DC.
B. virens DC.
Blumeopsis Gagnep.
B. flava (DC.) Gagnep.
Caesulia Roxb.
C. axillaris Roxb.
Centipeda Lour.
C. minima (L.) A. Br. & Aschers.
Chrysanthellum Rich.
C. americanum (L.) Vatke
Conyza Less., *nom. cons.*
C. stricta Willd.
Cyathocline Cass.
C. purpurea (Buch.-Ham. ex D. Don) Kuntze
Elephantopus L.
E. scaber L.
Emilia Cass.
Emilia sonchifolia (L.) DC.
Glossogyne Cass.
G. bidens (Retz.) Alston
Gnaphalium L.
G. luteo-album L.
subsp. **affine** (D. Don) Koster
subsp. **luteo-album**

G. polycaulon Pers.
G. purpureum L.
Grangea Adans.
G. maderaspatana (L.) Poir.
Laggera Sch.-Bip. ex Koch
L. alata (D. Don) Sch.-Bip. ex Oliver
L. aurita L. f.
Launaea Cass.
L. procumbens (Roxb.) Ramayya & Rajagopal
Pentanema Cass.
P. indicum (L.) Ling
Pulicaria Gaertn.
P. angustifolia DC.
P. foliolosa DC.
P. wightiana (DC.) C.B. Clarke
Senecio L.
S. nudicaulis Buch.-Ham. ex D. Don
Siegesbeckia L.
S. orientalis L.
Sonchus L.
S. brachyotus DC.
Sphaeranthus L.
S. indicus L.
Tagetes L.
T. patula L.
Tridax L.
T. procumbens L.
Vernonia Schreb., *nom. cons.*
V. cinerea (L.) Less.
V. divergens (Roxb.) Edgew.
V. pyramidale (D. Don) S.N. Mitra
Xanthium L.
X. indicum Koenig
Youngia Cass.
Y. acaulis DC.

STYLIDIACEAE

Stylidium Sw. ex Willd., *nom. cons.*
S. tenellum Sw. ex Willd.

LOBELIACEAE

Lobelia L.
L. alsinoides Lam.
L. heyneana Roem. & Schult.

CAMPANULACEAE

Campanula L.
C. benthamii Wall. ex DC.
Wahlenbergia Schrad. ex Roth, *nom. cons.*
W. marginata (Thunb.) DC.

PLUMBAGINACEAE

Plumbago L.
P. zeylanica L.

PRIMULACEAE

Anagallis L.
A. pumila Sw.
Lysimachia L.
L. candida Lindl. subsp. **obovata** (Buch.-Ham. ex Hook. f.) Kunth

MYRSINACEAE

Embelia Burm. f., *nom. cons.*
E. basaal (Roem. & Schult.) A. DC.

SAPOTACEAE

Madhuca Buch.-Ham. ex J.F. Gmelin
M. longifolia (J. Koenig) Macbr. var. **latifolia** (Roxb.) Chevalier

EBENACEAE

Diospyros L.
D. melanoxylon Roxb.
D. montana Roxb.

OLEACEAE

Jasminum L.
J. arborescens Roxb.
Jasminum multiflorum (Burm. f.) Andr.
J. sambac (L.) Aiton
Nyctanthes L.
N. arbor-tristis L.

APOCYNACEAE

Carissa L., *nom. cons.*
C. spinarum L.
Catharanthus G. Don
C. roseus (L.) G. Don

Holarrhena R. Br.
H. pubescens (Buch.-Ham.) Wall. ex G. Don
Ichnocarpus R. Br., *nom. cons.*
I. frutescens (L.) R. Br.
Nerium L.
N. indicum Mill.
Plumeria L.
P. rubra L.
Tabernaemontana L.
T. divaricata (L.) R. Br.
Thevetia L., *nom. cons.*
T. peruviana (Pers.) K. Schum.
Vallaris Burm. f.
V. solanacea (Roth) Kuntze
Wrightia R. Br.
W. tinctoria R. Br.

ASCLEPIADACEAE

Asclepias L.
A. curassavica L.
Calotropis R. Br.
C. gigantea (L.) R. Br.
C. procera (Ait.) R. Br.
Ceropegia L.
C. hirsuta Wight & Arn.
Cryptolepis R. Br.
C. buchanani Roem. & Schult.
Cynanchum L.
C. callialata Buch.-Ham. ex Wight
Hemidesmus R. Br.
H. indicus (L.) R. Br.
Marsdenia R. Br., *nom. cons.*
M. tenacissima (Roxb.) Moon

GENTIANACEAE

Canscora Lam.
C. diffusa (Vahl) R. Br. ex Roem. & Schult.
Exacum L.
E. tetragonum Roxb.
Nymphoides J. Hill
N. hydrophylla (Lour.) Kuntze
N. indica (L.) Kuntze
Swertia L.
S. chirata Buch.-Ham.
S. corymbosa (Griseb.) C.B.Clarke

BORAGINACEAE

Bothriospermum Bunge
B. tenellum (Hornem.) Fischer & C.A. Meyer
Coldenia L.
C. procumbens L.
Cordia L.
C. macleodii (Griff.) Hook. f. & Thomson
C. wallichii G. Don
Cynoglossum L.
C. lanceolatum Forssk.
C. wallichii G. Don
Ehretia R. Br.
E. laevis Roxb.
Heliotropium L.
H. indicum L.
Rotula Lour.
R. aquatica Lour.
Trichodesma R. Br., *nom. cons.*
T. indicum (L.) R. Br. ex Lehm. var. **amplexicaule** (Roth) Cooke
var. **indicum**
Trichodesma zeylanicum (Burm. f.) R. Br.

CONVOLVULACEAE

Argyreia Lour.
A. sericea Dalz. & Gibs.
Convolvulus L.
C. prostratus Forssk.
Evolvulus L.
E. alsinoides (L.) L.
E. nummularius (L.) L.
Ipomoea L., *nom. cons.*
I. carnea Jacq.
I. eriocarpa R. Br.
I. hederifolia L.
I. pes-tigridis L.
I. quamoclit L.
I. sepiaria Koenig ex Roxb.
Merremia Dennst. ex Endl., *nom. cons.*
M. gangetica (L.) Cufod.
Rivea Choisy
R. hypocrateriformis (Desr.) Choisy

CUSCUTACEAE

Cuscuta L.

C. chinensis Lam.

SOLANACEAE

Datura L.
D. metel L.
Nicandra Adans., *nom. cons.*
N. physalodes (L.) Scop.
Physalis L.
P. peruviana L.
Solanum L.
S. nigrum L.
S. violaceum Ortega
S. virginianum L.

SCROPHULARIACEAE

Bacopa Aublet, *nom. cons.*
B. monnieri (L.) Wettst.
Dopatrium Buch.-Ham. ex Benth.
D. junceum (Roxb.) Buch.-Ham. ex Benth.
Limnophila R. Br., *nom. cons.*
L. aromatica (Lam.) Merr.
L. indica (L.) Druce
Lindernia All.
L. anagallis (Burm. f.) Pennell
L. antipoda (L.) Alston
L. caespitosa (Blume) Panigrahi
L. ciliata (Colsm.) Pennell
L. crustacea (L.) F.v. Muell.
L. hyssopioides (L.) Haines
L. nummulariifolia (D. Don) Wettst.
L. procumbens (Krock.) Borbas
Mazus Lour.
M. pumilus (Burm. f.) Steenis
Mecardonia Ruiz & Pavon
M. procumbens (Mill.) Small
Microcarpaea R. Br.
M. minima (J. Koenig ex Retz.) Merr.
Mimulus L.
M. strictus Benth.
Scoparia L.
S. dulcis L.
Sopubia Buch.-Ham. ex D. Don
S. delphiniifolia (L.) G. Don
Stemodia L., *nom. cons.*
S. viscosa Roxb.
Sutera Roth
S. dissecta (Delile) Walp.
Torenia L.
Torenia thouarsii (Cham. & Schlechtend.) Kuntze
Verbascum L.
V. chinense (L.) Santapau
Veronica L.
V. anagallis-aquatica L.

OROBANCHACEAE

Aeginetia L.
A. indica L.

LENTIBULARIACEAE

Utricularia L.
U. exoleta R. Br.

BIGNONIACEAE

Jacaranda Juss.
J. mimosaefolia D. Don
Oroxylum Vent.
O. indicum (L.) Vent.
Radermachera Zoll. & Moritzi
R. xylocarpa (Roxb.) K. Schum.
Stereospermum Cham.
S. chelonoides (L. f.) DC.

PEDALIACEAE

Martynia L.
M. annua L.
Sesamum L.
S. indicum L.

ACANTHACEAE

Adhatoda Mill.
A. zeylanica Medik.
Barleria L.
B. cristata L.
B. prattensis Santapau
B. strigosa Willd.
Dipteracanthus Nees
D. beddomei (C.B. Clarke) Santapau
D. prostratus (Poir.) Nees
Dyschoriste Nees
D. nagchana (Nees) Bennet

Eranthemum L.
E. purpurascens Wight ex Nees
E. roseum (Vahl) R. Br.
Hemigraphis Nees
H. latebrosa (Heyne ex Roth) Nees
var. **heyneana** Bremek.
var. **latebrosa**
Hygrophila R. Br.
H. auriculata (Schumach.) Heine
H. salicifolia (Vahl) Nees
H. serpyllum (Nees) T. Anderson
Justicia L.
J. betonica L.
J. diffusa Willd.
J. gendarussa Burm. f.
J. prostrata (C.B. Clarke) Gamble
J. quinqueangularis Koenig ex Roxb.
var. **peploides** (Nees) C.B. Clarke
var. **quinqueangularis**
J. simplex D. Don
J. vahlii Roth
Lepidagathis Willd.
L. fasciculata (Retz.) Nees
L. hamiltoniana Wall. ex Nees
L. incurva Buch.-Ham. ex D. Don
Nelsonia R. Br.
N. canescens (Lam.) Spreng.
Perilepta Bremek.
P. auriculata (Nees) Bremek.
Petalidium Nees
P. barlerioides (Roth) Nees
Rungia Nees
R. pectinata (L.) Nees
R. repens (L.) Nees

VERBENACEAE

Clerodendrum L.
C. indicum (L.) Kuntze
C. inerme (L.) Gaertn.
C. serratum (L.) Moon
Duranta L.
D. repens L.
Gmelina L.
G. arborea Roxb.
Lantana L.
L. camara L. var. **aculeata** (L.) Moldenke
Premna L., *nom. cons.*
P. barbata Wall. ex Schauer
Pygmaeopremna Merr.
P. herbacea (Roxb.) Moldenke
Tectona L. f., *nom. cons.*
T. grandis L. f.
Vitex L.
V. negundo L.

LAMIACEAE

Acrocephalus Benth.
A. hispidus (L.) Nicolson & Sivadasan
A. verbenifolius Watt ex Mukherjee
Ajuga L.
A. bracteosa Wall. ex Benth.
Anisochilus Wall. ex Benth.
A. eriocephalus Benth.
Anisomeles R. Br.
A. indica (L.) Kuntze
Colebrookea Sm.
C. oppositifolia Sm.
Hyptis Jacq., *nom. cons.*
H. suaveolens (L.) Poit.
Lavandula L.
L. bipinnata (Roth) Kuntze
Leonotis (Pers.) R. Br.
L. nepetifolia (L.) R. Br.
Leucas R. Br.
L. biflora (Vahl) R. Br.
L. cephalotes (Koenig ex Roth) Spreng.
Leucas hyssopifolia Wall. ex Benth.
L. mollissima Wall. ex Benth.
Micromeria Benth., *nom. cons.*
M. capitellata Benth.
Nepeta L.
N. hindostana (Heyne ex Roth) Haines
Ocimum L.
O. canum Sims
O. tenuiflorum L.
Orthosiphon Benth.
O. rubicundus (D. Don) Benth.
Plectranthus L'Hérit., *nom. cons.*
P. mollis (Ait.) Spreng.
Pogostemon Desf.

P. benghalense (Burm. f.) Kuntze
Salvia L.
S. plebeia R. Br.

NYCTAGINACEAE

Boerhavia L.
B. diffusa L.
B. repens L.
Bougainvillea spectabilis Willd.

AMARANTHACEAE

Achyranthes L.
A. aspera L. var. **aspera**
var. **porphyristachya** (Wall. ex Moq.) Hook. f.
Aerva Forssk., *nom. cons.*
A. lanata (L.) Juss. ex Schult.
A. sanguinolenta (L.) Blume
Allmania R. Br. ex Wight
A. nodiflora (L.) R. Br. ex Wight
Alternanthera Forssk.
A. sessilis (L.) R. Br. ex DC.
Amaranthus L.
A. spinosus L.
Celosia L.
C. argentea L.
Gomphrena L.
G. celosioides Mart.
Psilotrichum Blume
P. ferrugineum (Roxb.) Moq.

POLYGONACEAE

Muehlenbeckia Meisn., *nom. cons.*
M. platyclada (F. Muell. ex Hook.) Meisn.
Polygonum L., *nom. cons.*
P. barbatum L.
subsp. **barbatum**
subsp. **gracile** Danser
P. glabrum Willd.
P. hydropiper L.
P. limbatum Meisn.
P. plebeium R. Br.
P. serrulatum Lag.
Rumex L.
R. dentatus L. subsp.
klotzschianus (Meisn.) Reichb. f.

PROTEACEAE

Grevillea R. Br. ex J. Knight, *orth. et nom. cons.*
G. robusta A. Cunn. ex R. Br.

LORANTHACEAE

Dendrophthoe Mart.
D. falcata (L. f.) Etting.
Loranthus Jacq., *nom. cons.*
L. philippensis Cham. & Schlechtend.
Viscum L.
V. articulatum Burm.f.

EUPHORBIACEAE

Acalypha L.
A. ciliata Forssk.
A. indica L.
Antidesma L.
A. acidum Retz.
A. ghaesembilla Gaertn.
Baliospermum Blume
B. montanum (Willd.) Muell. Arg.
BrideliaWilld.
B. retusa (L.) Spreng.
B. squamosa (Lam.) Gehrm.
Chrozophora Adr. Juss., *orth. et nom. cons.*
C. rottleri (Geiseler) Adrs. Juss. ex Spreng.
Cleistanthus Hook. f. ex Planch.
C. collinus (Roxb.) Benth. ex Hook. f.
Emblica L.
E. officinalis Gaertn.
Euphorbia L.
E. chamaesyce L.
E. heterophylla L.
E. hirta L.
E. hypericifolia L.
E. milii Desmoul.
E. nivulia Buch.-Ham.
E. thymifolia L.
Glochidion J.R. Forst. & G. Forst, *nom. cons.*
G. velutinum Wight
Homonoia Lour.
H. riparia Lour.
Mallotus Lour.
M. philippensis (Lam.) Muell. Arg.

Phyllanthus L.
P. airy-shawii Brunel ex Roux
P. urinaria L.
P. virgatus G. Forst.
Securinega Commerson ex Juss., *nom. cons.*
S. virosa (Roxb. ex Willd.) Baill.

ULMACEAE

Holoptelea Planch.
H. integrifolia (Roxb.) Planch.
Trema Lour.
T. orientalis (L.) Blume

URTICACEAE

Elatostema J.R. Forst. & G. Forst., *nom. cons.*
E. cuneatum Wight
Girardinia Gaud.
G. diversifolia (Link) Friis
Laportea Gaud., *nom. cons.*
L. interrupta (L.) Chew.
Pouzolzia Gaud.
P. pentandra (Roxb.) Benn.

MORACEAE

Artocarpus J.R. Forst. & G. Forst., *nom. cons.*
A. heterophyllus Lam.
Ficus L.
F. arnottiana (Miq.) Miq.
F. beddomei King
F. benghalensis L.
F. hispida L. f.
F. microcarpa L. f.
F. mollis Vahl
F. racemosa L.
F. religiosa L.
F. semicordata Buch.-Ham. ex Sm.
F. tinctoria G. Forst. subsp. **parasitica** (Willd.) Corner
F. virens Dryand.

SALICACEAE

Salix L.
S. tetrasperma Roxb.

HYDROCHARITACEAE

Blyxa Noronha ex Thouars
B. echinosperma (C.B.Clarke) Hook. f.
B. octandra (Roxb.) Planch. ex Thwaites
Hydrilla Rich.
H, verticillata (L. f.) Royle
Lagarosiphon W.H. Harvey
L. alternifolia (Roxb.) Druce
Vallisneria L.
V. spiralis L.

ORCHIDACEAE

Aerides Lour.
A. multiflorum Roxb.
Eulophia R. Br. ex Lindl., *nom. cons.*
E. nuda Lindl.
Habenaria Willd.
H. commelinifolia (Roxb.) Wall. ex Lindl.
H. furcifera Lindl.
H. marginata Colebr.
Malaxis Soland. ex Sw.
M. rheedii Sw.
Nervilia Commerson ex Gaud., *nom. cons.*
N. aragoana Gaud.
Oberonia Lindl., *nom. cons.*
O. falconeri Hook. f.
Vanda W. Jones ex R. Br.
V. tessellata (Roxb.) Hook. ex G. Don
V. testacea (Lindl.) Reichb. f.
Zeuxine Lindl., *orth. et nom. cons.*
Z. strateumatica (L.) Schlechter

ZINGIBERACEAE

Curcuma L., *nom. cons.*
C. angustifolia Roxb.
C. pseudomontana J. Graham
Globba L.
G. marantina L.
G. racemosa Sm.
Zingiber Boehmer, *orth. et nom. cons.*
Z. capitatum Roxb.

COSTACEAE

Costus L.
C. speciosus (J. Koenig) Sm.

MUSACEAE

Musa L.
Musa paradisiaca L.

AMARYLLIDACEAE

Crinum L.
C. defixum Ker-Gawl.
C. pratense Herb.

HYPOXIDACEAE

Curculigo Gaertn.
C. orchioides Gaertn.

TACCACEAE

Tacca J.R. Forst. & G. Forst., *nom. cons.*
T. leontopetaloides (L.) Kuntze

DIOSCOREACEAE

Dioscorea L.
D. alata L.
D. belophylla (Prain) Voigt ex Haines
D. bulbifera L.
D. oppositifolia L.
D. pentaphylla L.

LILIACEAE

Asparagus L.
A. racemosus Willd.
Chlorophytum Ker-Gawl.
C. arundinaceum Baker
C. tuberosum (Roxb.) Baker
Gloriosa L.
G. superba L.
Iphigenia Kunth, *nom. cons.*
I. indica (L.) A. Gray

SMILACACEAE

Smilax L.
S. zeylanica L.

PONTEDERIACEAE

Monochoria K. Presl
M. hastata (L.) Solms
M. vaginalis (Burm. f.) K. Presl

COMMELINACEAE

Commelina L.
C. benghalensis L.
C. hasskarlii C.B. Clarke
C. longifolia Lam.
C. paludosa Blume
C. suffruticosa Blume
Cyanotis D. Don, *nom. cons.*
C. cristata (L.) D. Don
Murdannia Royle, *nom. cons.*
M. nudiflora (L.) Brenan
M. vaginata (L.) Brückner
Tonningia Neck. ex Adr. Juss.
T. axillaris (L.) Kuntze

JUNCACEAE

Juncus L.
J. leschenaultii Gay

ARECACEAE

Phoenix L.
P. acaulis Buch.-Ham. ex Roxb.

ARACEAE

Colocasia Schott, *nom. cons.*
C. esculenta (L.) Schott
Theriophonum Blume
T. minutum (Willd.) Baill.

ALISMATACEAE

Caldesia Parl.
C. parnassifolia (L.) Parl.

NAJADACEAE

Najas L.
N. graminea Delile

APONOGETONACEAE

Aponogeton L. f., *nom. cons.*
A. natans (L.) Engl. & K. Krause
A. undulatus Roxb.

ERIOCAULACEAE

Eriocaulon L.
E. achiton Koern.

E. quinquangulare L.

CYPERACEAE

Bulbostylis Kunth, *nom. cons.*
B. barbata (Rottb.) C.B. Clarke
Cyperus L.
Cyperus alulatus Kern
C. brevifolius (Rottb.) Hassk.
C. compactus Retz.
C. compressus L.
C. cyperoides (L.) Kuntze
C. difformis L.
C. distans L. f.
C. exaltatus Retz.
C. iria L.
C. kyllingia Endl.
C. melanospermus (Nees) Valck.-Suring.
C. nutans Vahl var. **eleusinoides** (Kunth) Haines
C. paniceus (Rottb.) Boeck.
C. pilosus Vahl
C. platystylis R. Br.
C. pseudokyllingioides Kuekenth.
C. pygmaeus Rottb.
C. sanguinolentus Vahl
C. triceps Endl.
Eleocharis R. Br.
E. dulcis (Burm. f.) Hensch.
Fimbristylis Vahl, *nom. cons.*
F. aestivalis (Retz.) Vahl
F. alboviridis C.B. Clarke
F. dichotoma (L.) Vahl
F. ferruginea (L.) Vahl
F. miliacea (L.) Vahl
F. schoenoides (Retz.) Vahl
F. tetragona R. Br.
Fuirena Rottb.
Fuirena ciliaris (L.) Roxb.
Lipocarpha R. Br., *nom. cons.*
Lipocarpha chinensis (Osbeck) Kern
Scirpus L., *nom. cons.*
S. lateriflorus J.F. Gmelin
S. mucronatus L.
S. squarrosus L.
S. supinus L.
Scleria Bergius
S. levis Retz. *non* C.B. Clarke

POACEAE

Alloteropsis K. Presl
A. cimicina (L.) Stapf
Apluda L.
A. mutica L.
Aristida L.
A. setacea Retz.
Arthraxon P. Beauv.
A. hookeri (Hack.) Henr.
A. lanceolatus (Roxb.) Hochst.
A. lancifolius (Trin.) Hochst.
A. quartinianus (A. Rich.) Nash
Arundinella Raddi
A. pumila (Hochst. ex A. Rich.) Steud.
Arundo L.
A. donax L.
Bambusa' Schreb., *nom. cons.*
B. arundinacea (Retz.) Willd.
Bothriochloa Kuntze
B. bladhii (Retz.) S.T.Blake
B. intermedia (R. Br.) A. Camus
B. kuntzeana (Hack.) Henr.
B. pertusa (L.) A. Camus
Brochiaria (Trin.) Griseb.
B. ramosa (L.) Stapf
Capillipedium Stapf
C. assimile (Steud.) A. Camus
C. parviflorum (R. Br.) Stapf
Chionachne R. Br.
C. koenigii (Spreng.) Thwaites
Chloris Sw.
C. dolichostachya Lag.
C. virgata Sw.
Chrysopogon Trin., *nom. cons.*
C. fulvus (Spreng.) Chiov.
Coix L.
C. aquatica Roxb.
C. lacryma-jobi L.
Cymbopogon Spreng.
C. martinii (Roxb.) Wats.
Cyndon Rich., *nom. cons.*
C. dactylon (L.) Pers.

Dactyloctenium Willd.
D. aegyptium (L.) Willd.
Dendrocalamus Nees
D. strictus (Roxb.) Nees
Desmostachya Stapf
D. bipinnata (L.) Stapf
Dichanthium Willemet
D. annulatum (Forssk.) Stapf
D. aristatum (Poir.) C.E. Hubb.
D. caricosum (L.) A. Camus
Digitaria Haller, *nom. cons.*
D. abludens (Roem. & Schult.) Veldk.
D. ciliaris (Retz.) Koel.
D. longiflora (Retz.) Pers.
D. setigera Roth ex Roem. & Schult.
D. stricta Roth ex Roem. & Schult.
Dimeria R. Br.
D. ornithopoda Trin.
Echinochloa P. Beau., *nom. cons.*
E. stagnina (Retz.) P. Beauv.
Eleusine Gaertn.
E. indica (L.) Gaertn.
Elytrophorus P. Beau.
E. spicatus (Willd.) A. Camus
Eragostiella Bor
E. bifaria (Vahl) Bor
E. brachyphylla (Stapf) Bor
E. nardoides (Trin.) Bor
Eragrostis Wolf
E. atrovirens (Desf.) Trin. ex Steud.
E. namaquensis Schrad. var.
diplachnoides (Steud.) W.D. Clayton
E. nutans (Retz.) Nees ex Steud.
E. tenella (L.) P. Beauv. ex Roem. & Schult.
E. tenuifolia (A. Rich.) Hochst. ex Steud.
E. unioloides (Retz.) Nees ex Steud.
Eulalia Kunth
E. trispicata (Schult.) Henr.
Eulaliopsis Honda
E. binata (Retz.) C.E. Hubb.
Hackelochloa Kuntze
H. granularis (L.) Kuntze
Heteropogon Pers.
H. contortus (L.) P. Beauv. ex
Roem. & Schult.
Hygroryza Nees
H. aristata (Retz.) Nees ex Wight & Arn.
Imperata Cirillo
I. cylindrica (L.) Raeuschel. var.
major (Nees) Hubb. ex Hubb. & Vaughan
Isachne R. Br.
I. dispar Trin.
Ischaemum L.
I. indicum (Houtt.) Merr.
I. rugosum Salisb.
Iseilema Anderss.
I. anthephoroides Hack.
I. laxum Hack.
I. prostratum (L.) Anderss.
Manisuris L.
M. clarkei (Hack.) Bor
Mnesithea Kunth
M. laevis (Retz.) Kunth
Narenga Bor
N. porphyrocoma (Hance) Bor
Ophiuros Gaertn. f.
O. megaphyllus Stapf ex Haines
Oplismenus P. Beauv., *nom. cons.*
O. burmannii (Retz.) P. Beauv.
O. compositus (L.) P. Beauv.
Oryza L.
O. sativa L.
Panicum L.
P. notatum Retz.
P. psilopodium Trin.
P. sumatrense Roth ex Roem. & Schult.
Panicum trypheron Schult.
P. walense Mez
Paspalidium Stapf
P. flavidum (Retz.) A. Camus
Paspalum L.
P. scrobiculatum L.
Pennisetum Rich. ex Pers.
P. hohenackeri Hochst. ex Steud.
P. pedicellatum Trin.
Perotis Aiton
P. indica (L.) Kuntze
Phragmites Adans.
P. karka (Retz.) Trin. ex Steud.
Pogonatherum P. Beauv.

P. paniceum (Lam.) Hack.
Polypogon Desf.
P. monspeliensis (L.) Desf.
Rottboellia. L.f., *nom. cons.*
R. cochinchinensis (Lour.) W.D. Calyton
Saccharum L.
S. spontaneum L.
Sacciolepis Nash
S. indica (L.) A. Chase
Sacciolepis myosuroides (R. Br.) A. Camus
Sehima Forssk.
S. nervosum (Rottl.) Stapf
Setaria P. Beauv., *nom. cons.*
S. intermedia Roem. & Schult.
S. pumila (Poir.) Roem. & Schult.
Sorghum Moench, *nom. cons.*
S. halepense (L.) Pers.
S. nitidum (Vahl) Pers.
Sporobolus R. Br.
S. tenuissimus (Schrank) Kuntze .
Thelepogon Roth ex Roem. & Schult.
T. elegans Roth ex Roem. & Schult.
Themeda Forssk.
T. arundinacea (Roxb.) Risdley
T. laxa (Anders.) A. Camus
T. quadrivalvis (L.) Kuntze
T. triandra Forssk.
Thysanolaena Nees
T. maxima (Roxb.) Kuntze
Urochloa P. Beauv.
U. panicoides P. Beauv.
Vetiveria Bory
V. zizanioides (L.) Nash

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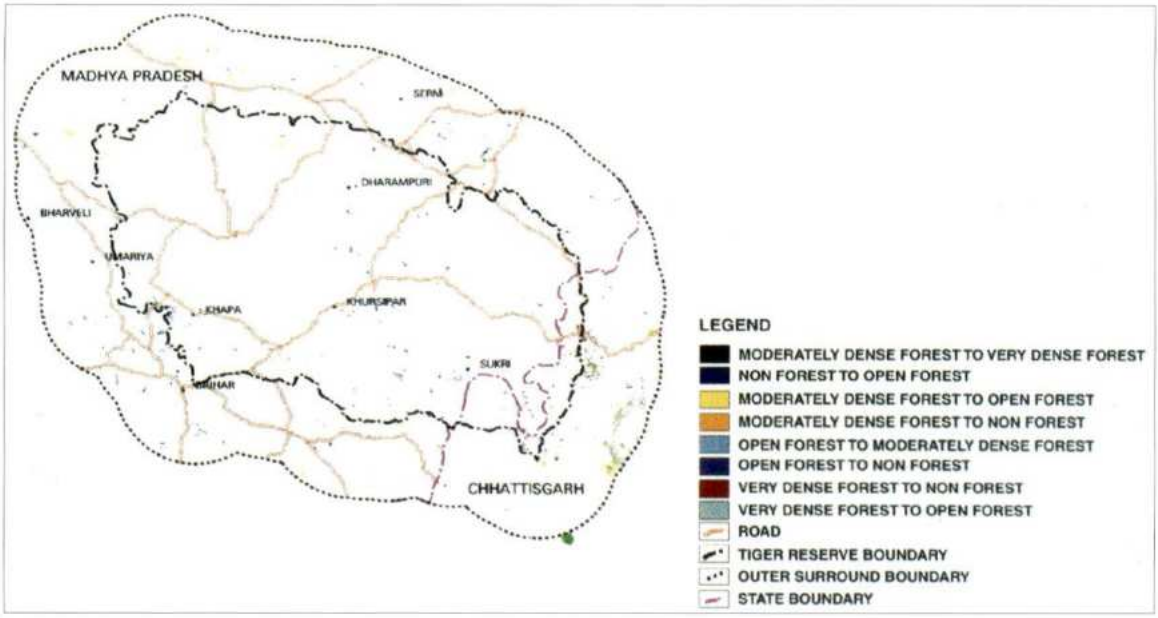

Map of Kanha Tiger Reserve

SALIENT FEATURES

Area

Core	:	940 sq km
Buffer	:	1005 sq km
Total	:	1945 sq km
Longitude	:	80°26' to 81°04'
Latitude	:	22°01'to 22°28'
Altitude	:	450 m. to 950 m. (M.S.L.)
Rainfall	:	1224 mm

Temperature

Minimum	:	2°C
Maximum	:	43°C

Seasons

Monsoon	:	Mid June to early October
Winter	:	November to February
Summer	:	March to mid-June

By Air

Nagpur (266 km) is the nearest airport. It is connected by Indian Airlines flights with Mumbai.

By Rail

Jabalpur (175 km) is the convenient railhead to visit Kanha.

By Road

Kanha National Park is connected by road with Jabalpur (175 km), Khajuraho (445 km), Nagpur (266 km), Mukki (25 km), and Raipur (219 km).

Local Transport

The Madhya Pradesh State Tourism Development Corporation (MPSTDC) operates a jeep service for visitors to go around in the park.

Panna Tiger Reserve

NR Suman, A Pinokiyo, KP Singh & BK Shukla
Botanical Survey of India, Central Circle, Allahabad-211 002

Conservation of living resources is the main objective of National Wildlife Action Plan, which involves establishment of protected areas in various forms such as national parks, wild life sanctuaries, bisophere reserves, etc. Panna Tiger Reserve is one such protected area in Madhya Pradesh, a state well known for its wild life management. It falls under Biogeographic zone -Deccan Penninsula, Central Highlands (6A) of the country (Rodger & al 2002). Panna was a famous shooting reserve *(Shikargarh)* of the rulers of Chatrasal dynasty during Mughal period. After independence, this shooting reserve constituting an area of about 285.33 sq km was declared as a wild life sanctuary in the year 1971. In the year 1981, this Sanctuary was upgraded to the status of National Park and some parts of Chhattarpur district were also included in territory of park, thereby increasing the total area of the park to 542.67 sq km. Finally, it was declared as tiger reserve in the year 1994-1995 considering the impressive population of tigers.

Panna Tiger Reserve lies between 24° 27' to 24° 47' N latitudes and 79° 45' to 80° 09' E longitudes. It covers parts of Panna and Gunour tehsils of Panna district and Bijawar and Chhattarpur tehsils of Chhattarpur district in North Central Madhya Pradesh. It is the narrow belt of flat top hill ranges, locally known as Panna, Ajaygarh and Vindhyan hills in different places. The dissected plateau in Panna and Bijawar tehsils where the reserve is marked by beveled summits and steep valleys. The river Ken enters the reserve towards the south, flows through its western parts for a distance of about 55 km, makes boundary between Panna and Chhattarpur, then emerges out at Madia village in the north and ultimately meets Yamuna river in Banda district of Uttar Pradesh.

Panna Tiger Reserve enjoys typical monsoon climate. It receives northwest monsoon from June and till middle of September. The weather becomes milder by this period with average relative humidity rarely crossing 95%. Average annual rainfall is about 1,200 mm and 1,100 mm in Panna and Chhatarpur districts respectively. A little rain from north east monsoon is received generally during December to January. The short winter season is from December to mid February. The temperature of the area varies between 2°C and 47°C.

The area is represented by basement rocks comprising Bundelkhand Granites with smaller bodies of metamorphic rocks such as quartzite banded magnetite quartzite, schist and amphibolites. This sequence of igneous metamorphic rocks is overlain by Vindhyan super group of rocks comprising sand stones, shales, limestones and conglomerates. The soils are of three kinds- (i) laterite soil covers majority of the area and spreads over large areas in Panna, Hinouta and Chandranagar ranges, (ii) heavier black cotton soil, which is restricted to some depressions, and in vicinity of water bodies in above mentioned three ranges and (iii) loamy soil, which is found mostly in river-side areas of Madia and Hinouta range and to some extent in Chandranagar range.

VEGETATION

According to Champion and Seth (1968) classification, the forest types of Panna Tiger Reserve fall under Tropical dry deciduous forests. It is further categorized into following 6 sub heads.

(i) Dry Teak forests: These forests occur on trap, shells, granites, geneses and sandstones. The growth is good in Ken valley where the soil is sandy and water table is high. But shallow soil and low water table on the plateaus exhibit stunted and sparsely distributed tree species. These are represented by *Tectona grandis* L., *Anogeissus latifolia* (Roxb. ex DC.) Wall. ex Bedd., *Terminalia tomentosa* (Roxb. ex. DC.) Wight. & Arnott, *Lagerstroemia parviflora* Roxb., *Phyllanthus emblica* L., *Ougeinia oogeinsis* (Roxb.) Hochr., *Pterocarpus marsupium* Roxb., *Lannea coromandelica* (Houtt.) Merr., *Boswellia serrata* Roxb. ex Colebr. etc. The under story comprises *Buchanania lanzan* Spreng., *Miliusa tomentosa* (Roxb.) Sinclair., *Gardenia latifolia* Aion, *Aegle marmelos* (L.) Correa, *Cassia fistula* L., *Acacia catechu* (L.f.) Willd., *Ziziphus xylopyrus* (Retz.) Willd. The small trees or shrubs are represented by *Carissa opaca* Stapf ex Haines, *Nyctanthes arbor-tristis* L., *Holarrhena pubescens* (Buch-Ham.) Willd., *Helicteres isora* L., *Euphorbia neriifolia* L., *Woodfordia fruticosa* (L.) Kurz, *Wrightia tinctoria* R. Br., etc, while the common herbs comprises *Indigofera tinctoria* L., *Cassia tora* L., *Sida cordata* (Burm. f.) Borss., *Hibiscus lobatus* (J.A. Muir) Kuntze, *Crotalaria prostata* Rottl. ex Willd., *Desmodium heterocarpon* (L.) DC., *D. triflorum* (L.) DC., *Uraria picta* (Jacq.) Desv. ex DC., *Cassia absus* L., *Oldenlandia corymbosa* L., *Elephantopus scaber* L. etc. The dominant grasses of these forests are *Alloteropsis cimicina* (L.) Stapf, *Arthraxon lancifolius* (Trin.) Hochst, *Chrysopogon fulvus* (Spreng.) Chiov., *Hackclochloa granularis* (L.) Kuntze, *Heteropogon contortus* (L.) P. Beauve. ex Roem. & Schult, *Eragrostis tenella* (L.) P. Beauve. ex Roem. & Schult, *Oplismenus burmannii* (Retz.) P. Beauv., *Themeda quadrivalvis* (L.) Kuntze, etc.

A beautiful flower of *Cochlospermum religiosum*

(ii) Dry deciduous mixed forests: These forests occur mainly on sandstones, shales and laterites where soils are shallow to fairly deep, sandy, lateritic and red loam. They are more prone to fires and have been subjected to heavy cattle grazing in the past. The tree species here belong to *Terminalia alata* Heyne ex Roth, *Anogeissus latifolia* (Roxb. ex DC.) Wall., ex Bedd., *Mitragyna parvifolia* (Roxb.) Korth., *Lannea coromandelica* (Houtt.) Mirr, *Boswellia serrata* Roxb. *ex* Colebr, *Terminalia arjuna* (Roxb. ex DC.) Wight & Arn., *Schleichera oleosa* (Lour.) Oken., *Holoptelea integrifolia* (Roxb.) Planch., *Hoppea dichotoma* Hayne ex Willd., *Catunaregum nilotica* (Stapf) Tirvengadum, *Combretum roxburghii* Spreng. and patches of *Tectona grandis* L.f., The under story consists of *Phyllanthus emblica* L., *Buchanania lanzan* Spreng., *Acacia catechu* (L.f.) Willd., *Cassia fistula* L., *Ehretia laevis* Roxb., *Jatropha curcas* L., *Cassia surattensis* Burm. f., *Ziziphus xylopyrus* (Retz.) Willd.,

Euphorbia neriifolia in Dry Scrub Forest

Gardenia latifolia Aiton, *Acacia leucophloea* (Roxb.) Willd., *Butea monosperma* (Lam.) Taub., *Dendrocalamus strictus* (Roxb.) Nees, etc. The shrubby species comprises *Woodfordia fruticosa* (L.) Kurz , *Helicteres isora* L., *Carissa opaca* Stapf ex Haines, *Ziziphus mauritiana* Lam., *Euphorbia neriifolia* L. etc, while *Ziziphus oenoplia* (L.) Mill., and *Butea superba* Roxb. are common climbers. The prominent grasses found here are *Eragrostis tenella* (L.) P. Beauv. ex Roem. & Schult., *Cynodon dactylon* (L.) Pers., *Bothriochloa pertusa* (L.) A. Camus, *Dichanthium annulatum* (Forssk.) Stapf, *Chrysopogon fulvus* (Spreng.) Chiov., *Cenchrus ciliaris* L., *Brachiaria ramosa* (L.) Stapf, etc.

(iii) Dry Scrub forests: These forests are found in the areas adjacent to villages and cultivated fields and do not show stratification. The main components of these forests are represented by *Vitex negundo* L., *Annonasquamosa* L., *Carissa opaca* Stapf ex Haines, *Capparis zeylanica* L., *Calycopteris floribunda* Lam., *Flacourtia indica* (Burm. f.) Merr., *Grewia hirsuta* Vahl, *Helicteres isora* L., *Holarrhena pubescens* (Buch.-Ham) Wall. ex G. Don, *Jatropha curcas* L., *Woodfordia fruticosa* (L.) Kurz, *Ziziphus oenoplia* (L.) Mill., *Lantana camara* L., *Datura innoxia* Mill., *Wrightia tinctoria* R. Br., *Diospyros melanoxylon* Roxb., *Haldinia cordifolia* (Roxb.) Ridsd., *Ziziphus nummularia* (Burm.) Wight & Arn., etc. Most of the tree species of these forests are stunted and sparsely distributed.

(iv) Boswellia forests: These forests occur on dry upper slopes of hills having dry shallow and stony soils. The main characteristic component of these forests is *Boswellia serrata* Roxb. ex Colebf. which occupies the higher plateaus and slopes in dry conditions. These forests sometimes become pure on ridges in some areas of Talgaon and Kawar beats. The other common species associated with these forests are *Mitragyna parvifolia* (Roxb.) Korth., *Lannea coromandelica* (Houtt.) Merr., *Terminalia alata* Heyne ex Roth,, *Anogeissus latifolia* (Roxb. ex DC.) Wall. ex Bedd., *Diospyros melanoxylon* Roxb., *Ougeinia oogeinsis* (Roxb.) Hochr., *Phyllanthus emblica* L., *Soymida febrifuga* (Roxb.) A. Juss., *Ziziphus xylopyrus* (Retz.) Willd., *Holarrhena pubescens* (Buch.-Ham.) Wall., ex G. Don, *Gardenia latifolia* Aiton, *Cassia fistula* L., *Buchanania lanzan*

Spreng., while *Ziziphus oenoplia* (L.) Mill., *Butea parviflora* Roxb., *B. superba* Roxb. and *Ventilago denticulata* Willd. are some of the common climbers of these forests. Fodder grasses are represented by the species viz. *Apluda mutica* L., *Bothriochloa pertusa* (L.) A. Camus, *Eragrostis tenella* (L.) P. Beauv. ex Roem. & Schult., *Heteropogon contortus* (L.) P. Beauv. ex Roem. & Schult. *Phragmites karka* (Retz.) Trin. ex Steud., *Themeda caudata* (Nees) A. Camus, *Themeda quadrivalvis* (L.) Kuntze, *Thysanolaena latifolia* (Roxb. ex Hornem.) Honda etc.

(v) **Dry bamboo breaks:** Bamboos do not occur in pure patches and are usually found on the slopes of hills, in upper reaches of nalas and occasionally along the banks of streams. Well protected valleys and certain other areas of beats like Manour, Pipertola, Raipura, Patan, Sukwaha etc. show good growth of bamboos with healthy culms. The areas which were over exploited in the past and are close to the habitations still have bamboo growth but with poorly developed and quickly drying culms. These forests are mainly represented by two species viz. *Dendrocalamus strictus* (Roxb.) Nees and *Bambusa arundinacea* (Retz.) Willd., which are found in the understorey of *Tectona grandis* L. f. and mixed forests such as *Phyllanthus emblica* L. f., *Acacia catechu* (L. f.) Willd., *Cassia fistula* L., *Jatropha curcas* L., *Acacia leucophloea* (Roxb.) Willd., *Woodfordia fruticosa* (L.) Kurz, *Ziziphus mauritiana* Lam., etc.

(vi) **Anogeissus pendula forests:** These forests occur mainly in a long strip of small width at the foothills from Pipertola to Gangau Dam along both the banks of Ken river. The growth of *Anogeissus pendula* Edgew. is luxuriant in Sutwaha ghat in north Khameri beat, near Gherighat. *Tectona grandis* L. f. sometimes intrudes the strip in small patches but its growth is not prominent.

FLORISTIC DIVERSITY

Although, Panna Tiger Reserve comprises dry deciduous forests yet it is quite rich in phytodiversity. As such, floristic diversity of the reserve is represented by 450 species of Angiosperms, distributed under 318 genera and 89 families (Table-1). 9 species of Pteridophytes distributed under 8 genera and 7 families are also recorded from the area. The family Poaceae shows maximum diversity and is represented by 43 genera and 56 species. It is followed by Fabaceae (30 genera and 50 spp.), Asteraceae (22 genera and 31 spp.), Acanthaceae (11 genera and 15 spp.), Cyperaceae (3 genera and 16 spp.), Convolvulaceae (7 genera and 13 spp.), Scrophulariaceae (8 genera and 12 spp.), Euphorbiaceae (7 genera and 14 spp.), Lamiaceae (8 genera and 11 spp.). and Amaranthaceae (7 genera and 11 spp.), These ten families altogether represent 154 genera and 229 species, which is almost half of the phytodiversity of angiosperms in the reserve (Table-3). Among the genera, maximum species diversity is exhibited by *Cyperus* (8 spp.), followed by *Eragrostis, Indigofera* with 7 spp. each, *Acacia, Blumea,* with 6 spp. each, *Ficus, Fimbristylis, Ipomoea, Euphorbia* with 5 spp. each, *Desmodium, Zizyphus, Sida,* with 4 spp. each (Table-4). Similarly, based on their habit, the flora may again be analyzed for their dominance. Herbaceous plants dominate the flora and are represented by 268 species; followed by trees (85 spp.) shrubs (78 spp.) and lianas/ climbers (28 spp.) (Table-2). There are 27 species of rare plants, which have less population in the reserve (Table-5). A conspectus of families showing the number of genera and species from the area are also shown (Table-6). In addition to this, the flora of the reserve also includes several species, which have economic potential and used as fodder, wild edibles, dyes and medicines (Tables 7,8 and 9).

Table-1: Statistics of flora

Name of group	No. of families	No. of genera	No. of species
Pteridophytes	7	8	9
Angiosperms			
Dicots	74	254	357
Monocots	15	64	93
Total	**96**	**326**	**459**

Table-2: Habit wise categories

	Trees	Shrubs	Lianas/Climbers	Herbs
No. of species	85	78	28	268

Table-3: 10 Dominant families

Name of family	No. of genera	No. of species
Poaceae	43	56
Fabaceae	30	50
Asteraceae	22	31
Cyperaceae	3	16
Acanthaceae	11	15
Scrophulariaceae	8	12
Convolvulaceae	7	13
Euphorbiaceae	7	14
Lamiaceae	8	11
Amaranthaceae	7	11

Table-4: Some dominant genera

Name of genera	No. of species
Cyperus	8
Indigofera	7
Acacia	6
Blumea	6
Eragrostis	7
Ficus	5
Ipomoea	5
Fimbristylis	5
Desmodium	4
Euphorbia	5
Sida	4
Zizyphus	4

Table-5: Rare species

Name of Species	Family	Locality
Acacia lenticularis Buch.-Ham. ex Baker	Mimosaceae	Manour
Begonia malabarica Lam.	Begoniaceae	Badgadi
Centella asiatica (L.) Urban	Apiaceae	Madla
Crateva unilocularis Buch.-Ham.	Capparaceae	Manour
Crotalaria umbellate Wight ex Wight & Arn.	Fabaceae	Madla
Curcuma aromatica Salisb.	Zingiberaceae	Jhalar
Cuscuta hyaline Roth	Convolvulaceae	Lalar
Diplazium esculentum (Retz.) Sw.	Athyriaceae	Pandev Fall
Dipteracanthus patulus (Jacq.) Nees	Acanthaceae	Umrawan
Eragrostis coarctata Stapf	Poaceae	Hinouta
Eragrostis viscosea (Retz.) Trin.	Poaceae	Talgaon
Eriocaulon parviflorum (Fyson.) Ansari & Balakr.	Eriocaulaceae	Pandav fall
Eriocaulon longicuspis Hook. f.	Eriocaulaceae	Pandev fall
Fimbristylis ferruginea (L.) Vahl	Cyperaceae	Manour
Fimbristylis miliacea (L.) Vahl	Cyperaceae	Chandranagar
Gloriosa superba L.	Liliaceae	Talgaon
Indoneesiella echioides (L.) Sreemadh.	Acanthaceae	Madla
Laggera aurita Schultz-Bip. ex Schw.	Asteraceae	Judi
Limnophila heterophylla (Roxb.) Benth.	Scrophulariaceae	Raepura
Litsea monopetala (Roxb.) Pers.	Lauraceae	Palkohan
Narenga porphyrocoma (Hance) Bor	Poaceae	Pandav fall
Ocimum kilimandscharicum Guerke	Lamiaceae	Gherighat
Pentatropis nivalis (J.F. Gmelin) D.V. Field & J.R.I. Wood	Asclepidaceae	Badgadi
Phalaris minor Retz.	Poaceae	Talgoan
Pteris vittata L.	Pteridaceae	Pandav Fall
Sonchus asper (L.) Hill.	Asteraceae	Jardhoba
Stephania glabra (Roxb.) Miers	Menispermaceae	Talgaon
Themeda caudata (Nees) A. Camus	Poaceae	Pipertola

Table-6: A conspectus of families showing number of genera and species

Name of family	Number of genera	Number of species
DICOTS		
Ranunculaceae	1	1
Annonaceae	2	2
Menispermaceae	3	3
Papaveraceae	1	1
Brassicaceae	4	5
Capparaceae	2	2
Violaceae	1	1
Cochlospermaceae	1	1
Flacourtiaceae	1	1
Polygalaceae	1	1
Caryophyllaceae	1	2
Portulacaceae	1	2
Tamaricaceae	1	1
Elatinaceae	1	1
Malvaceae	4	8
Bombacaceae	1	1
Sterculiaceae	4	5
Tiliaceae	3	7
Linaceae	1	1
Oxalidaceae	1	1
Rutaceae	3	3
Simaroubaceae	1	1
Burseraceae	2	2
Meliaceae	3	3
Celastraceae	3	4
Rhamnaceae	2	5
Vitaceae	2	3
Sapindaceae	3	3
Anacardiaceae	3	3
Fabaceae	30	50
Ceasalpiniaceae	4	11
Mimosaceae	4	9
Rosaceae	1	1
Combretaceae	4	7
Myrtaceae	1	1
Lythraceae	4	5
Onagraceae	1	1
Cucurbitaceae	6	8
Begoniaceae	1	1
Molluginaceae	2	2
Apiaceae	1	1
Rubiaceae	9	10
Asteraceae	22	31
Campanulaceae	1	1
Plumbaginaceae	1	1
Primulaceae	2	2
Sapotaceae	3	3
Ebenaceae	1	1

Name of family	Number of genera	Number of species
Apocynaceae	8	9
Asclepiadaceae	5	5
Gentianaceae	4	5
Menyanthaceae	1	1
Hydrophyllaceae	1	1
Boraginaceae	6	7
Convolvulaceae	7	13
Solanaceae	4	7
Scrophulariaceae	8	12
Lentibulariaceae	1	1
Gesneriaceae	1	1
Bignoniaceae	1	1
Pedaliaceae	1	1
Acanthaceae	11	15
Verbenaceae	4	5
Lamiaceae	8	11
Nyctaginaceae	1	1
Amaranthaceae	7	11
Chenopodiaceae	1	1
Polygonaceae	1	3
Aristolochiaceae	1	1
Loranthaceae	1	1
Lauraceae	1	1
Euphorbiaceae	7	14
Ulmaceae	2	2
Moraceae	1	7
MONOCOTS		
Hydrocharitaceae	2	2
Orchidaceae	2	2
Zingiberaceae	1	1
Costaceae	1	1
Amaryllidaceae	1	1
Agavaceaae	1	1
Dioscoreaceae	1	2
Liliaceae	3	3
Pontederiaceae	1	1
Commelinaceae	1	1
Juncaceae	1	1
Araceae	2	2
Eriocaulaceae	1	3
Cyperaceae	3	16
Poaceae	43	56
PTERIDOPHYTES		
Equisetaceae	1	1
Cheilanthaceae	1	1
Pteridaceae	1	1
Adiantaceae	1	2
Perkeriaceae	1	1
Thelipteridaceae	2	2
Athyriaceae	1	1

Table –7 : Medicinal Plants

Name of species	Parts used	Diseases
Acacia nilotica ssp. *indica* (Benth.) Brenan	Flower, seed and gum resin	Diarrhoea and dysentery
Achyranthes aspera L.	Leaf Root	Swelling of eyes, Snake bite and Anti-fertility
Aegle marmelos (L.) Correa	Leaf juice Fruit pulp	Pains swellings and body-ache Jaundice and liver diseases
Argeratum conyzoides L.	Plant paste	Headache
Argemone mexicana L.	Latex	Scorpions sting
Anisomeles indica (L.) Kuntze	Whole plant	Constipation and stomach pain
Aristolochia indica L.	Root	Diarrhoea and dysentry
Asparagus racemosus Willd.	Root	Lactation, skin diseases
Azadirachta indica A. Juss.	Leaf and Bark	Cuts, Wounds and boils
Barleria pionitis L.	Leaf	Cold, cough and bronchitis
Bauhinia racemosa Lam.	Bark	Diarrhoea and dysentry
Blumea lacera (Burm. f.) DC.	Leaf	Cuts, wounds and boils
Buchanania lanzan Spreng.	Stem and Bark	Cuts, wounds and boils
Butea monosperma (Lam.) Taub.	Stem Seed, flower	Cuts, wounds and boils Inflammation
Calotropis procera (Ait.) R. Br. *Capparis zeylanica* L.	Latex Root bark	Sanke bite and Scorpion sting Hydrocele and swelling of testicles
Cassia fistula L.	Root bark Seed	Pains, swellings, body-ache, cuts Jaundice and stomach pain
C. tora L.	Seed	Cold, cough and bronchitis
Catunaregam nilotica (Stapf) Tirvengadum	Fruit pulp	Diahhroea and dysentery
Celastrus paniculatus Willd.	Seed	Hair growth problems
Celosia argentea L.	Seed	Diarrhoea and dysentery
Centella asiatica (L.) Urb.	Whole plant	Diarrhoea and dysentery
Cissampelos pareiara L. var. *hirsuta* (Buch. -Ham. ex DC.) Forman	Leaf	Constipation and stomach pain
Cleome viscosa L.	Leaf	Cuts, wounds and boils
Cochlospermum religiosum (L.) Alston	Bark	Jaundice and liver diseases
Cordia dichotoma G. Forst.	Leaf	Cold, cough and bronchitis

Name of species	Parts used	Diseases
Curculigo orchioides Gaertn.	Tuberous root	Impotency and sexual disorders
Cuscuta reflexa Roxb.	Plant paste Whole plant	Headache Hydrocele, swelling of testicles
Cyperus rotundus L.	Root	Diarrhoea and dysentery
Datura metal L.	Leaf	Hydrocele and Swelling of testicles
Dendrophthoe falcata (L.f.) Etting.	Root	Skin diseases
Echinops echinatus Roxb.	Root	Delivery problem
Eclipta alba (L.) Hassk.	Root Watery latex	Filaria, diarrhoea and dysentery Pains, swellings and body aches
Elephantopus scaber L.	Root	Filaria
Euphorbia hirta L.	Leaf	Snake bite and Scorpion sting
Ficus benghalensis L.	Bark	Snake bite and Scorpion sting
Gloriosa superba L.	Tuberous root	Abortion
Helicteres isora L.	Watery extract of seed	Constipation and stomach pains
Hemidesmus indicus (L.) R. Br.	Root Stem	Urinary troubles, skin diseases, impotency, sexual disorders; Toothe-ache.
Holoptelea integrifolia (Roxb.) Planch	Stem bark	Hydrocele and swelling of testicles
Hoppea dichotoma Heyne ex Willd.	Whole plant	Snake bite and Scorpion sting
Hygrophila auriculata (Schum.) Haines	Seed	Impotency and sexual disorders
Ichnocarpus frutescens (L.) R. Br.	Stem	Tooth-ache
Indoneesiella echioides (L.) Sreemadh.	Plant juice	Fever
Mallotus philippensis (Lam.) Muell. Arg.	Fruit	Skin diseases
Ocimum tenuiflorum L.	Leaf	Fever, cold, cough and bronchitis
Oxalis corniculata L.	Leaf	Fever
Peristophe paniculata (Forssk.) Brummitt	Stem	Bone fractures and sprains
Phyllanthus amarus Schumach. & Thonn.	Whole plant	Cuts, wounds and boils
Pogostemon benghalense (Burm. f.) Kuntze	Whole plant	Worms in animal wounds
Phyllanthus emblica L.	Fruit	Hair growth problems
Sida rhombifolia L.	Flower	Impotency and sexual disorders

Name of species	Parts used	Diseases
Spermacoce hispida L.	Plant juice	Pains, swellings and body aches
Tinospora cordifolia (Willd.) Miers ex Hook. f. & Thomson	Stem	Bone fractures and sprains
Tridax procumbens L.	Whole plant	Cuts, wounds and boils
Vanda tessellata (Roxb.) Hook. ex G. Don	Stem	Bone fractures and sprains
Verbascum chinense (L.) Sant.	Leaf and flower	Cough, cold and bronchitis
Woodfordia fruticosa (L.) Kurz	Leaf	Inflammation

Table –8: Dye yielding plants

Name of species	Dye yielding parts	Colour of dye
Aegle marmelos (L.) Correa	Rind of fruit	Yellow dye
Ampelocissus latifolia (Roxb.) Planch.	Leaf	Green
Azadrachta indica A. Juss.	Bark	Red dye
Butea monosperma (Lam.) Taub.	Flower	Saffron dye
Cassia fistula L.	Bark	Light red dye
C. tora L.	Seed	Blue dye
Curcuma aromatica Salisb.	Rhizome	Orange yellow dye
Ficus racemosa L.	Bark	Black dye
F. religiosa L.	Leaf	Reddish pale-Brown dye
Jatropha curcas L.	Latex	Reddish-brown dye
Lawsonia inermis L.	Leaf	Red dye
Mallotus philippensis (Lam.) Muell. Arg.	Capsule	Red dye
Mimusops elengi L.	Root	Red and purple dyes
Morinda umbellate L.	Root	Yellow dye
Phyllanthus emblica L.	Leaf, fruit and bark	Blakish-grey, Black dye
Tectona grandis L. f.	Leaf	Red dye
Woodfordia fruticosa (L.) Kurz	Flower	Orange dye

Table-9: Wild edible plants

Name of species	Parts eaten
Aegle marmelos (L.) Correa	Fruit pulp
Amaranthus spinosus L.	Leaf
A. viridis L.	Leaf
Ampleocissus latifolia (Roxb.) Plench.	Ripe fruit
Anogeissus latifolia (Roxb. ex DC.) Wall. ex Bedd.	Gum
Asparagus racemosus Willd.	Root
Bauhinia racemosa Lam.	Fruit
B. purpurea L.	Flower
Boerhavia diffusa L.	Young leaf

Name of species	Parts eaten
Bombax ceiba L.	Young fruit and root
Buchanania lanzen Spreng.	Ripe fruit and seed
Capparis zeylanica L.	Fruit
Cassia tora L.	Young leaf
Celosia argentea L.	Leaf
Centella asiantica (L.) Urb.	Leaf
Dendrocalamus strictus (Roxb.) Nees	Young shoot
Dendrophthoe falcate (L. f.) Etting.	Flower juice and fruit
Dioscorea bulbifera L.	Tuber
D. pentaphylla L.	Tuber
Diospyros melanoxylon Roxb.	Fruit
Ehretia laevis Roxb.	Fruit
Feronia limonia (L.) Swingle	Fruit
Ficus benghalensis L.	Fruit
F. racemosa L.	Fruit
F. religiosa L.	Fruit
F. virens Dryander	Fruit
Gardenia latifolia Aiton	Ripe fruit
Grewia hirsuta Vahl	Fruit
Habenaria marginata Colebr.	Tuber
Indigofera cassioides Rottl. ex DC.	Flower
Leucas cephalotes (Koenig ex Roth) Spreng.	Leaf
Madhuca longifolia (J. Koenig) Macbr. var. *latifolia* (Roxb.) Chevalier	Flower
Manilkara hexandra (Roxb.) Dubard	Fruit
Momordica charantia L.	Fruit
M. dioica Roxb. ex Willd.	Fruit
Phyllanthus emblica L.	Fruit
Pithecellobium dulce (Roxb.) Benth.	Fruit
Physalis minima L.	Fruit
Schleichera oleosa (Lour.) Oken	Fruit
Solanum nigrum L.	Leaf and fruit
Sterculia urens Roxb.	Gum and young fruit
S. villosa Roxb. ex Smith	Root
Syzygium heyneanum Wall. ex Wight & Arn.	Ripe fruit
Woodfordia fruitcosa (L.) Kurz	Flower juice
Ziziphus mauritiana Lam.	Fruit
Z. nummularia (Burm. f.) Wight & Arn.	Fruit
Z. oenoplia (L.) Mill.	Fruit

Fodder grasses: *Apluda mutica* L., *Bothrichloa pertusa* (L.) A. Camus, *Brachiaria ramosa* (L.) Stapf, *Chrysopogon fulvus* (Spreng.) Chiov., *Cynodon dactylon* (L.) Pers., *Eragrostis tenella* (L.) P. Beauv. ex Roem. & Schult., *Heteropogon contortus* (L.) P. Beauv. ex Roem. & Schult., *Paspalum scrobiculatum* L., *Themeda quadrivalvis* (L.) Kuntze, *Thysanolaena latifolia* (Roxb. ex Hornem) Honda, etc.

Oil yeilding plants: *Argemone mexicana* L., *Azadirachta indica* A. Juss., *Brassica juncea* (L.) Gzern. & Coss, *Buchanania lanzan* Spreng., *Cymbopogon martinii* (Roxb.) Wats., *Jatropha curcas* L., *Linum usitissimum* L., *Seasmum indicum* L., and *Vetiveria zizanioides* (L.) Nash, etc.

Plants used for fibers, mats and baskets: *Abutilon indicum* (L.) Sweet (Stem), *Bauhina*

A Bamboo patch

purpurea L. (Stem.), *B. vahlii* Wight & Arn. (Stem), *Butea monosperma* (Lam.) Taub. (Stem and roots.), *B. superba* Roxb. (Stem), *Corchorus capsularis* L.(Stem), The floor or cotton which are hairy outgrowths of seeds is obtained from *Bombax ceiba* L., *Calotropis procera* (Ait.) R. Br., *Cochlospermum religiosum* (L.) Alston, *Cryptolepis buchanani* Roem. & Schult., *Gossypium hirsutum* L., etc.

Plants used for Gums and Resins: *Acacia nilotica* ssp. *indica* (Benth.) Brenan, *A. catechu* (L.) Willd., *A. leucophloea* (Roxb.) Willd., *Azadirachta indica* A. Juss., *Boswellia serrata* Roxb. ex Colebr., *Buchanania lanzan* Spreng., *Butea monosperma* (Lam.) Taub., *Cochlospermum religiosum* (L.) Alston,. *Lannea coromandelica* (Hout.) Merr. and *Sterculia urens* Roxb.

Timber yielding plants: *Acacia catechu* (L.f.) Willd. *A. nilotica* ssp. *indica* (Benth.) Brenan, *Albizia lebbek* (L.) Benth., *Azadirachta indica* A. Juss., *Boswellia serrata* Roxb. ex Colebr., *Butea monosperma* (Lam.) Taub., *Cordia dichotoma* G. Forst., *Dalbergia sissoo* Roxb., *Haldinia cordifolia* (Roxb.) Ridsdale, *Lagerstroemia parviflora* Roxb., *-Lannea coromandelica* (Houtt.) Merr., *Mallotus philippensis* (Lam.) Mull. Arg., *Mangifera indica* L., *Mitragyna parviflora* (Roxb.) Korth., *Sterculia urens* Roxb.; *Tectona grandis* L., *Terminalia arjuna* (Roxb. ex DC.) Wight & Arn., etc.

Miscellaneous uses :

(a) The leaves of *Diospyros melanoxylon* Roxb. are largely used far making 'Bidis' for smoking. Sometimes leaves of *Bauhinia* spp. are also used for this purpose by tribal people.

(b) Leaf cups and plates are mainly made from the leaves of *Butea monosperma* (Lam.) Taub. and *Bauhinia vahlii* Wight & Arn.

(c) Brooms are made from *Vetiveria zizanioides* (L.) Nashi.

(d) Match sticks are made from wood of *Bombax ceiba* L. and *Boswellia serrata* Roxb. ex Colebr.

(e) Plants used for thatching purposes are *Saccharuam spontaneum* L., *Heteropogon contortus* (L.) P. Beauv ex Roem. & Schult., and young leaves of *Tectona grandis* L.f.

(f) There are several species, which can be used as raw material in paper industry. These are *Dendrocalamus strictus* (Roxb.) Nees, *Heteropogon contortus* (L.) P. Beauv ex Roem.& Schult., *Saccharum spontaneum* L. etc.

THREATS AND CONSERVATION

Yoganand (2001) described the reserve as *Vulnerable Paradise* and appealed the need of real protection that legal documents notionally offer for such fragile pockets. This indicates that the reserve is facing various threat problems from within as well as from outside. Agriculture and cattle raring are the main occupations of villagers residing within and surrounding the reserve area (Tiwari, 1998). These have direct impact on the vegetation of the protected area. The aggressive grazing pressure by cattle results in the loss of many valuable and rare species in the reserve. Similarly, the population of *Tactona grandis* L. is suffering from illicit cutting. Moreover, infestation of weeds like *Lantana camara, Parthenium hysterophorus, Portulaca oleracea , Melilotus alba, Sonchus asper, Ipomoea eriocarpa, Anagalis arvensis , Gnaphalium affine, Cyperus iria, Convolvulus arvensis,* etc. poses threat to the growth of other species. Another noteworthy, very disastrous threat is the location of Diamond mines at the periphery of the reserve without maintenance of required minimum distance of 25 km from the area. This pollutes the water of surrounding and the slurry from mines feeds into Kaimsan nullah which flows through the tiger reserve, thereby threatening the life of wild animals and creating congenial conditions for the growth of harmful weeds like *Lantana camara* and *Parthenium hysterophorus.* Moreover, open forests boundary, pressure of tourism, forest fire in dry season, construction of state High way No. 6 (Chattarpur-Rewa) within the reserve, etc, are some of the other factors responsible for the destruction of flora.

In general, conservation strategies of the protected areas in discussed by Singh (2002). For Panna Tiger Reserve, Chowdhery (2002) has already discussed the management plan for Panna Tiger Reserve and needs no elaboration. However, rehabilitation of enclave villagers outside the reserve boundary and maintaining a minimum required distance as per Government's norms will be a great help to conserve the flora of the reserve. Ecotourism, diversion of State high way No. 6 outside the reserve, proper maintenance of grazing land and encouraging the villagers to take part in joint forest management programmes will be helpful in conserving the floristic diversity. The weed flora should be uprooted and burnt at vegetative stage and replaced by fodder species.

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ENUMERATION

PTERIDOPHYTES

EQUISETACEAE

Equisetum ramosissimum Desf.
subsp. **debile** (Roxb. ex Vauch.) Hauke

A view of Grassland Vegetation

CHEILANTHACEAE

Cheilanthus farinosa (Forssk.) Kaulf

PTERIDACEAE

Pteris vittata L.

ADIANTACEAE

Adiantum capillus-veneris L.
A. philippense L.

PARKERIACEAE

Certatopteris thalictroides (L.) Boengn.

THELYPTERIDACEAE

Christella parasitica (L.) Lèv.
Pseudocyclosorus falcilbous (Hook.) Ching

ATHYRIACEAE

Diplazium esculentum (Retz.) Sw.

ANGIOSPERMS
DICOTS

RANUNCULACEAE

Ranunculus scleratus L.

ANNONACEAE

Annona squamosa L.
Miliusa tomentosa (Roxb.) Sinclair

MENISPERMACEAE

Cocculus hirsutus (L.) Diels
Stephania glabra (Roxb.) Mie.
Tinospora cordifolia (Willd.) Miers. ex Hook. f. & Thomson

PAPAVERACEAE

Argemone mexicana L.

BRASSICACEAE

Brassica rapa L. subsp. **campestris** (L.) Clapham
B. juncea (L.) Czern.
Cochlearia cochlearioides (Roth) Sant. & Maheshw.
Raphanus sativus L.
Rorippa indica (L.) Hiern

CAPPARACEAE

Capparis zeylanica L.
Crateva unilocularis Buch.-Ham.

VIOLACEAE

Hybanthus enneaspermus (L.) F. Muell.

COCHLOSPERMACEAE

Cochlospermum religiosum (L.) Alston

FLACOURTIACEAE

Flacourtia Indica (Burm. f.) Merr.

POLYGALACEAE

Polygala chinensis L.

CARYOPHYLLACEAE

Spergula arvensis L.
S. fallax (Lowe) Krause

PORTULACACEAE

Portulaca pilosa L.
P. oleracea L.

Vegetation along the Ken River side

TAMARICACEAE

Tamarix ericoides Rottl. & Willd.

ELATINACEAE

Bergia ammannioides Roxb. ex Roth

MALVACEAE

Abutilon indicum (L.) Sweet
Gossypium hirsutum L.
Hibiscus cannabinus L.
H. lobatus (J.A. Murr.) Kuntze
Sida acuta Burm. f.
S. cordata (Burm. f.) Borss.
S. cordifolia L.
S. rhombifolia L.

BOMBACACEAE

Bombax ceiba L.

STERCULIACEAE

Helicteres isora L.
Melochia corchorifolia L.
Sterculia urens Roxb.
S. villosa Roxb.
Waltheria indica L.

TILIACEAE

Corchorus capsularis L.
C. fascicularis Lam.
Grewia flavescens A. L. Juss.
G. hirsuta Vahl
G. rothii DC.
Triumfetta pentandra A. Rich.
T. rhomboidea Jacq.

LINACEAE

Linum usitatissimum L.

OXALIDACEAE

Biophytum sensitivum (L.) DC.

RUTACEAE

Aegle marmelos (L.) Correa
Feronia limonia (L.) Swingle
Naringi crenulata (Roxb.) Nicolson

SIMAROUBACEAE

Ailanthus excelsa Roxb.

BURSERACEAE

Boswellia serrata Roxb. ex Colebr.
Garuga pinnata Roxb.

MELIACEAE

Azadirachta indica A. Juss.
Melia azedarach L.
Soymida febrifuga (Roxb.) A. Juss.

CELASTRACEAE

Cassine glauca (Rottb.) Kuntze
Celastrus paniculatus Willd.
Maytenus emarginata (Willd.) Ding-Hou
M. senegalensis (Lam.) Exell.

RHAMNACEAE

Ventilago denticulata Willd.
Ziziphus mauritiana Lam.
Z. nummularia (Burm. f.) Wight & Arn.
Z. oenoplia (L.) Mill.
Z. xylopyrus (Retz.) Willd.

VITACEAE

Ampelocissus latifolia (Roxb.) Planch.
A. tomentosa (Heyne ex Roth) Planch.
Cayratia trifolia (L.) Domin

SAPINDACEAE

Cardiospermum helicacabum L.
Sapindus laurifolia Vahl
Schleichera oleosa (Lour.) Oken.

ANACARDIACEAE

Buchnania lanzan Spreng.
Lannea coromandelica (Houtt.) Merr.
Mangifera indica L.

FABACEAE

Alysicarpus bupleurifolius (L.) DC.
Atylosia volubilis (Blanco) Gamble
Butea monosperma (Lam.) Taub.
B. parviflora Roxb.
B. superba Roxb. ex Willd.
Cajanus cajan (L.)
C. scarabacoides (L.) der Petit-Thou
C. platycarpus (Benth.)Van der Maesen
Canavolia gladiata (Jacq.) DC.

Cicer arietinum L.
Crotolaria medicaginea Lam.
C. prostrata Rottl.
C. umbellata Wight ex Wight & Arn.
Dalbergia sisoo Roxb.
Desmodium gangeticum (L.) DC.
D. heterocarpon (L.) DC.
D. triflorum (L.) DC.
D. velutinum (Willd.) DC.
Flemingia strobilifera (L.) Ait. & Ait. f.
Galactia tenuiflora (Klein ex Willd.) Wight & Arn.
Indigofera cassioides Rottl. ex DC.
I. cordifolia Heyne ex Roth
I. glandulosa Wendl.
I. linifolia (L. f.) Retz.
I. linnaei Ali
I. tinctoria L.
I. tirta L. f.
Lathyrus aphaca L.
L. sativus L.
Lens culinaris Medik.
Medicago polymorpha L.
M. alba Medik. ex Desr.
M. indica (L.) All.
Milletia extensa (Benth.) Benth. ex Baker
Mucuna pruriens (L.) DC.
Ougeinia ojeinensis (Roxb.) Hochr.
Phaseolus subramanyanum Babu ex Raizada
Pisum sativum L.
Pterocarpus massupium Roxb.
Rhynchosia bracteata Benth. ex Baker
R. minima (L.) DC.
Tephrosia pumila (Lam.) Pers.
T. purpurea (L.) Pers.
Teramnus labialis (L.f.) Spreng.
Trigonella corniculata (L.) L.
T. foenum-graecum L.
Uraria picta (Jacq.) Desv. ex DC.
Vicia hirsuta (L.), S. F. Gray.
V. sativa L.
Zornia gibbosa Span.

CAESALPINIACEAE

Bauhinia purpurea L.
B. racemosa Lam.
B. vahlii Wight & Arn.
Caesalpinia bonduc (L.) Roxb.
Cassia absus L.
C. fistula L.
C. obtusifolia L.
C. pumila Lam.
C. tora L.
Cassia surattensil Burm. f.
Parkinsonia aculeata L.

MIMOSACEAE

Acacia catechu (L. f.) Willd.
A. donaldi Haines
A. jacqumontii Benth.
A. leucophloea (Roxb.) Willd.
A. lenticularis Buch.-Ham. ex Benth.
A. pennata (L.) Willd.
Albizia lebbek (L.) Benth.
Mimosa himalayana Gamble
Pithecellobium dulce (Roxb.) Benth.

ROSACEAE

Potentilla supina L.

COMBRETACEAE

Anogeissus acuminata (Roxb. ex DC.) Guill. & Perr.
A. latifolia (Roxb. ex DC.) Wallich ex Guill. & Perr.
Anogeissus pendula Edgew.
Calycopteris Horibunda Lank.
Combretum roxburghii Spreng.
Terminalia alata Heyne ex Roth
T. arjuna (Roxb. ex DC.) Wight & Arn.

MYRTACEAE

Syzygium heyneanum Wall. ex Gamble

LYTHRACEAE

Lagerstroemia parviflora Roxb.
Lawsonia inermis L.
Rotala rotundifolia (Roxb.) Koehne
R. serpyllifolia (Roth.) Bremek.
Woodfordia fruticosa (L.) Kurz

ONAGRACEAE

Ludwigia octovalvis (Jacq.) Raven

CUCURBITACEAE

Balastania gracinii (Burm. f.) Cogn.
Citrulus lanatus (Thunb.) Matsumara & Nakai

Cucumis melo L.
Melothria heterophylla (Lour.) Cogn.
M. maderaspatana (L.) Cogn.
Memordica dioca Roxb. ex Willd.
Trichosanthes bracteata (Lam.) Voigt
T. cucumerina L.

BEGONIACEAE

Begonia malabarica C.B. Clarke

MOLLUGINACEAE

Glinus oppositifolius (L.) A. DC.
Mollugo pentaphylla L.

APIACEAE

Centella asiatica (L.) Urban

RUBIACEAE

Catunaregum nilotica (Stapf) Trivengadum
Dentella repens (L.) J.R. Forst. & G. Forst.
Gardenia latifolia Ait.
Haldinia cordifolia (Roxb.) Ridsd.
Ixora pavetta Andrews
Mitragyna parvifolia (Roxb.) Korth.
Morinda umbellata L.
Oldenlandia corymbosa L.
Spermacoce hispida L.
S. pusilla Wall.

ASTERACEAE

Acanthospermum hispidum DC.
Ageratum conyzoides L.
Bidens biternata (Lour.) Merr. & Shreff.
Blainvillea acmella (L.) Philipson
Blumea eriantha DC.
B. lacera (Burm. f.) DC.
B. membranacea DC. var. **membranacea**
B. membranacea Wall. ex DC. var. **jacquemontii** (Hook.f.) Ranadria.
B. mollis (D. Don) Merr.
B. obliqua (L.) Druce
B. oxyodonta DC.
Caesulia axillaris Roxb.
Centipeda minima (L.) A. Br. & Ashers.
Cyathocline purpurea (Buch.-Ham. ex D. Don) Kuntze
Echinops echinatus Roxb.
Elephantopus scaber L.
Gnaphalium luteo-album L.
subsp. **affine** (D. Don.) Koster
G. polycaulon Pers.
Grangea maderaspatana (L.) Poir.
L. mollis Cav.
L. aurita L.
Launaea procumbens (Roxb.) Ramayya & Rajgopal
Parthenium hysterophorus L.
Pulicaria angustifolia DC.
P. foliolosa DC.
Sonchus asper (L.) Hill.
S. oleraceus L.
Sphaeranthus indicus L.
Tridax procumbens L.
Vernonia cinerea (L.) Less.
V. divergens (Roxb.) Edgew.
Xanthium indicum Koen.

CAMPANULACEAE

Wahlenbergia marginata (Thunb.) DC.

PLUMBAGINACEAE

Plumbago zeylanica L.

PRIMULACEAE

Anagallis arvensis L.
Primula umbellata (Lour.) Bentvelzen

SAPOTACEAE

Madhuca lOngifolia (Koen.) Macbr.
var. **latifolia** (Roxb.) Chev.
Manilkara hexandra (Roxb.) Dub
Mimusops elengi L.

EBENACEAE

Diospyros melanoxylon Roxb.

APOCYNACEAE

Carissa opaca Stapf ex Haines
Carissa spinarum L.
Catharanthus pusillus (Murr.) G. Don
Holarrhena pubescens (Buch.-Ham.) Wall. ex G. Don
Ichnocarpus frutescens (L.) R. Br.
Nerium indicum Mill.
Tabernaemontana divaricata (L.) R. Br.
Thevetia peruviana (Pers.) K. Schum.
Wrightia tinctoria R. Br.

ASCLEPIADACEAE

Calotropis procera (Ait.) R. Br.
Cryptolepis buchanani Roem. & Schult.
Hemidesmus indicus (L.) R. Br.
Pentatropis nivalis (J. F. Gmelin) D. V. Field & J. R. I. Wood
Pergularia daemia (Forssk.) Chiov.

GENTIANACEAE

Canscora decurrens Dalzell
C. diffusa (Vahl) R. Br. ex Roem. & Schult.
Centaurium meyeri (Bunge) Druce
Enicostema axillare (Lam.) A. Raynal
Hoppea dichotoma Heyne ex Willd.

MENYANTHACEAE

Nymphoides hydrophylla (Lour.) Kuntze

HYDROPHYLLACEAE

Hydrolea zeylanica (L.) Vahl

BORAGINACEAE

Bothriospermum tenellum (Hornem.) Fisch. & C. A. Meyer
Cordia dichotoma G. Forst.
Cynoglossum lanceolatum Forssk.
Ehretia laevis Roxb.
Heliotropium ovalifolium Forssk.
Trichodesma indicum(L.) R. Br. ex Lehm. var. **indicum**
T. indicum (L.) R. Br. var. **subsessilis** C. B. Clarke
T. zeylanicum (Burm. f.) R. Br.

CONVOLVULACEAE

Argyreia bella (C. B. Clarke) Raizada
Convolvulus arvensis L.
C. prostratus Forssk.
Cuscuta hyalina Roth
Evolvulus alsinoides (L.) L.
E. nummularis (L.) L.
Ipomoea carnea Jacq.
I. eriocarpa R. Br.
I. hederifolia L.
I. pes-tigridis L.
I. quamoclit L.
Merremia tridentata (L.) Hall. f.
Porana paniculata Roxb.

SOLANACEAE

Datura innoxia Mill.
D. metel L.
Lycopersicon esculentum Mill.
Physalis minima L.
Solanum incanum L.
S. nigrum L.
S. virginianum L.

SCROPHULARIACEAE

Bacopa monnieri (L.) Wettst.
Limnophila heterophylla (Roxb.) Benth.
L. indica (L.) Druce
L. rugosa (Roth) Merr.
Lindenbergia indica (L.) Vatke
Lindernia ciliata (Colsm.) Pennell
L. crustacea (L.) F. v. Muell.
L. hookeri (C. B. Clarke ex Hook. f.) Wettst.
Scoparia dulcis L.
Sutera dissecta (Delile) Walp.
Verbascum chinense (L.) Santapau
Veronica anagallis-aquatica L.

LENTIBULARIACEAE

Utricularia exoleta R. Br.

GESNERIACEAE

Didymocarpus pygmaea C.B. Clarke

BIGNONIACEAE

Sterospermum chelonoides (L. f.) DC.

PEDALIACEAE

Martynia annua L.

Sesamum indicum L.

ACANTHACEAE

Barleria cristata L.
Barleria prionitis L.
Dipteracanthus patulus (Jacq.) Nees
D. prostratus (Poir.) Nees
Eranthemum purpurascens Wight ex Nees
Gendarussa vulgaris Nees
Hemigraphis latebrosa (Heyne ex Roth) Nees
Hygrophila auriculata (Schumach.) Heine
Indoneesiella echioides (L.) Sreemadh.

Justicia diffusa Willd.
J. prostrata (C.B. Clarke) Gamble
J. quinqueangularis Koenig. ex Roxb.
Lepidagathis trinervis Wallich ex Nees
Peristrophe paniculata (Forssk.) Brummitt
Rungia pectinata (L.) Nees

VERBENACEAE

Clerodendrum multiflorum (Burm. f.) Kuntze
Lantana camara L. var. **aculeata** (L.) Modenke
Tectona grandis L. f.
Vitex leucoxylon L. f.
V. negundo L.

LAMIACEAE

Anisomeles indica (L.) Kuntze
Colebrookea oppositifolia Sm.
Hyptis suaveolens (L.) Poir.
Leucas cephalotes (Koenig ex Roth) Spreng.
L. clarkei Hook. f.
Ocimum basilicum L.
O. kilimandscharicum Guerke
O. tenuiflorum L.
Orthosiphon pallidus Royle ex Benth.
Pogostemon benghalense (Burm. f.) Kuntze
Salvia plebeia R. Br.

NYCTAGINACEAE

Boerhavia diffusa L.

AMARANTHACEAE

Achyranthes aspera L.
Aerva lanata (L.) Juss. ex Schult.
A. sanguinolenta (L.) Blume
Alternanthera paronychioides St. Hill
A. pungens Kunth
Amranthus spinosus L.
A. tricolor L.
A. viridis L.
Celosia argentea L.
Gomphrena celosioides Mart.
Pupalia lappacca (L.) Juss.

CHENOPODIACEAE

Chenopodium album L.

POLYGONIACEAE

Polygonum barbatum L.
P. glabrum Willd.
P. plebeium R. Br.

ARISTOLOCHIACEAE

Aristolochia indica L.

LAURACEAE

Litsea monopetala (Roxb.) Pers.

LORANTHACEAE

Dendrophthoe falcata (L. f.) Etting.

EUPHORBIACEAE

Baliospermum montanum (Willd.) Muell. Arg.
Chrozophora rottleri (Geiseler) A. Juss. ex Spreng.
Euphorbia drancunculoides Lam.
E. heyneana Spreng.
E. hypercifolia L.
E. neriifolia L.
E. nivulia Buch.-Ham.
Jatropha curcas L.
Mallotus philippensis (Lam.) Muell. Arg.
Phyllanthus amarus Schumach. & Thonn.
P. emblica L.
P. maderaspatensis L.
P. virgatus G. Forst.
Trewia polycarpa Benth.

ULMACEAE

Holoptelea integrifolia (Roxb.) Planch.
Trema orientalis (L.) Blume

MORACEAE

Ficus arnoltiana (Miq.) Miq.
F. benghalensis L.
F. microcarpa L. f.
F. mollis Vahl
F. racemosa L.
F. religiosa L.
F. virens Dryander

MONOCOTS

HYDROCHARITACEAE

Blyxa aubertii Rich.

Hydrilla verticillata (L. f.) Royle

ORCHIDACEAE

Habenaria marginata Colbr.
Vanda tessellata (Roxb.) Hook. ex G. Don

ZINGIBERACEAE

Curcuma aromatica Salisb.

COSTACEAE

Costus speciosus (J. Koenig) Sm.

AMARYLLIDACEAE

Crinum defixum Ker-Gawl.

AGAVACEAE

Sansevieria hyacinthoides (L.) Druce

DIOSCORIACEAE

Dioscorea bulbifera L.
D. pentaphylla L.

LILIACEAE

Asparagus racemosus Willd.
Gloriosa superba L.
Urginea indica (Roxb.) Kunth

PONTEDERIACEAE

Monochoria vaginalis (Burm. f.) K. Presl

COMMELINACEAE

Commelina suffruticosa Blume

JUNCACEAE

Juncus bufonius L.

ARACACEAE

Colocasia esculenta (L.) Schott
Cryptocornye retrospiralis (Roxb.) Wydler

ERIOCAULACEAE

Eriocaulon longicuspis Hook. f.
E. parviflorum (Fyson) Ansari and Balakr.
E. quinquangulare L.

CYPERACEAE

Cyperus brevifolius (Rottb.) Hassk.
C. compressus L.
C. cyperoides (L.) Kuntze
C. difformis L.
C. distans L. f.
C. iria L.
C. pangorei Rottb.
C. tenuispica Steud.
Eleocharis autropurpurea (Retz.) Presl
E. geniculata (L.) Roem. & Schult.
E. reteroflexa (Poir.) Urb.
Fimbristylis bisumbellata (Forssk.) Bubani
F. dipsacea (Rottb.) C.B. Clarke
F. ferruginea (L.) Vahl
F. littoralis Gaud.
F. miliacea (L.) Vahl

POACEAE

Alloteropsis cimicina (L.) Stapf
Apluda mutica L.
Arthraxon lancifolius (Trin.) Hochst.
Arundo donax L.
Bambusa arundinacea (Retz.) Willd.
Bothriochloa pertusa (L.) A. Camus
Brachiaria ramosa (L.) Stapf
Cenchrus ciliaris L., Mant.
Chloris dolichostachya Lag.
Chrysopogon fulvus (Spreng.) Chiov.
Cymbopogon martinii (Roxb.) Wats.
Cynodon dactylon (L.) Pers.
Dactyloctenium aegyptium (L.) P. Beauv.
Dendrocalamus strictus (Roxb.) Nees
Desmostachya bipinnata (L.) Stapf
Dichanthium annulatum (Forssk.) Stapi
D. aristatum (Poir.) Hubb.
Digitaria bicornis (Lam.) Roem. & Schult. ex Loud.
Echinochloa colonum (L.) Link
E. stagnina (Retz.) P. Beauv.
Eleusine indica (L.) Gaertn.
Eragrostis atrovirens (Desf.) Trin. ex Steud.
E. coaretata Stapf
E. diarrhena (Schult.) Steud.
E. gangetica (Roxb.) Steud.
E. tenella (L.) P. Beauv. ex Roem. & Schult.
E. viscosa (Retz.) Trin.
Hackelochloa granularis (L.) Kuntze
Heteropogon contrtus (L.) P. Beauv. ex Roem. & Schult.

Mixed Dry Deciduous Forest at Maniyagarh Hill

Hygroryza aristata (Retz.) Nees ex Wight & Arn.
Ischaemum indicum (Houtt.) Merr.
I. rugosum Salisb.
Iseilema laxum Hack.
Melanocenchris jacquemontii Jaub. & Spach
Narenga porphyrocoma (Hance) Bor
Oplismenus burmannii (Retz.) P. Beauv.
Panicum psilopodium Trin.
P. sumatrense Roth ex Roem. & Schult.
Paspalum scrobiculatum L.
Pennisetum pedicellatum Trin.
Phalaris minor Retz.
Phragmites karka (Retz.) Trin. ex Steud.
Pogonatherum paniceum (Lam.) Hack.
Saccharum spontaneum L.
Sacciolepis interrupta (Willd.) Stapf
Setaria glauca (L.) P. Beauv.
S. pumila (Poir.) Roem. & Schult.
Setaria verticillata (L.) P. Beauv.
Themeda caudata (Nees) Acamus
T. quadrivalvis (L.) Kuntze
T. triandra Forssk.
Thysanolaena maxima (Roxb.) Kuntze
Tragus roxburghii Panigrahi
Triticum aestivum L.
Vetiveria zizanioides (L.) Nash
Zea mays L.

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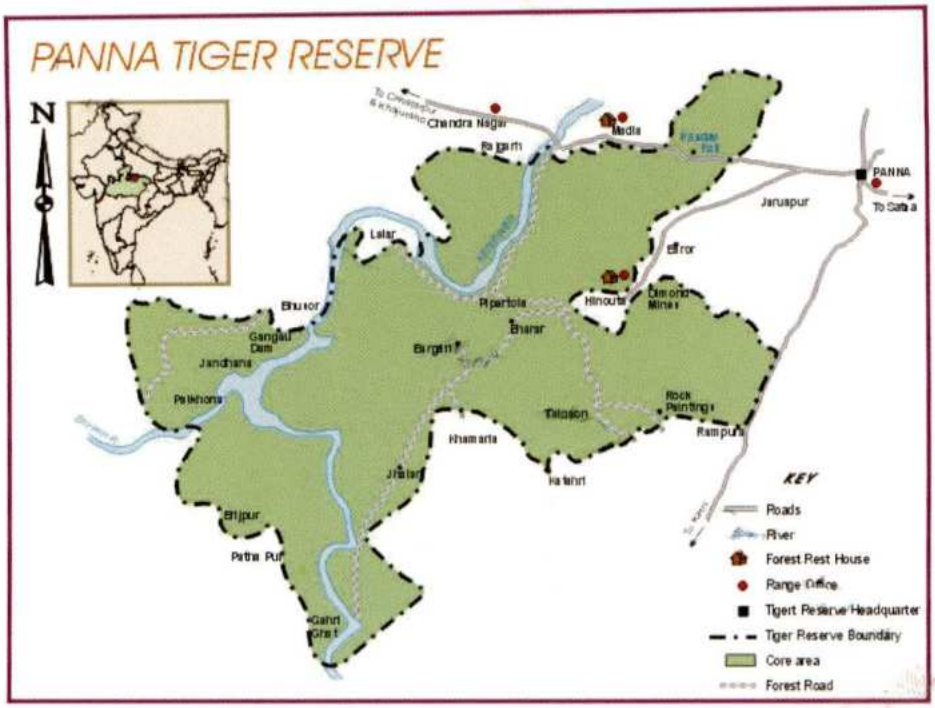


Map of Panna Tiger Reserve

SALIENT FEATURES

Area

Core	:	542.67 sq km
Buffer	:	Nil
Total	:	542.67 sq km
Longitude	:	79° 45' to 80° 09' E
Latitude	:	24°27' to 24°47' N
Altitude	:	330 m
Rainfall	:	1100 mm average.

Temperature

Minimum	:	2°C
Maximum	:	47°C

Seasons

Winter	:	Mid-November - February
Summer	:	March - mid-June
Monsoon	:	Mid-June - mid-September

By Rail :

Satna, at a distance of around 90 km, is the nearest railway station. It is a major railway hub and is connected to many places in central and western India, the most important of them being Mumbai at a distance of 1,540 km.

By Air :

The nearest airport is at Khajuraho at a distance of around 57 km from the Panna National Park. There are daily Alliance Air flights to Delhi, Mumbai and Varanasi from Khajuraho.

By Road :

The park is well connected with the other parts of the region by a good network of roads. Distances of some important places in India from the Panna National Park are Khajuraho 57 km, Bhopal 727 km, Delhi 889 km, Chennai 1761, and Calcutta 1040 km.

Nearby Cities :

Khajuraho

Location :

Chattarpur district, 57 kms from Khajuraho, 727 kms from Bhopal, Madhya Pradesh. Panna National Park is located in the central Indian state of Madhya Pradesh. It is one of the best in the region. The river Ken passes through the park, adding to its scenic beauty. You can view wildlife in jeeps, boats or on foot. It is close to Khajuraho and forms an ideal halt for people going to Bandhavgarh and Kanha National Parks.

Coverage Area:

543 sq kms

Main Attractions:

Deer, Chital, Crocodile.

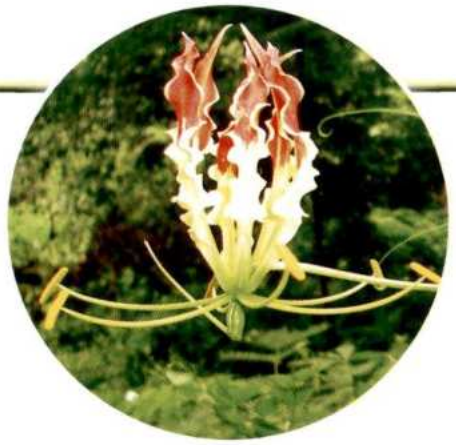
Best time to Visit:

November To April.

HIGHWAYS

The Jhansi-Chhatarpur-Panna-Rewa State Highway No. 6 is reported to have been upgraded as National Highway recently. About 10 km. long stretch of this road passes through the Reserve or makes the Reserve boundary (Madla Range). Whole of this 10 km. stretch is dense teak and bamboo forest and is hilly. There is a threat of forest degradation and increased chances of accidents involving wild animals, if works like widening of road, diversions etc. are taken up in future. About a thousand vehicles ply on this road everyday. Wild animals like Hyena, Wild boar, Nilgai, Sambar etc. do sometimes get killed in road accidents here Kishangarh-Palkoha-Bhusor-bamitha road, passes through Chandranagar range. A few buses and other vehicles ply between Bamitha and Palkoha every day.

A patch of *Chrysopogon fulvus*



Pench Tiger Reserve

KK Khanna & KP Singh
Botanical Survey of India, Central Circle, Allahabad.

Pench Tiger Reserve, established in 1977 as 19th Tiger Reserve of the country, is situated in the southern part of Seoni district of Madhya Pradesh. It lies between 21° 37' - 21° 57' N latitude and 78° 56' - 79° 32' E longitude, and covers an area of about 758 sq km. Moreover, an area of 293 sq km constitutes the core zone which has also been declared as National Park while an area of 464 sq km forms the buffer zone. The reserve is about 57 km away from the Seoni town and has been named after the Pench river which flows through the forests of the reserve. The reserve is inhabited by Gond and Kol tribes who reside in the forest villages. The altitude of the area varies from 500-900 m. Due to altitudinal and latitudinal locations, the reserve remains much away from the dust storms and heat waves of Indo-Gangetic plain and thus, the climate is comparatively cooler. December and January are the coolest months while May and June are hottest months. The area usually experiences premonsoon showers during May-June and monsoon from July-September with average rainfall ranging from 70-120 cm. Usually gneissic rocks prevail in the reserve, and the soil is usually black and brown mixed with sand or limestone grit. Due to good rainfall coupled with high humidity and suitable temperature the reserve is blessed with luxuriant growth of flora typical of tropical type. Besides, tiger, leopard, chinkara, sloth bear, chausinga etc. are important faunal elements.

VEGETATION

According to Champion & Seth (1968), the forests of the reserve can be grouped into two categories.

1. Southern tropical dry deciduous teak forests (5A/C1b): *Tectona grandis* L. f. is the most dominant species in this type of forests. Other associates are *Anogeissus latifolia* (Roxb. ex DC.) Wall. ex Guill. & Perr., *Diospyros melanoxylon* Roxb., *Terminalia alata* Heyne ex Roth, *Lagerstroemia parviflora* Roxb., *Phyllanthus emblica* L., *Dalbergia latifolia* Roxb., *Lannea coromandelica* (Houtt.) Merr., *Ougeinia oojeinensis* (Roxb.) Hochr., *Pterocarpus marsupium* Roxb., *Mitragyna parvifolia* (Roxb.) Korth., *Haldina cordifolia* (Roxb.) Ridsdale, *Butea monosperma* (Lam.) Taub. etc. Some of the common shrubs and undershrubs are *Nyctanthes arbor-tristis* L., *Helicteres isora* L., *Holarrhena pubescens* (Buch.-Ham.) Wall. ex G. Don, *Adhatoda zeylanica* Medik., *Woodfordia fruticosa* (L.) Kurz, *Lantana camara* L. var. *aculeata* (L.) Moldenke, *Cassia occidentalis* L., *Capparis zeylanica* L., *Indigofera cassioides* Rottler ex DC. etc. A number of herbs and grasses like *Cassia tora* L., *Heliotropium indicum* L., *Euphorbia thymifolia* L., *Apluda mutica* L., *Aristida setacea* Retz., *Dichanthium annulatum* (Forssk.) Stapf, *Eragrostiella bifaria* (Vahl) Bor, *Heteropogon contortus* (L.) P. Beauv., *Themeda quadrivalvis* (L.) Kuntze, *Desmodium gangeticum* (L.) DC., *Elephantopus scaber* L., *Thecagonum ovatifolium* (Cav.) Babu form the ground flora. The climbers in this type of forests are *Tinospora cordifolia* (Willd.) Hook. f. & Thomson, *Abrus precatorius* L., *Ventilago denticulata* Willd., *Ziziphus oenoplia* (L.) Mill., *Millettia extensa* (Benth.) Benth. ex Baker, *Cryptolepis buchanani* Roem. & Schult. etc. It is interesting to note that *Dendrocalamus strictus* (Roxb.) Nees forms impenetrable thickets.

Grassland with dry deciduous teak forest in the background

2. Southern tropical dry mixed deciduous forests (5A/C3): The most characteristic tree species is *Anogeissus latifolia* (Roxb. ex DC.) Wall. ex Guill. & Perr. while other associates are *Terminalia alata* Heyne ex Roth, *Mitragyna parvifolia* (Roxb.) Korth., *Buchanania lanzan* Spreng., *Boswellia serrata* Roxb. ex Colebr., *Chloroxylon swietenia* DC., *Dichrostachys cinerea* (L.) Wight & Arn., *Sterculia urens* Roxb., *Schrebera swietenioides* Roxb., *Cochlospermum religiosum* (L.) Alston, *Syzygium cumini* (L.) Skeels, *Albizia odoratissima* (L. f.) Benth., *A. procera* (Roxb.) Benth., *Madhuca longifolia* (J. Koenig) Macbr. var. *latifolia* (Roxb.) Chevalier, *Aegle marmelos* (L.) Correa, *Mallotus philippensis* (Lam.) Muell. Arg. etc. A number of shrubs and undershrubs also occur in this type of forests. Some of them are *Helicteres isora* L., *Flacourtia indica* (Burm. f.) Merr., *Vitex negundo* L., *Holarrhena pubescens* (Buch.-Ham.) Wall. ex G. Don, *Maytenus emarginata* (Willd.) Ding Hou, *Woodfordia fruticosa* (L.) Kurz, *Adhatoda zeylanica* Medik., *Grewia hirsuta* Vahl, *G. tiliifolia* Vahl, *Carissa spinarum* L. etc. The common herbs and grasses are *Malvastrum coromandelianum* (L.) Garcke, *Sida cordifolia* L., *Achyranthes aspera* L., *Ocimum basilicum* L., *Corchorus capsularis* L., *C. fascicularis* Lam., *Vetiveria zizanioides* (L.) Nash, *Eragrostis ciliaris* (L.) R. Br., *Arthraxon lancifolius* (Trin.)Hochst, *Eulaliopsis binata* (Retz.) C. E. Hubb., *Oplismenus burmanii* (Retz.) P. Beauv., *Cyperus difformis* L., *Fimbristylis bisumbellata* (Forssk.) Bubani, *Clerodendrum serratum* (L.) Moon, *Chrozophora prostrata* Dalzell, *Scoparia dulcis* L. etc. Some of the climbers are *Bauhinia vahlii* Wight & Arn., *Cissampelos pareira* L. var. *hirsuta* (Buch.-Ham. ex

DC.) Forman, *Pergularia daemia* (Forssk.) Chiov., *Ziziphus oenoplia* (L.) Mill., *Tinospora cordifolia* (Willd.) Hook. f. & Thomson.

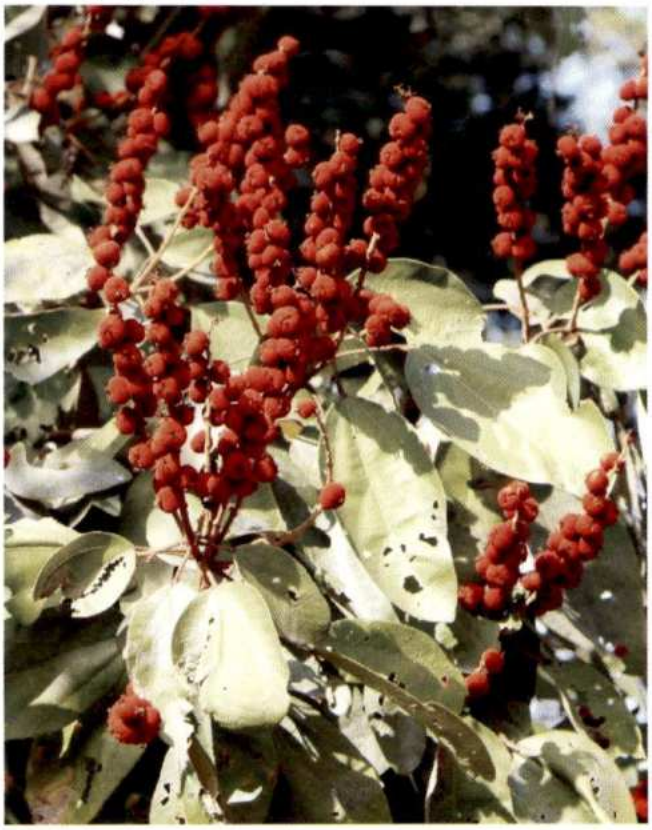
AQUATIC VEGETATION

A number of plants grow along the river, in and along streams and ponds in the reserve. Such plants may be grouped into following three categories on the basis of their habitat.

(a) Plants growing along river and streams

Terminalia arjuna (Roxb. ex DC.) Wight & Arn., *Polygonum barbatum* L., *Nepeta hindostana* (Heyne ex Roth) Haines, *Rotula aquatica* Lour., *Veronica anagallis- aquatica* L., *Ficus racemosa* L., *Limnophila indica* (L.) Druce, *Ludwigia octovalvis* (Jacq.)Raven, *Cyperus alulatus* Kern, *C. compressus* L., *C. difformis* L., *C. iria* L., *C. pygmaeus* Rottb., *Fimbristylis bisumbellata* (Forssk.) Bubani, *F. miliacea* (L.) Vahl, *Phragmites karka* (Retz.) Trin. ex Steud., *Thysanolaena maxima* (Roxb.) Kuntze, *Vetiveria zizanioides* (L.) Nash etc.

Mallotus philippensis



(b) Plants growing in ponds and adjoining areas

Nymphaea pubescens Willd., *Aeschynomene indica* L., *Ammannia baccifera* L., *Ludwigia octovalvis* (Jacq.) Raven, *L. perennis* L., *Utricularia aurea* Lour., *U. exoleta* R. Br., *U. stellaris* L. f., *Hydrilla verticillata* (L. f.) Royle, *Najas graminea* Del., *Aponogeton crispus* Thunb., *Potamogeton crispus* L., *P. nodosus* Poir., *Scirpus lateriflorus* Gmel., *S. articulatus* L., *Vallisneria natans* (Lour.) Hara, *Polygonum glabrum* Willd. etc.

(c) Plants growing in marshy habitats

Ammannia baccifera L., *Glinus lotoides* L., *Caesulia axillaris* Roxb., *Cyathocline purpurea* (Buch.-Ham. ex D. Don) Kuntze, *Lobelia alsinoides* Lam., *Wahlenbergia marginata* (Thunb.) DC., *Dopatrium junceum* (Roxb.) Buch.-Ham. ex Benth., *Lindernia nummulariifolia* (D. Don) Wettst., *L. parviflora* (Roxb.) Haines, *Mimulus strictus* Benth., *Hygrophila auriculata* (Schumach.) Heine, *Rungia repens* (L.) Nees, *Polygonum plebeium* R. Br., *Eriocaulon cinereum* R. Br. *E. quinquangulare* L., *Cyperus alulatus* Kern, *C. brevifolius* (Rottb.) Hassk., *C. triceps* Endl., *Fimbristylis dichotoma* (L.) Vahl, etc.

FLORISTIC DIVERSITY

Although the floristic account of Pench Tiger Reserve has not been thoroughly investigated but on the basis of available data the status and analysis of various angiospermic families occurring in the reserve have been worked out and presented in Table 1. The data indicate that the families represented by a single genus and single species in the reserve are Nymphaeaceae, Papaveraceae, Violaceae, Cochlospermaceae, Portulacaceae, Elatinaceae, Bombacaceae, Malpighiaceae, Simaroubaceae, Olacaceae, Leeaceae, Moringaceae, Rosaceae, Lecythidaceae, Begoniaceae, Cactaceae, Lobeliaceae Plumbaginaceae, Myrsinaceae, Sapotaceae, Loganiaceae, Cuscutaceae, Orobanchaceae, Pedaliaceae, Lauraceae, Urticaceae, Costaceae,

Musaceae, Hypoxidaceae, Taccaceae, Juncaceae, Typhaceae, Smilacaceae, Pontederiaceae, Araceae, Lemnaceae, Alismataceae, Limnocharitaceae, Najadaceae and Aponogetonaceae. It is interesting to note that Cochlospermaceae is also represented by a single genus with single species in India. An analysis has further indicated that the flora of the reserve includes seven unigeneric families viz., Leeaceae, Moringaceae, Cuscutaceae, Aponogetonaceae, Taccaceae, Typhaceae and Najadaceae. It is worthwhile to record that a few families which are represented by a single genus in India also occur in the reserve. The families are Leeaceae, Begoniaceae, Ebenaceae, Potamogetonaceae and Eriocaulaceae.

The data presented in Table 2 indicate that 558 species under 351 genera belonging to 102 families occur in the reserve. Out of these, 127 species (22.7 %) in 79 genera (22.5 %) and 24 families (23.5 %) belong to monocotyledons while 431 species (77.2 %) in 272 genera (77.4 %) and 78 families (76.5 %) belong to dicotyledons. The analysis (Table 3) further indicates that the ratio of monocotyledons to dicotyledons in respect of families, genera and species is 1 : 3.2, 1 : 3.4 and 1 : 3.4 respectively. On the other hand, the ratio of families to genera and genera to species with respect to dicotyledons, monocotyledons and total are entirely different.

The data of ten dominant families showing maximum species diversity and their percentage have been presented in Table 4. It is apparent that Fabaceae is the most dominant family, followed by Poaceae, Acanthaceae, Euphorbiaceae, Rubiaceae, Cyperaceae, Asteraceae, Scrophulariaceae, Lamiaceae and Caesalpiniaceae. The ten dominant families comprise 273 species constituting 48.9 % of the total species while the remaining 92 families with a total of 285 species constitute 51.1 %. On the other hand, the data presented in Table 5 showing maximum generic diversity reveal that Poaceae is the most dominant family followed by Fabaceae, Asteraceae, Acanthaceae, Rubiaceae, Scrophulariaceae,

Adhatoda zeylanica

Euphorbiaceae, Amaranthaceae, Malvaceae and Lamiaceae. Here, the ten dominant families comprise 168 genera constituting 47.86 % of the total genera while the remaining 92 families with a total of 183 genera constitute 52.13 %.

An analysis (Table 6) has further pointed out that some of the dominant genera in the reserve are *Cyperus* (14 spp.), *Indigofera* (10 spp.), *Ficus* (9 spp.), *Crotalaria* and *Cassia* (7 spp. each), *Desmodium, Alysicarpus* and *Polygala* (6 spp. each), *Bauhinia, Euphorbia, Eragrostis, Grewia, Justicia, Leucas, Habenaria* and *Dioscorea* (5 spp. each). It is interesting to record that 21 monotypic genera occur in the reserve. These are *Allmania, Apluda, Butomopsis, Caesulia, Chloroxylon, Gantelbua, Gloriosa, Goniocaulon, Haldina, Hemidesmus, Hydrilla, Nelsonia, Nicandra, Oroxylum, Ougeinia, Rotula, Schleichera, Spermadictyon, Tamarindus,*

Thysanolaena and *Trichuriella*. Further, some of the genera, which are represented in India by single species/variety also occur in the reserve. These are *Aegle, Centipeda, Cissampelos, Costus, Dodonaea, Eclipta, Holarrhena, Petalidium, Sutera, Tectona, Tridax, Waltheria* and *Woodfordia*.

Table 1: A conspectus of families showing number of genera and species in Pench Tiger Reserve

S. No.	Family	Genera	Species
1.	Annonaceae	3	3
2.	Menispermaceae	3	3
3.	Nymphaeaceae	1	1
4.	Papaveraceae	1	1
5.	Brassicaceae	2	2
6.	Capparaceae	2	3
7.	Violaceae	1	1
8.	Cochlospermaceae	1	1
9.	Flacourtiaceae	2	3
10.	Polygalaceae	1	6
11.	Caryophyllaceae	2	2
12.	Portulacaceae	1	1
13.	Elatinaceae	1	1
14.	Malvaceae	8	14
15.	Bombacaceae	1	1
16.	Sterculiaceae	5	5
17.	Tiliaceae	3	9
18.	Malpighiaceae	1	1
19.	Oxalidaceae	2	2
20.	Rutaceae	2	2
21.	Simaroubaceae	1	1
22.	Burseraceae	2	2
23.	Meliaceae	2	2
24.	Olacaceae	1	1
25.	Celastraceae	2	2
26.	Rhamnaceae	2	5
27.	Vitaceae	2	4
28.	Leeaceae	1	1
29.	Sapindaceae	4	5
30.	Anacardiaceae	4	4
31.	Moringaceae	1	1
32.	Fabaceae (*l.c.*)	28	66
33.	Caesalpiniaceae	4	15
34.	Mimosaceae	4	9
35.	Rosaceae	1	1
36.	Combretaceae	3	7
37.	Myrtaceae	1	2
38.	Lecythidaceae	1	1
39.	Lythraceae	4	7
40.	Onagraceae	2	3
41.	Cucurbitaceae	2	2
42.	Begoniaceae	1	1
43.	Cactaceae	1	1
44.	Molluginaceae	2	2
45.	Apiaceae	1	2
46.	Rubiaceae	15	21
47.	Asteraceae	17	20
48.	Campanulaceae	2	3
49.	Lobeliaceae	1	1
50.	Plumbaginaceae	1	1
51.	Myrsinaceae	1	1
52.	Sapotaceae	1	1
53.	Ebenaceae	1	3
54.	Oleaceae	3	3
55.	Apocynaceae	5	7
56.	Asclepiadaceae	6	7
57.	Loganiaceae	1	1
58.	Boraginaceae	6	11
59.	Convolvulaceae	7	12

S. No.	Family	Genera	Species
60.	Cuscutaceae	1	1
61.	Solanaceae	4	6
62.	Scrophulariaceae	13	16
63.	Orobanchaceae	1	1
64.	Lentibulariaceae	1	3
65.	Bignoniaceae	2	3
66.	Pedaliaceae	1	1
67.	Acanthaceae	17	23
68.	Verbenaceae	6	6
69.	Lamiaceae	8	16
70.	Nyctaginaceae	1	2
71.	Amaranthaceae	9	10
72.	Polygonaceae	1	4
73.	Lauraceae	1	1
74.	Loranthaceae	3	21
75.	Euphorbiaceae	13	21
76.	Urticaceae	1	1
77.	Ulmaceae	2	3
78.	Moraceae	1	9
79.	Hydrocharitaceae	2	2
80.	Orchidaceae	4	9
81.	Zingiberaceae	4	5

S. No.	Family	Genera	Species
82.	Costaceae	1	1
83.	Musaceae	1	1
84.	Hypoxidaceae	1	1
85.	Taccaceae	1	1
86.	Dioscoreaceae	1	5
87.	Liliaceae	4	5
88.	Smilacaceae	1	1
89.	Pontederiaceae	1	1
90.	Commelinaceae	4	8
91.	Juncaceae	1	1
92.	Typhaceae	1	1
93.	Araceae	1	1
94.	Lemnaceae	1	1
95.	Alismataceae	1	1
96.	Limnocharitaceae	1	1
97.	Najadaceae	1	1
98.	Aponogetonaceae	1	1
99.	Potamogetonaceae	1	2
100.	Eriocaulaceae	1	2
101.	Cyperaceae	4	21
102.	Poaceae	40	54

Table 2: Number and percentage of families, genera and species of Angiosperms in Pench Tiger Reserve

Group	Families		Genera		Species	
	No.	% of total	No.	% of total	No.	% of total
Dicotyledons	78	76.5	272	77.5	431	77.2
Monocotyledons	24	23.5	79	22.5	127	22.8
Total	**102**		**351**		**558**	

Table 3: Ratio among various groups/taxa in Pench Tiger Reserve

Group/Taxa	Ratio	
Monocotyledons to Dicotyledons	Families	1:3.2
	Genera	1:3.4
	Species	1.3.4
Families to Genera	Dicotyledons	1:3.5
	Monocotyledons	1:3.3
	Total	1:3.4
Genera to Species	Dicotyledons	1:1.6
	Monocotyledons	1:1.6
	Total	1:1.6

Table 4: Ten dominant families showing maximum species diversity in Pench Tiger Reserve

S.No.	Family	Number of species	% of total
1.	Fabaceae	66	11.82
2.	Poaceae	54	9.67
3.	Acanthaceae	23	4.12
4.	Euphorbiaceae	21	3.76
5.	Rubiaceae	21	3.76
6.	Cyperaceae	21	3.76
7.	Asteraceae	20	3.58
8.	Scrophulariaceae	16	2.86
9.	Lamiaceae	16	2.86
10.	Caesalpiniaceae	15	2.68

Table 5: Ten dominant families showing maximum generic diversity in Pench Tiger Reserve

S.No.	Family	Number of genera	% of total
1.	Poaceae	40	11.39
2.	Fabaceae	28	7.97
3.	Asteraceae	17	4.84
4.	Acanthaceae	17	4.84
5.	Rubiaceae	15	4.27
6.	Scrophulariaceae	13	3.70
7.	Euphorbiaceae	13	3.70
8.	Amaranthaceae	9	2.56
9.	Malvaceae	8	2.27
10.	Lamiaceae	8	2.27

Table 6: Dominant genera of Pench Tiger Reserve

S. No.	Genera	Family	Number of species
1.	*Cyperus*	Cyperaceae	14
2.	*Indigofera*	Fabaceae	10
3.	*Ficus*	Moraceae	9
4.	*Crotalaria*	Fabaceae	7
5.	*Cassia*	Caesalpiniaceae	7
6.	*Desmodium*	Fabaceae	6
7.	*Alysicarpus*	Fabaceae	6
8.	*Polygala*	Polygalaceae	6
9.	*Bauhinia*	Caesalpiniaceae	5
10.	*Euphorbia*	Euphorbiaceae	5
11.	*Eragrostis*	Poaceae	5
12.	*Grewia*	Tiliaceae	5
13.	*Justicia*	Acanthaceae	5
14.	*Leucas*	Lamiaceae	5
15.	*Habenaria*	Orchidaceae	5
16.	*Dioscorea*	Dioscoreaceae	5

Economic plants

The reserve abounds in several economically important plants. Although the utility of a number of plants are well known but of several species are still untapped as the area has not been properly explored while it is inhabited by Gond and Kol tribes living amidst the forests. Many plants occurring in the area are useful in different aspects of life of tribal/rural/common people. These plants are listed under the following categories on the basis of their utility.

1. **Timber:** *Albizia odoratissima* (L. f.) Benth., *A. procera* (Roxb.) Benth., *Anogeissus latifolia* (Roxb. ex DC.) Wall. ex Guill. & Perr., *Azadirachta indica* A.Juss., *Cassia fistula* L., *Chloroxylon swietenia* DC., *Dalbergia sissoo* Roxb., *Diospyros melanoxylon* Roxb., *Gmelina arborea* Roxb., *Haldina cordifolia* (Roxb.) Ridsd., *Kydia calycina* Roxb., *Lannea coromandelica* (Houtt.) Merr., *Madhuca longifolia* (J. Koenig) Macbr. var. *latifolia* (Roxb.) Chevalier, *Mangifera indica* L., *Mitragyna parvifolia* (Roxb.) Korth., *Ougeinia oojeinensis* (Roxb.) Hochr., *Schleichera oleosa* (Lour.) Oken., *Syzygium cumini* (L.) Skeels, *Tamarindus indica* L., *Tectona grandis* L. f. and *Terminalia alata* Heyne ex Roth.

2. **Thatching:** *Bauhinia vahlii* Wight & Arn., *Dendrocalamus strictus* (Roxb.) Nees, *Phragmites karka* (Retz.) Trin. ex Steud., *Saccharum spontaneum* L., *Themeda quadrivalvis* (L.) Kuntze, *Vetiveria zizanioides* (L.) Nash.

3. **Broom:** *Aristida setacea* Retz., *Desmodium gangeticum* (L.) DC., *Phragmites karka* (Retz.) Trin. ex Steud., *Sida acuta* Burm. f., *Thysanolaena maxima* (Roxb.) Kuntze, *Vetiveria zizanioides* (L.) Nash.

4. **Basket, mat and hat:** *Apluda mutica* L., *Bauhinia vahlii* Wight & Arn., *Dendrocalamus strictus* (Roxb.)

Nees, *Eleusine indica* (L.) Gaertn., *Indigofera cassioides* Rottler ex DC., *Phragmites karka* (Retz.) Trin. ex Steud., *Rottboellia exaltata* L. f., *Scirpus lateriflorus* Gmel., *Vetiveria zizanioides* (L.) Nash.

5. Fibre: *Abelmoschus crinitus* Wall., *Bauhinia vahlii* Wight & Arn., *Corchorus aestuans* L., *C. olitorius* L., *Cryptolepis buchanani* Roem. & Schult., *Eulaliopsis binata* (Retz.) C. E. Hubb., *Sida acuta* Burm. f., *S. cordifolia* L., *Triumfetta rhomboidea* Jacq., *Urena lobata* L., *Ventilago denticulata* Willd.

6. Gum: *Acacia nilotica* (L.) Willd. ex Delile subsp. *indica* (Benth.) Brenan, *Aegle marmelos* (L.) Corrêa, *Anogeissus latifolia* (Roxb. ex DC.) Wall. ex Guill. & Perr., *Boswellia serrata* Roxb. ex Colebr., *Butea monosperma* (Lam.) Taub., *Gardenia gummifera* L. f., *Lannea coromandelica* (Houtt.) Merr., *Sterculia urens* Roxb.

7. Dye: *Acacia catechu* (L. f.) Willd., *Butea monosperma* (Lam.) Taub., *Hymenodictyon orixense* (Roxb.) Mabb., *Mallotus philippensis* (Lam.) Muell. Arg., *Nyctanthes arbor-tristis* L., *Pterocarpus marsupium* Roxb., *Woodfordia fruticosa* (L.) Kurz, *Wrightia tinctoria* R. Br.

8. Beverage: *Madhuca longifolia* (J. Koenig) Macbr. var. *latifolia* (Roxb.) Chevalier.

9. Oil: *Argemone mexicana* L., *Jatropha curcas* L., *Nepeta hindostana* (Heyne ex Roth) Haines, *Pogostemon benghalense* (Burm. f.) Kuntze, *Ricinus communis* L., *Schleichera oleosa* (Lour.) Oken., *Ventilago denticulata* Willd.

10. Fish poison: *Casearia elliptica* Willd., *Cleistanthus collinus* (Roxb.) Benth. ex Hook. f., *Gardenia turgida* Roxb., *Verbascum chinene* (L.) Santapau.

11. Floss: *Bombax ceiba* L., *Calotropis gigantea* (L.) R. Br., *C. procera* (Aiton) R. Br., *Cochlospermum religiosum* (L.) Alston.

Ficus semicordata

Dry mixed deciduous forest

12. Tannin: *Acacia pennata* (L.) Willd., *Bauhinia vahlii* Wight & Arn., *Casearia elliptica* Willd., *Cassia fistula* L., *Lagerstroemia parviflora* Roxb., *Mitragyna parvifolia* (Roxb.) Korth., *Ougenia oojeinensis* (Roxb.) Hochr., *Phyllanthus emblica* L., *Schleichera oleosa* (Lour.) Oken., *Syzygium cumini* (L.) Skeels, *Terminalia alata* Heyne ex Roth, *Woodfordia fruticosa* (L.) Kurz.

13. Paper: *Boswellia serrata* Roxb. ex Colebr., *Dendrocalamus strictus* (Roxb.) Nees, *Gmelina arborea* Roxb., *Haldina cordifolia* (Roxb.) Ridsd., *Heteropogon contortus* (L.) P. Beauv., *Phragmites karka* (Retz.) Trin. ex Steud., *Themeda quadrivalvis* (L.) Kuntze.

14. Wild edible:

(a) Tubers or rhizomes: *Colocasia esculenta* (L.) Schott, *Curcuma angustifolia* Roxb., *Dioscorea bulbifera* L., *D. pentaphylla* L., *Orthosiphon rubicundus* (D. Don) Benth., *Pueraria tuberosa* (Roxb. ex Willd.) DC.

(b) Leaves and young shoots: *Alternanthera sessilis* (L.) R. Br. ex DC., *Amaranthus viridis* L., *Antidesma ghaesembilla* Gaertn., *Celosia argentea* L., *Glinus lotoides* L., *Ipomoea aquatica* Forssk., *Leucas mollissima* Wall. ex Benth., *Limnophila indica* (L.) Druce, *Mollugo pentaphylla* L., *Oxalis corniculata* L., *Portulaca oleracea* L., *Solanum nigrum* L.

(c) Flowers: *Bauhinia racemosa* Lam., *B. variegata* L., *Indigofera cassioides* Rottler ex DC., *Madhuca longifolia* (J. Koenig) Macbr. var. *latifolia* (Roxb.) Chevalier, *Moringa oleifera* Lam., *Semecarpus anacardium* L. f., *Wrightia tinctoria* R. Br.

(d) Fruits: *Aegle marmelos* (L.) Corrêa, *Bridelia retusa* (L.) Spreng., *Buchanania lanzan* Spreng., *Carissa*

spinarum L., *Cordia obliqua* Willd., *Ficus hispida* L. f., *F. racemosa* L., *Flacourtia indica* (Burm. f.) Merr., *Grewia hirsuta* Vahl, *G. tiliifolia* Vahl, *Limonia acidissima* L., *Madhuca longifolia* (J. Koenig) Macbr. var. *latifolia* (Roxb.) Chevalier, *Mangifera indica* L., *Moringa oleifera* Lam., *Schleichera oleosa* (Lour.) Oken., *Solanum nigrum* L., *Syzygium cumini* (L.) Skeels, *Tamarindus indica* L., *Ziziphus rugosa* Lam.

(e) **Seeds:** *Buchanania lanzan* Spreng., *Cassia occidentalis* L., *Coix lacryma-jobi* L., *Eleusine indica* (L.) Gaertn., *Panicum sumatrense* Roth ex Roem. & Schult., *Paspalidium flavidum* (Retz.) A. Camus, *Semecarpus anacardium* L. f., *Sterculia urens* Roxb., *Vigna umbellata* (Thunb.) Ohwi & Ohashi.

15. Medicinal plants

A number of plants of the reserve are of medicinal value and referred for the treatment of various diseases. The data of some of these plants indicating part(s) used and medicinal use(s) have been provided in Table 7.

Table 7: Medicinal plants of Pench Tiger Reserve

Botanical name	Part(s) used	Medicinal use(s)
Abelmoschus crinitus Wall.	Whole plant	Dysentery
Abrus precatorius L.	Root	Cold and cough
Achyranthes aspera L.	Stem Whole plant	Toothache Skin diseases
Adhatoda zeylanica Medik.	Leaf	Cough and bronchitis
Aegle marmelos (L.) Corrêa	Leaf	Diabetes
	Fruit	Diarrhoea and dysentery
Ageratum conyzoides L.	Leaf	Cuts
Alternanthera sessilis (L.) R. Br. ex DC.	Leaf	Night blindness
Andrographis paniculata (Burm. f.) Wall. ex Nees	Leaf	Fever
Asparagus racemosus Willd.	Root	Tonic and lactagogue
Baliospermum montanum (Willd.) Muell. Arg.	Seed	Purgative
Barleria prionitis L.	Leaf	Toothache and boil
Bauhinia racemosa Lam.	Bark	Diarrhoea and dysentery
Blumea lacera (Burm. f.) DC.	Whole plant	Piles
Boerhavia diffusa L.	Root	Jaundice
Bombax ceiba L.	Root	Impotency
Boswellia serrata Roxb. ex Colebr.	Gum	Diarrhoea and dysentery
Butea monosperma (Lam.) Taub.	Gum	Diarrhoea
Cardiospermum halicacabum L.	Root	Rheumatism
Calotropis procera (Aiton) R. Br.	Root-bark	Leprosy

Botanical name	Part/s used	Medicinal use/s
Careya arborea Roxb.	Bark	Fever and diarrhoea
Casearia elliptica Roxb.	Bark	Dropsy
Cassia fistula L.	Fruit	Constipation
Celastrus paniculatus Willd.	Seed	Gout
Centipeda minima (L.) A. Br. & Aschers.	Whole plant	Toothache
Chlorophytum arundinaceum Baker	Root	Impotency
Cissampelos pareira L. var. *hirsuta* (Buch.-Ham. ex DC.) Forman	Leaf	Itch
Clerodendrum serratum (L.) Moon	Root	Bronchitis and malaria
Costus speciosus (J. Koenig) Sm.	Root	Anthelmintic
Datura innoxia Mill.	Seed	Skin diseases
Desmodium gangeticum (L.) DC.	Root	Cough and fever
Diospyros melanoxylon Roxb.	Seed	Urinary diseases
Elephantopus scaber L.	Whole plant	Fever
Evolvulus alsinoides (L.) L.	Whole plant	Asthma
Ficus hispida L. f.	Fig	Purgative
F. racemosa L.	Latex	Piles
Flemingia strobilifera (L.) Aiton & Aiton f.	Root	Epilepsy
Gardenia turgida Roxb.	Flower	Fever
Gloriosa superba L.	Root	Leprosy and piles
Gomphrena celosioides Mart.	Root	Cough
Helicteres isora L.	Bark and fruit	Diarrhoea and dysentery
Heliotropium indicum L.	Whole plant	As antidote to snake bite
Hemidesmus indicus (L.) R. Br.	Root	Fever, leucorrhoea and tonic
Holarrhena pubescens (Buch.-Ham.) Wall. ex G. Don	Bark	Diarrhoea and dysentery
Holoptelea integrifolia (Roxb.) Planch.	Bark	Rheumatism
Ichnocarpus frutescens (L.) R. Br.	Stem	Fever
Indigofera glandulosa Wendl.	Seed	Tonic
Ixora pavetta Andr.	Bark	Tonic
Justicia betonica L.	Leaf	Boils
Kydia calycina Roxb.	Leaf	Skin diseases
Lannea coromandelica (Houtt.) Merr.	Gum	Earacha
Leucas cephalotes (Koenig ex. Roth) Spreng	Flower	Cold and cough

Botanical name	Part/s used	Medicinal use/s
Mallotus philippensis (Lam.) Muell. Arg.	Seed	Rheumatism
Mitragyna parvifolia (Roxb.) Korth.	Bark	Colitis
Mucuna pruriens (L.) DC.	Seed	Impotency
Nelsonia canescens (Lam.) Spreng.	Leaf	Fever
Ocimum tenuiflorum L.	Leaf	Cold and fever
Oldenlandia corymbosa L.	Whole Plant	Jaundice
Polygonum barbatum L.	Root	Ulcer
Pterocarpus marsupium Roxb.	Wood	Diabetes
Pueraria tuberosa (Roxb. ex Willd.) DC.	Tuber	Tonic and fever
Rorippa indica (L.) Hiern	Seed	Asthma
Scoparia dulcis L.	Whole plant	Diarrhoea and dysentery
Semecarpus anacardium L. f.	Fruit	Anthelmintic and epilepsy
Sida cordifolia L.	Leaf	Fever and dysentery
S. rhombifolia L.	Root	Rheumatism
Spermacoce hispida L.	Whole plant	Headache
Spilanthes paniculata Wall. ex DC.	Whole plant	Piles
Syzygium cumini (L.) Skeels	Fruit	Colitis
	Seed	Diabetes
Tectona grandis L. f.	Leaf	Cough
Tephrosia purpurea (L.) Pers.	Whole plant	Impotency
Terminalia arjuna (Roxb. ex DC.) Wight & Arn.	Bark	Cardiac tonic
T. bellirica (Gaertn.) Roxb.	Fruit	Constipation and piles
T. chebula Retz.	Fruit	Constipation
Trichodesma indicum (L.) R. Br. ex Lehm.	Whole plant	Stomach diseases
Tridax procumbens L.	Leaf	Diarrhoea and dysentery
Uraria picta (Jacq.) Desv. ex DC.	Root	Fever and gonorrhoea
Vanda tessellata (Roxb.) Hook ex G. Don	Whole plant	Sciatica
Vernonia cinerea (L.) Less.	Root	Anthelmintic
Vitex negundo L.	Leaf	Arthritis and rheumatism
Woodfordia fruticosa (L.) Kurz	Flower	Cough

Wild relatives of crop plants

A number of wild relatives of crop plants occur in the reserve. Some of them are given in Table 8.

Table 8 : Wild relatives of crop plants occuring in Pench Tiger Reserve

Crop plants	Wild relatives
1. Cereals and millets	*Chionachne koenigii* (Spreng.) Thwaites
	Coix lacryma-jobi L.
	Eleusine indica (L.) Gaertn.
	Panicum psilopodium Trin.
	Setaria pallide-fusca (Schumach.) Stapf & C. E. Hubb.
	S. verticillata (L.) P. Beauv.
2. Legumes	*Atylosia volubilis* (Blanco) Gamble
	Cajanus scarabaeoides (L.) du Petit-Thou
	Flemingia strobilifera (L.) Aiton & Aiton f.
	Mucuna pruriens (L.) DC.
	Vigna trilobata (L.) Verdc.
	V. umbellata (Thunb.) Ohwi & Ohashi
3. Fruits	*Aegle marmelos* (L.) Corrêa
	Carissa spinarum L.
	Phyllanthus emblica L.
	Syzygium heyneanum Wall. ex Wight & Arn.
	Ziziphus oenoplia (L.) Mill.
	Z. rugosa Lam.
	Z. xylopyra (Retz.) Willd.
4. Vegetables	*Colocasia esculenta* (L.) Schott
	Solanum violaceum Ortega
5. Oil seeds	*Sesamum indicum* L.
6. Fibres	*Corchorus aestuans* L.
	C. capsularis L.
	C. fascicularis Lam.
	Crotalaria retusa L.
	Urena lobata L.
7. Spices and condiments	*Curcuma amada* Roxb.
	C. angustifolia Roxb.
8. Sugarcane	*Saccharum bengalense* Retz.
	S. spontaneum L.

Rare plants

A number of plants of the reserve show less population, and it is interesting to record that many of them also show less population in Madhya Pradesh. Such species are *Capparis sepiaria* L., *Polygala chinensis* L., *Firmiana colorata* (Roxb.) R.Br., *Aspidopterys cordata* (Heyne ex Wall.) A. Juss., *Maytenus emarginata* (Willd.) Ding Hou, *Crotalaria retusa* L., *Paracalyx scariosus* (Roxb.) Ali, *Pimpinella wallichiana* (Miq. ex Hohenck.) Gandhi, *Spermadictyon suaveolens* Roxb., *Flaveria trinervia* (Spreng.) C. Mohr., *Goniocaulon glabrum* Cass., *Diospyros cordifolia* Roxb., *Carissa paucinervia* A. DC., *Ceropegia hirsuta* Wight & Arn., *Strychnos potatorum* L. f., *Cordia macleodii* (Griff.) Hook. f. & Thomson, *Trichodesma sedgwickianum* Banerjee, *Oroxylum indicum* (L.) Vent., *Gantelbua urens* (Heyne ex Roth) Bremek., *Trichuriella monsoniae* (L. f.) Bennet, *Litsea glutinosa* (Lour.) Robinson, *Breynia retusa* (Dennst.) Alston, *Trewia polycarpa* Benth., *Ficus arnottiana* (Miq.) Miq., *Habenaria roxburghii* Nicolson, *Peristylus lawii* Wight, *Dioscorea wallichii* Hook. f. and *Aristida setacea* Retz.

Conservation Strategy

It is apparent from the foregoing account that the area of Pench Tiger Reserve has rich floristic diversity. Although the reserve has no endemic taxa, it harbours a number of useful and rare plants in addition to few wild relatives of crop plants. Despite the declaration of the area as tiger reserve for *in situ* conservation of plant resources, certain measures for *ex situ* conservation including tissue culture and rehabilitation in botanic gardens should be adopted. Besides, over exploitation of economic plants should also be regulated and the tribal / local rural people should be encouraged to cultivate such plants in order to meet the desired supply of raw materials in the market. Further, action should be taken to shift the tribal people residing in the forest villages of the reserve to other places as they are dependent on the plant resources of the reserve for their sustenance and thus causing threat to the diversity.

ENUMERATION

ANNONACEAE

Annona L.
A. squamosa L.
Miliusa Leschen. ex DC.
M. tomentosa (Roxb.) Finet & Gagnep.
Polyalthia Blume
P. longifolia (Sonner.) Thwaites

MENISPERMACEAE

Cissampelos L.
C. pareira L.
var. **hirsuta** (Buch.-Ham. ex DC.) Forman
Cocculus DC., *nom. cons.*
C. hirsutus L.
Tinospora Miers, *nom. cons.*
T. cordifolia (Willd.) Hook. f. & Thomson

NYMPHAEACEAE

Nymphaea L., *nom. cons.*
N. pubescens Willd.

PAPAVERACEAE

Argemone L.
A. mexicana L.

BRASSICACEAE

Cochlearia L.
C. cochlearioides (Roth) Santapau & Maheshw.
Rorippa Scop.
R. indica (L.) Hiern

CAPPARACEAE

Capparis L.
C. sepiaria L.
C. zeylanica L.
Cleome L.
C. monophylla L.

VIOLACEAE

Hybanthus Jacq., *nom. cons.*

H. enneaspermus (L.) F. Muell.

COCHLOSPERMACEAE

Cochlospermum Kunth ex DC., *nom. cons.*
C. religiosum (L.) Alston

FLACOURTIACEAE

Casearia Jacq.
C. tomentosa Roxb.
Flacourtia Commerson ex L'Hérit.
F. indica (Burm. f.) Merr.
F. jangomas (Lour.) Raeusch.

POLYGALACEAE

Polygala L.
P. arvensis Willd.
P. chinensis L.
P. elongata Klein
P. erioptera DC.
P. furcata Royle
P. jacobii Chandrab.

CARYOPHYLLACEAE

Polycarpaea Lam., *nom. cons.*
P. corymbosa (L.) Lam.
Polycarpon L.
P. prostratum (Forssk.) Aschers. & Schweinf.

PORTULACACEAE

Portulaca L.
P. oleracea L.

ELATINACEAE

Bergia L.
B. ammannioides Roxb. ex Roth

MALVACEAE

Abelmoschus Medik.
A. crinitus Wall.
A. manihot (L.) Medik.
subsp. **tetraphyllus** (Roxb. ex Hornem.) Borss.
Abutilon Mill.
A. indicum (L.) Sweet
Hibiscus L., *nom. cons.*
H. lobatus (Murray) Kuntze
H. panduraeformis Burm. f.
H. rosa-sinensis L.
Kydia Roxb.
K. calycina Roxb.
Malvastrum A. Gray, *nom. cons.*
M. coromandelianum (L.) Garcke
Sida L.
S. acuta Burm. f.
S. cordata (Burm. f.) Borss.
S. cordifolia L.
S. rhombifolia L.
Thespesia Soland. ex Corrêa, *nom. cons.*
T. lampas (Cav.) Dalzell & Gibson
Urena L.
U. lobata L.
subsp. **sinuata** (L.) Borss.

BOMBACACEAE

Bombax L., *nom. cons.*
B. ceiba L.

STERCULIACEAE

Firmiana Marsili
F. colorata (Roxb.) R. Br.
Helicteres L.
H. isora L.
Melochia L.
M. corchorifolia L.
Sterculia L.
S. urens Roxb.
Waltheria L.
W. indica L.

TILIACEAE

Corchorus L.
C. capsularis L.
C. fascicularis Lam.
Grewia L.
G. flavescens A.L. Juss.
G. helicterifolia Wall. ex G. Don
G. hirsuta Vahl
G. rothii DC.
G. tiliifolia Vahl
Triumfetta L.

T. pentandra A. Rich.
T. rotundifolia Lam.

MALPIGHIACEAE

Aspidopterys A. Juss.
A. cordata (Heyne ex Wall.) A. Juss.

OXALIDACEAE

Biophytum DC.
B. sensitivum (L.) DC.
Oxalis L.
O. corniculata L.

RUTACEAE

Aegle Corrêa, *nom. cons.*
A. marmelos (L.) Corrêa
Chloroxylon DC., *nom. cons.*
C. swietenia DC.

SIMAROUBACEAE

Ailanthus Desf., *nom. cons.*
A. excelsa Roxb.

BURSERACEAE

Boswellia Roxb. ex Colebr.
B. serrata Roxb. ex Colebr.
Garuga Roxb.
G. pinnata Roxb.

MELIACEAE

Azadirachta A. Juss.
A. indica A. Juss.
Melia L.
M. azedarach L.

OLACACEAE

Olax L.
O. scandens Roxb.

CELASTRACEAE

Celastrus L.
Ce. paniculatus Willd.
Maytenus Molina
M. emarginata (Willd.) Ding Hou

RHAMNACEAE

Ventilago Gaertn.
V. denticulata Willd.
Ziziphus Tourn. ex Mill.
Z. mauritiana Lam.
Z. oenoplia (L.) Mill.
Z. rugosa Lam.
Z. xylopyra (Retz.) Willd.

VITACEAE

Ampelocissus Planch., *nom. cons.*
A. latifolia (Roxb.) Planch.
A. tomentosa (Heyne ex Roth) Planch.
Cayratia Juss., *nom. cons.*
C. auriculata (Wall.) Gamble
C. trifolia (L.) Domin

LEEACEAE

Leea D. van Royen ex L., *nom. cons.*
L. asiatica (L.) Ridsdale

SAPINDACEAE

Cardiospermum L.
C. halicacabum L.
Dodonaea Mill.
D. viscosa Jacq.
Sapindus L.
S. emarginatus Vahl
S. laurifolia Vahl
Schleichera Willd., *nom. cons.*
S. oleosa (Lour.) Oken.

ANACARDIACEAE

Buchanania Spreng.
B. lanzan Spreng.
Lannea A. Rich., *nom. cons.*
L. coromandelica (Houtt.) Merr.
Mangifera L.
M. indica L.
Semecarpus L. f.
S. anacardium L. f.

MORINGACEAE

Moringa Adans.
M. oleifera Lam.

FABACEAE

Abrus Adans.
A. precatorius L.
Aeschynomene L.
A. indica L.
Alysicarpus Neck. ex Desv., *nom. cons.*
A. bupleurifolius (L.) DC.
A. hamosus Edgew.
A. monilifer (L.) DC.
A. rugosus (Willd.) DC.
A. scariosus (Rottler ex Spreng.) Graham ex Thwaites
A. vaginalis (L.) DC.
Atylosia Wight & Arn.
A. volubilis (Blanco) Gamble
Butea Roxb. ex Willd., *nom. cons.*
B. monosperma (Lam.) Taub.
B. superba Roxb.
Cajanus Adans., *orth. et nom. cons.*
C. scarabaeoides (L.) du Petit-Thou.
Clitoria L.
Clitoria biflora Dalzell
C. ternatea L.
Crotalaria L.
C. albida Heyne ex Roth
C. bialata Schrank
C. calycina Schrank
C. hebecarpa (DC.) Rudd
C. prostrata Rottler
C. retusa L.
C. spectabilis Roth
Cullen Medik.
C. corylifolia (L.) Medik.
Dalbergia L. f., *nom. cons.*
D. lanceolaria L. f.
D. latifolia Roxb.
D. sissoo Roxb.
D. volubilis Roxb.
Desmodium Desv., *nom. cons.*
D. dichotomum (Willd.) DC.
D. gangeticum (L.) DC.
D. heterocarpon (L.) DC.
D. pulchellum (L.) Benth.
D. triflorum (L.) DC.
D. velutinum (Willd.) DC.
Erythrina L.
E. suberosa Roxb.
E. variegata L.
Flemingia Roxb. ex Aiton & Aiton f., *nom. cons.*
F. nana Roxb.
F. paniculata Wall. ex Benth.
F. strobilifera (L.) Aiton & Aiton f.
Indigofera L.
I. astragalina DC.
I. cassioides Rottler ex DC.
Indigofera cordifolia Heyne ex Roth
I. glabra L.
I. glandulosa Wendl.
I. linifolia (L. f.) Retz.
I. linnaei Ali
I. spicata Forssk.
I. tinctoria L.
I. trifoliata L.
Millettia Wight & Arn., *nom. cons.*
M. extensa (Benth.) Benth. ex Baker
Mucuna Adans., *nom. cons.*
M. pruriens (L.) DC.
Ougeinia Benth.
O. oojeinensis (Roxb.) Hochr.
Paracalyx Ali
P. scariosus (Roxb.) Ali
Pterocarpus Jacq., *nom. cons.*
P. marsupium Roxb.
Pueraria DC.
P. tuberosa (Roxb. ex Willd.) DC.
Rhynchosia Lour., *nom. cons.*
R. minima (L.) DC.
Sesbania Scop., *nom. cons.*
S. bispinosa (Jacq.) W.F. Wight
S. grandiflora (L.) Poir.
Smithia Aiton, *nom. cons.*
S. conferta Sm.
Tephrosia Pers., *nom. cons.*
T. pumila (Lam.) Pers.
T. purpurea (L.) Pers.
T. strigosa (Dalzell) Santapau & Maheshw.
Teramnus R. Br.
T. labialis(L. f.) Spreng.
Uraria Desv.

U. lagopus DC.
U. picta (Jacq.) Desv.
Vigna Savi
V. trilobata (L.) Verdc.
V. umbellata (Thunb.) Ohwi & Ohashi
Zornia J.F. Gmelin
Z. gibbosa Span.

CAESALPINIACEAE

Bauhinia L.
B. malabarica Roxb.
B. purpurea L.
B. racemosa Lam.
B. vahlii Wight & Arn.
B. variegata L.
Caesalpinia L.
C. bonduc (L.) Roxb.
C. decapetala (Roth) Alston
Cassia L., *nom. cons.*
C. absus L.
C. fistula L.
C. mimosoides L.
C. occidentalis L.
C. pumila Lam.
C. siamea Lam.
C. tora L.
Tamarindus L.
T. indica L.

MIMOSACEAE

Acacia Mill.
Acacia leucophloea (Roxb.) Willd.
A. nilotica (L.) Willd. ex Delile
subsp. **indica** (Benth.) Brenan
A. pennata (L.) Willd.
A. torta (Roxb.) Craib
Albizia Durazz.
A. odoratissima (L. f.) Benth.
A. procera (Roxb.) Benth.
Dichrostachys (DC.) Wight & Arn., *nom. cons.*
D. cinerea (L.) Wight & Arn.
Mimosa L.
M. himalayana Gamble
M. pudica L.

ROSACEAE

Rosa L.
Rosa chinensis Jacq.

COMBRETACEAE

Anogeissus (DC.) Guill., Perr. & A. Rich.
A. acuminata (Roxb. ex DC.) Guill. & Perr.
A. latifolia (Roxb. ex DC.) Wall. ex Guill. & Perr.
Combretum Loefl., *nom. cons.*
C. albidum G. Don
Terminalia L., *nom. cons.*
T. alata Heyne ex Roth
T. arjuna (Roxb. ex DC.) Wight & Arn.
T. bellirica (Gaertn.) Roxb.
T. chebula Retz.

MYRTACEAE

Syzygium Gaertn., *nom. cons.*
S. cumini (L.) Skeels
S. heyneanum Wall. ex Wight & Arn.

LECYTHIDACEAE

Ammannia baccifera L.
Careya Roxb., *nom. cons.*
C. arborea Roxb.
Lythraceae ammannia L.
Lagerstroemia L.
L. parviflora Roxb.
Rotala L.
R. indica (Willd.) Koehne
R. rosea (Poir.) C.D. Cook
R. rotundifolia (Roxb.) Koehne
R. serpyllifolia (Roth) Bremek.
Woodfordia Salisb.
W. fruticosa (L.) Kurz

ONAGRACEAE

Ludwigia L.
L. hyssopifolia (G. Don) Exell
L. octovalvis (Jacq.) Raven
L. perennis L.

CUCURBITACEAE

Blastania Kotschy & Peyr.
B. garcinii (Burm. f.) Cogn.
Melothria L.
M. heterophylla (Lour.) Cogn.

BEGONIACEAE

Begonia L.
B. picta Sm.

CACTACEAE

Opuntia Mill.
O. elatior Mill.

MOLLUGINACEAE

Glinus L.
G. lotoides L.
Mollugo L.
M. pentaphylla L.

APIACEAE

Pimpinella L.
P. heyneana (DC.) Wall. ex Kurz
P. wallichiana (Miq. ex Hohenck.) Gandhi

RUBIACEAE

Catunaregam Wolf
C. uliginosa (Retz.) Sivarajan
Dentella J.R.Forst. & G. Forst.
D. repens (L.) J.R.Forst. & G.Forst.
Gardenia J. Ellis, *nom. cons.*
G. gummifera L. f.
G. latifolia Aiton
G. resinifera Roth
G. turgida Roxb.
Haldina Ridsdale
H. cordifolia (Roxb.) Ridsdale
Hymenodictyon Wall., *nom. cons.*
H. orixense (Roxb.) Mabberley
Ixora L.
I. pavetta Andr.
Knoxia L.
K. sumatrensis (Retz.) DC.
Mitragyna Korth., *nom. cons.*
M. parvifolia (Roxb.) Korth.
Morinda L.
M. pubescens Sm.
Oldenlandia L.
O. corymbosa L.
var. **corymbosa** var. **linearis** (DC.) Verdc.
O. herbacea (L.) Roxb.
Pavetta L.
P. tomentosa Roxb. ex Sm.
Spermacoce L.
S. hispida L.
S. pusilla Wall.
Spermadictyon Roxb.
S. suaveolens Roxb.
Thecagonum Babu
T. ovatifolium (Cav.) Babu
Wendlandia Bartl. ex DC., *nom. cons.*
W. heynei (Roem. & Schult.) Santapau & Merch.
W. tinctoria (Roxb.) DC.

ASTERACEAE

Ageratum L.
A. conyzoides L.
Blumea DC., *nom. cons.*
B. fistulosa (Roxb.) Kurz
B. lacera (Burm. f.) DC.
Caesulia Roxb.
C. axillaris Roxb.
Carthamus L.
C. oxycantha Bieb.
Centipeda Lour.
C. minima (L.) A. Br. & Aschers.
Cyathocline Cass.
C. purpurea (Buch.-Ham. ex D. Don) Kuntze
Eclipta L., *nom. cons.*
E. prostrata (L.) L.
Elephantopus L.
E. scaber L.
Flaveria Juss.
F. trinervia (Spreng.) C. Mohr.
Gnaphalium L.
G. affine D. Don
Goniocaulon Cass.

G. glabrum Cass.
Lagascea Cav., *orth. et nom. cons.*
L. mollis Cav.
Pentanema Cass.
P. indicum (L.) Ling
Sonchus L.
S. oleraceus L.
Spilanthes Jacq.
S. calva DC.
S. paniculata Wall. ex DC.
Tridax L.
T. procumbens L.
Vernonia Schreb., *nom. cons.*
V. cinerea (L.) Less.
V. divergens (Roxb.) Edgew.

CAMPANULACEAE

Campanula L.
C. benthamii Wall. ex DC.
C. pallida Wall.
Wahlenbergia Schrad. ex Roth, *nom. cons.*
W. marginata (Thunb.) DC.

LOBELIACEAE

Lobelia L.
L. alsinoides Lam.

PLUMBAGINACEAE

Plumbago L.
P. zeylanica L.

MYRSINACEAE

Embelia Burm. f., *nom. cons.*
E. basaal (Roem. & Schult.) A. DC.

SAPOTACEAE

Madhuca Buch.-Ham. ex J.F. Gmelin
M. longifolia (J. Koenig) Macbr. var. **latifolia** (Roxb.) Chevalier

EBENACEAE

Diospyros L.
D. cordifolia Roxb.
D. melanoxylon Roxb.
D. sylvatica Roxb.

OLEACEAE

Jasminum L.
J. arborescens Roxb.
Nyctanthes L.
N. arbor-tristis L.
Schrebera Roxb., *nom. cons.*
S. swietenioides Roxb.

APOCYNACEAE

Carissa L., *nom. cons.*
C. paucinervia A. DC.
C. spinarum L.
Catharanthus G. Don
C. pusillus (Murr.) G. Don
Holarrhena R. Br.
H. pubescens (Buch.-Ham.) Wall. ex G. Don
Ichnocarpus R. Br., *nom. cons.*
I. frutescens (L.) R. Br.
Wrightia R. Br.
W. arborea (Dennst.) Mabberley
W. tinctoria R. Br.
subsp. **rothii** (G. Don) P. T. Ngan

ASCLEPIADACEAE

Calotropis R. Br.
C. gigantea (L.) R. Br.
C. procera (Aiton) R. Br.
Ceropegia L.
C. hirsuta Wight & Arn.
Cryptolepis R. Br.
C. buchanani Roem. & Schult.
Hemidesmus R. Br.
H. indicus (L.) R. Br.
var. **indicus**
var. **pubescens** (Wight & Arn.) Hook. f.
Pergularia L.
P. daemia (Forssk.) Chiov.
Telosma Coville
T. pallida (Roxb.) Craib

LOGANIACEAE

Strychnos L.
S. potatorum L. f.

BORAGINACEAE

Cordia L.
C. macleodii (Griff.) Hook. f. & Thomson
C. obliqua Willd.
Cynoglossum L.
C. lanceolatum Forssk.
C. zeylanicum (Vahl ex Hornem.) Thunb. ex Lehm.
Ehretia R. Br.
E. laevis Roxb.
Heliotropium L.
H. indicum L.
H. marifolium Retz.
Rotula Lour.
R. aquatica Lour.
Trichodesma R. Br., *nom. cons.*
T. indicum (L.) R. Br. ex Lehm.
var. **indicum**
var. **subsessilis** C.B. Clarke
T. sedgwickianum Banerjee
T. zeylanicum (Burm. f.) R. Br.

CONVOLVULACEAE

Argyreia Lour.
A. sericea Dalzell & Gibson
A. strigosa (Roth) Roberty
Convolvulus L.
C. arvensis L.
C. prostratus Forssk.
Evolvulus L.
E. alsinoides (L.) L.
Ipomoea L., *nom. cons.*
Ipomoea aquatica Forssk.
I. hederifolia L.
I. nil (L.) Roth
I. turbinata Lag.
Merremia Dennst. ex Endl., *nom. cons.*
M. gangetica (L.) Cufod.
Porana Burm. f.
P. paniculata Roxb.
Rivea Choisy
R. hypocrateriformis (Desr.) Choisy

CUSCUTACEAE

Cuscuta L.
C. reflexa Roxb.

SOLANACEAE

Datura L.
D. innoxia Mill.
Nicandra Adans., *nom. cons.*
N. physalodes (L.) Scop.
Physalis L.
P. minima L.
Solanum L.
S. nigrum L.
S. violaceum Ortega
S. virginianum L.

SCROPHULARIACEAE

Bacopa Aublet, *nom. cons.*
B. monnieri (L.) Wettst.
B. procumbens (Mill.) Greenm.
Dopatrium Buch.-Ham. ex Benth.
D. junceum (Roxb.) Buch.-Ham. ex Benth.
Limnophila R. Br., *nom. cons.*
L. indica (L.) Druce
Lindenbergia Lehm.
L. indica (L.) Vatke
Lindernia All.
L. hookeri (C.B. Clarke ex Hook. f.) Wettst
L. nummulariifolia (D. Don) Wettst.
L. parviflora (Roxb.) Haines
Mimulus L.
M. strictus Benth.
Scoparia L.
S. dulcis L.
Sopubia Buch.-Ham. ex D. Don
S. delphiniifolia (L.) G. Don
Stemodia L., *nom. cons.*
S. viscosa Roxb.
Striga Lour.
S. angustifolia (D. Don) Saldanha
Sutera Roth
S. dissecta (Delile) Walp.
Verbascum L.
V. chinense (L.) Santapau
Veronica L.
V. anagallis-aquatica L.

OROBANCHACEAE

Aeginetia L.
A. indica L.

LENTIBULARIACEAE

Utricularia L.
U. aurea Lour.
U. exoleta R. Br.
U. stellaris L. f.

BIGNONIACEAE

Oroxylum Vent.
O. indicum (L.) Vent.
Stereospermum Cham.
S. chelonoides (L. f.) DC.
S. colais (Dillwyn) Mabberley

PEDALIACEAE

Sesamum L.
S. indicum L.

ACANTHACEAE

Adhatoda Mill.
A. zeylanica Medik.
Andrographis Wall. ex Nees
A. paniculata (Burm. f.) Wall. ex Nees
Barleria L.
B. cristata L.
B. prionitis L.
Blepharis Juss.
B. maderaspatensis (L.) Heyne ex Roth
Dipteracanthus Nees
D. beddomei (C.B. Clarke) Santapau
D. prostratus (Poir.) Nees
Eranthemum L.
E. purpurascens Wight ex Nees
Gantelbua Bremek.
G. urens (Heyne ex Roth) Bremek.
Hemigraphis Nees
H. latebrosa (Heyne ex Roth) Nees
Hygrophila R. Br.
H. auriculata (Schumach.) Heine
Indoneesiella Sreemadh.
I. echioides (L.) Sreemadh.
Justicia L.
J. betonica L.
J. diffusa Willd.
J. prostrata (C.B. Clarke) Gamble
J. quinqueangularis Koenig ex Roxb.
var. **peploides** (Nees) C.B. Clarke
J. simplex D. Don
Lepidagathis Willd.
L. cristata Willd.
Nelsonia R. Br.
N. canescens (Lam.) Spreng.
Perilepta Bremek.
P. auriculata (Nees) Bremek.
Peristrophe Nees
P. paniculata (Forssk.) Brummitt
Petalidium Nees
P. barlerioides (Roth) Nees
Rungia Nees
R. repens (L.) Nees

VERBENACEAE

Clerodendrum L.
C. serratum (L.) Moon
Gmelina L.
G. arborea Roxb.
Lantana L.
L. camara L.
var. **aculeata** (L.) Moldenke
Premna L., *nom. cons.*
P. tomentosa Willd.
Tectona L. f., *nom. cons.*
T. grandis L. f.
Vitex L.
V. negundo L.

LAMIACEAE

Anisomeles R. Br.
A. indica (L.) Kuntze
Leonotis (Pers.) R. Br.
L. nepetifolia (L.) R. Br.
Leucas R. Br.
L. aspera (Willd.) Link
L. cephalotes (Koenig ex Roth) Spreng.
L. clarkei Hook. f.
L. mollissima Wall. ex Benth.

L. montana (Roth) Spreng.
Nepeta L.
N. hindostana (Heyne ex Roth) Haines
Ocimum L.
O. basilicum L.
O. canum Sims
O. gratissimum L.
O. tenuiflorum L.
Orthosiphon Benth.
O. pallidus Royle ex Benth.
O. rubicundus (D. Don) Benth.
Plectranthus L'Hérit., *nom. cons.*
P. mollis (Aiton) Spreng.
Pogostemon Desf.
P. benghalense (Burm. f.) Kuntze

NYCTAGINACEAE

Boerhavia L.
B. diffusa L.
B. procumbens Banks ex Roxb.

AMARANTHACEAE

Achyranthes L.
A. aspera L.
Aerva Forssk., *nom. cons.*
A. lanata (L.) Juss. ex Schult.
Allmania R. Br. ex Wight
A. nodiflora (L.) R. Br. ex Wight
Alternanthera Forssk.
A. sessilis (L.) R. Br. ex DC.
Amaranthus L.
A. spinosus L.
A. viridis L.
Celosia L.
C. argentea L.
Gomphrena L.
G. celosioides Mart.
Pupalia Juss., *nom. cons.*
P. lappacea (L.) Juss.
Trichuriella Bennet
T. monsoniae (L. f.) Bennet

POLYGONACEAE

Polygonum L., *nom. cons.*
P. barbatum L.
P. glabrum Willd.
P. hydropiper L.
subsp. **microcarpum** Danser var.
triquetrum Danser
P. plebeium R. Br.
var. **griffithii** Hook. f.
var. **plebeium**

LAURACEAE

Litsea Lam., *nom. cons.*
L. glutinosa (Lour.) Robinson

LORANTHACEAE

Dendrophthoe Mart.
D. falcata (L. f.) Etting.
Loranthus Jacq., *nom. cons.*
L. philippensis Cham. & Schlechtend.
Viscum L.
V. articulatum Burm. f.

EUPHORBIACEAE

Acalypha L.
A. ciliata Forssk.
Antidesma L.
A. acidum Retz.
A. ghaesembilla Gaertn.
Baliospermum Blume
B. montanum (Willd.) Muell. Arg.
Breynia J.R. Forst. & G. Forst., *nom. cons.*
B. retusa (Dennst.) Alston
BrideliaWilld.
B. retusa (L.) Spreng.
Chrozophora Adr. Juss., *orth. et nom. cons.*
C. prostrata Dalzell
Cleistanthus Hook. f. ex Planch.
C. collinus (Roxb.) Benth. ex Hook. f.
Euphorbia L.
E. chamaesyce L.
E. heterophylla L.
E. hypericifolia L.
E. nivulia Buch.-Ham.
E. thymifolia L.
Jatropha L.
J. curcas L.
Mallotus Lour.

M. philippensis (Lam.) Muell. Arg.
Phyllanthus L.
P. amarus Schumach. & Thonn.
P. emblica L.
P. maderaspatensis L.
P. virgatus G. Forst.
Securinega Commerson ex Juss., *nom. cons.*
S. virosa (Roxb. ex Willd.) Baill.
Trewia L.
T. polycarpa Benth.

URTICACEAE

Laportea Gaud., *nom. cons.*
L. interrupta (L.) Chew.

ULMACEAE

Holoptelea Planch.
H. integrifolia (Roxb.) Planch.
Trema Lour.
T. orientalis (L.) Blume
T. politoria Planch.

MORACEAE

Ficus L.
F. arnottiana (Miq.) Miq.
F. benghalensis L.
F. hispida L. f.
F. microcarpa L. f.
F. mollis Vahl
F. racemosa L.
F. semicordata Buch.-Ham. ex Sm.
F. tinctoria G. Forst.
subsp. **parasitica** (Willd.) Corner
F. virens Dryand.

HYDROCHARITACEAE

Hydrilla Rich.
H. verticillata (L. f.) Royle
Vallisneria L.
V. natans (Lour.) Hara

ORCHIDACEAE

Geodorum G. Jacks
G. densiflorum (Lam.) Schlechter
Habenaria Willd.
H. commelinifolia (Roxb.) Wall. ex Lindl.
H. digitata Lindl.
H. furcifera Lindl.
H. plantaginea Lindl.
H. roxburghii Nicolson
Peristylus Blume, *nom. cons.*
P. lawii Wight
P. plantagineus (Lindl.) Lindl.
Vanda W. Jones ex R. Br.
V. tessellata (Roxb.) Hook. ex G. Don

ZINGIBERACEAE

Curcuma L., *nom. cons.*
C. amada Roxb.
C. angustifolia Roxb.
Globba L.
G. marantina L.
Hedychium J. Koenig
H. coronarium J. Koenig
Zingiber Boehmer
Z. capitatum Roxb.

COSTACEAE

Costus speciosus (J. Koenig) Sm.

MUSACEAE

Musa L.
M. paradisiaca L.

HYPOXIDACEAE

Curculigo Gaertn.
C. orchioides Gaertn.

TACCACEAE

Tacca J.R. Forst. & G. Forst., *nom. cons.*
T. leontopetaloides (L.) Kuntze

DIOSCOREACEAE

Dioscorea L.
Dioscorea bulbifera L.
D. hispida Dennst.
D. oppositifolia L.
D. pentaphylla L.
D. wallichii Hook. f.

LILIACEAE

Asparagus L.
A. racemosus Willd.
var. **javanicus** (Kunth) Baker
var. **racemosus**
Chlorophytum Ker-Gawl.
C. arundinaceum Baker
Gloriosa L.
G. superba L.
Iphigenia Kunth, *nom. cons.*
I. indica (L.) A. Gray
I. pallida Baker

SMILACACEAE

Smilax L.
S. zeylanica L.

PONTEDERIACEAE

Eichhornia Kunth
E. crassipes (Mart.) Solms

COMMELINACEAE

Commelina L.
C. benghalensis L.
C. hasskarlii C.B.Clarke
C. paludosa Blume
Cyanotis D. Don, *nom. cons.*
C. cristata (L.) D. Don
C. fasciculata (Heyne ex Roth) Schult. & J.H.Schult.
Murdannia Royle, *nom. cons.*
M. nudiflora (L.) Brenan
M. spirata (L.) Brückner
Tonningia Neck. ex Adr., Juss.
T. axillaris (L.) Kuntze

JUNCACEAE

Juncus L.
J. leschenaultii Gay

TYPHACEAE

Typha L.
T. angustifolia L.

ARACEAE

Colocasia Schott, *nom. cons.*
C. esculenta (L.) Schott

LEMNACEAE

Lemna L.
L. perpusilla Torr.

ALISMATACEAE

Limnophyton Miq.
L. obtusifolium (L.) Miq.

LIMNOCHARITACEAE

Butomopsis Kunth
B. latifolia (D. Don) Kunth

NAJADACEAE

Najas L.
N. graminea Delile

APONOGETONACEAE

Aponogeton L. f., *nom. cons.*
A. crispus Thunb.

POTAMOGETONACEAE

Potamogeton L.
P. crispus L.
P. nodosus Poir.

ERIOCAULACEAE

Eriocaulon L.
E. cinereum R. Br.
E. quinquangulare L.

CYPERACEAE

Bulbostylis Kunth, *nom. cons.*
B. barbata (Rottb.) C.B. Clarke
Cyperus L.
C. alulatus Kern
C. brevifolius (Rottb.) Hassk.
C. compressus L.
C. cyperoides (L.) Kuntze
C. difformis L.
C. exaltatus Retz.
C. halpan L.

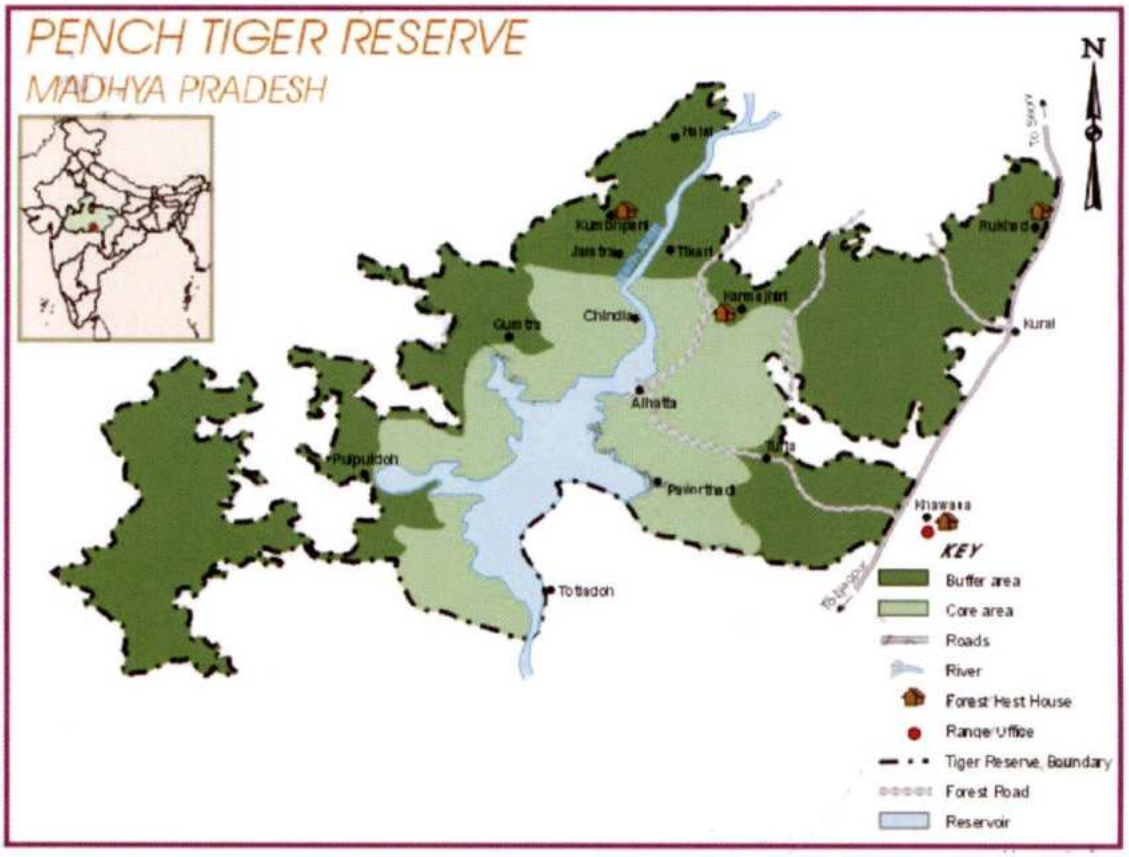
C. iria L.
C. niveus Retz.
C. pangorei Rottb.
C. pumilus L.
C. pygmaeus Rottb.
C. rotundus L.
C. triceps Endl.
Fimbristylis Vahl, *nom. cons.*
F. bisumbellata (Forssk.) Bubani
F. dichotoma (L.) Vahl
F. miliacea (L.) Vahl
F. schoenoides (Retz.) Vahl
Scirpus L.
S. articulatus L.
S. lateriflorus J.F.Gmelin

POACEAE

Alloteropsis K. Presl
A. cimicina (L.) Stapf
Apluda L.
A. mutica L.
Aristida L.
A. setacea Retz.
Arthraxon P. Beauv.
A. lancifolius (Trin.) Hochst.
Bothriochloa Kuntze
B. pertusa (L.) A. Camus
Brachiaria (Trin.) Griseb.
B. eruciformis (Sm.) Griseb.
B. reptans (L.) Gardn. & C.E. Hubb.
Chionachne R. Br.
C. koenigii (Spreng.) Thwaites
Chloris Sw.
C. dolichostachya Lag.
C. virgata Sw.
Chrysopogon Trin., *nom. cons.*
C. fulvus (Spreng.) Chiov.
Coix L.
C. lacryma-jobi L.
Cymbopogon Spreng.
C. martinii (Roxb.) Wats.
Cynodon Rich., *nom. cons.*
C. dactylon (L.) Pers.
Dactyloctenium Willd.
D. aristatum Link
Dendrocalamus Nees
D. strictus (Roxb.) Nees
Dichanthium Willemet
D. annulatum (Forssk.) Stapf
D. aristatum (Poir.) C.E. Hubb.
Digitaria Haller, *nom. cons.*
D. bicornis (Lam.) Roem. & Schult. ex Loud.
D. ciliaris (Retz.) Koel.
Echinochloa P. Beauv., *nom. cons.*
E. colonum (L.) Link
E. crusgalli (L.) P. Beauv.
Eleusine Gaertn.
E. indica (L.) Gaertn.
Eragrostiella Bor
E. bifaria (Vahl) Bor
Eragrostis Wolf
E. ciliaris (L.) R. Br.
E. gangetica (Roxb.) Steud.
E. poaeoides P. Beauv.
E. tenella (L.) P. Beauv. ex Roem. & Schult.
E. unioloides (Retz.) Nees ex Steud.
Eulaliopsis Honda
E. binata (Retz.) C.E. Hubb.
Hackelochloa Kuntze
H. granularis (L.) Kuntze
Hemarthria R. Br.
H. compressa (L. f.) R. Br.
Heteropogon Pers.
H. contortus (L.) P. Beauv. ex Roem. & Schult.
Imperata Cirillo
I. cylindrica (L.) P. Beauv. var. **major** (Nees) Hubb. ex Hubb. & Vaughan
Iseilema Anderss.
I. laxum Hack.
Melanocenchris Nees
M. jacquemontii Jaub. & Spach
Oplismenus P. Beauv., *nom. cons.*
O. burmannii (Retz.) P. Beauv.
O. compositus (L.) P. Beauv.
Oryza L.
O. rufipogon Griff.
Panicum L.
P. psilopodium Trin.

Sterculia urens

Panicum sumatrense Roth ex Roem. & Schult.
Paspalidium Stapf
P. flavidum (Retz.) A. Camus
Paspalum L.
P. scrobiculatum L.
Phragmites Adans.
P. karka (Retz.) Trin. ex Steud.
Rottboellia L. f., *nom. cons.*
R. cochinchinensis (Lour.) W.D. Clayton
Saccharum L.
S. bengalense Retz.
S. spontaneum L.
Setaria P. Beauv., *nom. cons.*
S. pallide-fusca (Schumach.) Stapf & C.E.Hubb.
S. pumila (Poir.) Roem. & Schult.
S. verticillata (L.) P. Beauv.
Themeda Forssk.
T. quadrivalvis (L.) Kuntze
Thysanolaena Nees
T. maxima (Roxb.) Kuntze
Urochloa P. Beauv.
U. panicoides P. Beauv.
Vetiveria Bory
V. zizanioides (L.) Nash



Map of Pench Tiger Reserve

SALIENT FEATURES

Area

Core	:	292.85 sq. km
Buffer	:	465.00 sq.km
Total	:	757.85 sq km
Longitude	:	79°07' to 79°22' E
Latitude	:	21°37' to 21°50' N
Altitude	:	580-675 m Above MSL
Rainfall	:	1397 mm

Seasons

Winter	:	November to February
Summer	:	March to mid-June
Monsoon	:	Mid-June to September

Temperature

Minimum	:	3.1°C
Maximum	:	47°C

No state or national highway passes through the core area. National Highway No.7 passes along the border of the Pench Sanctuary in the Buffer. A number of accidents of wild animals takes place due to vehicles plying during the night.

Pench is ideally situated for tourism, being only 12 km away from Khawasa on N.H. 7 between Nagpur and Jabalpur. Khawasa is 81 km from Nagpur and 193 km from Jabalpur.

MAHARASHTRA

A small cascades in monsoon : *Ensete superbum* on rocks

- **Melghat Tiger Reserve**
- **Pench Tiger Reserve**
- **Taroba-Andhari Tiger Reserve**

Melghat Tiger Reserve

PSN Rao
Botanical Survey of India, Western Circle, Pune - 411001

The Melghat area in Amravati District of Maharashtra State has an expanse of nearly 3575 sq km with good forest cover and the Melghat Tiger Reserve (Lat. 21°14' -21°45' N & Long. 76°53' E - 77°32' E) covers an area of about 1677 sq km out of which 316.28 sq km is the core area and 1360.65 sq km is the buffer area. It is situated in the mountainous region, the Gavilgarh hills of Satpuras from Chikalda and Dharni tahsils of Amravati District. This part of Satpuras is known as Melghat and consists of succession of hills and valleys showing much variation in aspect, gradient and altitude. The core area is the "sanctum sanctorum" in which the fellings, grazing by domestic cattle and movement of man except for management is totally prohibited. It is now a closed area without any interference. The government of Maharashtra has declared its intention to constitute the area of "sanctum sanctorum" as "Gugamal National Park" since 27 November 1987. It s is also important to note that the entire area of 'Melghat Tiger Reserve' is notified as "Melghat Tiger Sanctuary" by the Maharashtra Government from 5th September 1985 under the provision of Wildlife (Protection) Act 1972.

Topographically the entire area of this Tiger Reserve is in the form of mountainous ranges. The highest point is Vairat plateau with an altitude of 1178 m Chikhalda, the only well developed hill station of Vidarbha is located on a plateau with a slightly lower altitude of 1116 m. The crest of the Gavilgarh is the main ridge of these ranges and runs eastwest in the south. This ridge shows flat plateau on the top, which descends into abrupt and very steep scarps on either side. Most of the ridges show very steep slopes. These slopes finally form very narrow valleys, locally called 'khoras' and the Dhalia khora, Gerangao, Bhut khora, Vairat khora, Jamli khora and others give picturesque sights. The ridges show locally called "ballas"-at places, which are their flat tops e.g. Gugamal balla, Chameli balla, Haldu balla, Bokaldi balla, etc.

Though the forest is of dry deciduous type, there are several valleys and cliffs that remain wet for maximum period of the year. Due to the protection given, plants are on their own to grow, reproduce, evolve and adjust freely to their ecological niche. Biodiversity is expected to be high under such conditions. The maximum rainfall noted in Melghat is around 150 cm, with maximum of 73 rainy days per year. Though summer months are dry, relative humidity is very high during monsoon. This offers a good opportunity for even temperate ephemeral species to grow during rainy season.

As per the revised classification of the forest types by Champion and Seth, these forests belong to, Subgroup-5 A of Group 5 and designated as 'Southern Tropical Dry Deciduous Forests'. *Tectona grandis* is the most dominant species. It surpasses all other component species in frequency and density. It attains an average height of 20-27 m and has a tendency to grow gregariously in better quality forests.

The associates of *Tectona grandis* differ depending upon the altitude, gradient and other physiographic

Melghat the land of "Rugged Terrain & Bountiful Nature"

features of the habitat. However, its most common associates in almost all localities are *Legerstroemia parviflora, Lannea coromandelica, Emblica officinalis, Terminalia tomentosa, Anogeissus latifolia* and *Ougenia oojeinensis.* At lower elevations other associates of Teak may be *Boswellia serrata, Wrightia tinctoria, Cassia fistula, Miliusa tomentosa, Bauhinia racemosa, Butea monosperma* etc. At higher elevations and in more moist localities other associates are mainly *Mitragyna parviflora, Adina cordifolia, Schleichera oleosa, Albizzia procera, Casearia elliptica* etc.

Indian tradition in wildlife conservation is well known . However during subsequent era wide clearance of forests opened vistas for advances in agriculture sector, but soon it was realised that ecological prudence is required and nature conservation practices were formulated and countries first national park was established in 1935 Jim Corbett National Park.

After the realization that protected areas are emential for conservation efforts, the National wildlife Act of 1977 paned a may for creation of protected areas in national park, Barctuacis native reserves, etc.The climate of the Reserve is of monsoon type. The winter season extends from the last week of October to the middle of March. The coldest months of the season being December and January. The mean temperature very between 8.0°C - 22°C. the relative humidity being 74.2 per cent. The summer season starts from the middle of March and extends up to the break of monsoon. The mean relative humidity being 63.5% and the mean temperatures ranging between 23.50° - 36.9°C. The rainy season starts from the first week of July extending up to the first week of October. July and August are the wettest months of the year. The average total annual rainfall is about 1160 mm, the mean relative humidity being ca 78.8 per cent.

There are eighty six naturally occurring tree species recorded during recent studies from the forests of this reserve. Phytosociological studies have been carried out by Dhore and Joshi (1988) based on which, the first twenty seven species according to their frequency of occurrence are : 1. *Tectona grandis,* 2. *Lagerstroemia parviflora,* 3. *Lannea coromandelica,* 4. *Emblica officinalis,* 5. *Zizyphus xylopyra,* 6. *Ougenia oojennsis,* 7. *Anogeissus latifolia,* 8. *Termialia alata,* 9. *Grewia tiliifolia,* (b) frequency from 51 to 75%, 10. *Mitragyna parviflora,* 11. *Cassia fistula,* 12. *Garuga pinnata,* 13. *Diospyros melanoxylon,* 14. *Adina cordifolia,* 15. *Wrightia tinctoria,* frequency from 26 to 50% 16. *Bauhinia racemosa,* 20. *Schleichera oleosa,* 21. *Madhuca indica,* 22. *Bridelia retusa,* 23. *Flacourtia indica,* 24. *Casearia elliptica,* 25. *Acacia chundra,* 26. *Miliusa tomentosa* and 27. *Butea monospema.*

Dendrocalamus strictus is widespread in this reserve and is often gregarious on hill slopes and in valleys.

Woody climbers constitute an important category of life form in a forest community. The more extensive and conspicuous lianas of this reserve are *Butea superba, Bauhinia vahlii, Milletia auriculata, Pueraria tuberosa, Celastrus paniculatus, Combretum ovalifolium, Acacia pennata, Zizyphus rugosa* occurring at higher elevations in Chikhalda range and on Makhala plateau. Other lianas frequently met with in different localities are *Cissampelos pariera, Capparis zeylanica, Ampelocissus latifolia, Cayratia auriculata, C. trifolia, Cissus repanda, Canvalia gladiata, Dregea volubilis, Cryptolepis buchanani, Hemidesmus indicus, Argyreia sericea, Mucuna prurita* etc. Dioscoreas occur very commonly throughout the area. Koktu valley, probably one of the most moist valleys of the reserve abounds in a variety of woody climbers. *Lantana camara* has invaded large tracts of the reserve affecting the growth of the ground cover and forest regeneration.

The grass species of the forest undergrowth are mostly tall growing, of monsoon growth and their drying commences in November. The major grass associations which dominate the forest floor growth are *Heteropogon contortus, Heteropogon ritchiei; Apluda mutica, Heteropogon contortus; Apluda mutica, Sehima sulcatum; Sehima sulcatum, Sorghum controversum; Apluda mutica, Pennisetum pedicellatum; Themeda quadrivalvis, Pseudanthistiria hispida; Apluda mutica, Capillipedium huegelli; Apluda mutica, Capillipedium filiculme; Sorghum controversum, Heteropogon ritchiei; Spodiopogon rhizophorus, Apluda mutica; Chloris dolichostachya, Paspalidium flavidum,* etc.

Grasses like *Brachiaria ramosa, Hackelochloa granularis, Setaria pallid-fusca, Panicum tripheron, Cymbopogon martinii, Oplismenus burmanni, Rottboelia exaltata, Sorghum decannense, Sorghum verticilliflorum* and other occur in such associations but in insignificant percentages.

Depending upon the habitat, certain taxa like *Heteropogon ritchie, Spodiopogon rhizophorus, Themeda quadrivalvis, Sorghum controversum* show almost pure patches of growth (above 90%) in local areas of the reserve.

Depending upon the habitat and the locality, the species making their early appearance on the forest floor along with the grasses immediately after first sufficient rains of monsoon (June-July) are: *Adiantum incisum* (fern), *Curculigo pseudomontana, Curculigo orchioides, Scilla hyacinthina, Arisaema murrayi, Theriophonum* spp. *Kyllinga tenuifolia, Habenaria planitaginea, Commelina* spp., *Murdannia nudiflora, Cyanotis fasciculata, Sida cordata, Hibiscus lobatus, Vernonia cinerea, Vicoa auriculata, Justicia diffusa, J. simplex, Anisochilus carnosus,* etc.

Grass-legume association is of special significance in any forest ecosystem. More frequently occurring leguminous taxa in association with different grasses as a part of ground vegetation of

Vegetation is an important even for a mammal like 'Tiger'.

this Reserve are: *Alysicarpus buplurifolius, A. scariosus, A. tetragonolobus, A. vaginalis, Atylosia scarabioides, Clitoria biflora, Crotalaria calycina, C. linifolia, C. mysorensis, C. prostrata, C. spectabilis, Desmodium rotundifolium, D. laxiflorum, Galactia tenuiflora, Indigofera astragalina, I. cordifolia, I. linifolia, 'Rhynchosia minima, Sesbania bispinosa, Tephrosia pumila, Uraria picta, Vigna trilobata, Zornia diphylla, Cassia absus, C. mimosoides, C. pumila, C. tora,* etc. *Clitoria biflora* is the most common and abundant species in several localities.

Apart from the above mentioned ones, several other species occur among grasses on the forest floor. They are *Cleome viscosa, Sida acuta, S. alba, S. orientalis, Triumfetta pentandra, T. rhomboidea, Biophytum sensitivum, Leea edgeworthii, Cardiospermum helicacabum, Mukia maderaspatana, Pimpinella lateriflora, P. monoica, Hybanthes eneaspermus, Polygala elongata, Spermacoce hispida, S. stricta, Bidens biternata, Blainvillea acmella, Conyza stricta, Galinsoga parviflora, Glossocardia bosvallea, Lagascea mollis, Tridax procumbens, Cryptolepis buchananii, Hemidesmus indicus, Paracaryum coelestinum, Trichodesma indicum, Argyreia sericea, Evolvulus alsinoides, Ipomoea quamoclit, I. obscura, I. pestigridis, Sopubia delphinifolia, Sesamum indicum, Dipteracanthus patulus, Hemigraphis latebrosa, Lepidagathis cristata, L. trinervis, Rungia elegans, Lavandula burmannii, Leucas biflora, Achyranthes aspera, Celosia argentea, Trichurus monsoniae, Euphorbia prunifolia, E. piluifera, E.hypericifolia, Phyllanthus debilis, P. virgatus, Habenaria platyphylla, Crinum* spp., *Dioscorea belophylla, D. hispida, D. bulbifera, D. pentaphylla, Chlorophytum tuberosum, Eriocaulon luzulaefolium, Cyperus alulatus, C. compressus, C. squarrosus,* etc. Their occurrence, frequency and abundance depend upon the locality and the habitat. In several localities *Urena lobata, Desmodium gangeticum, D. laxiflorum, Pseudarthria viscida, Uraria rufescens,*

Uraria picta

Orthosiphon rubicundus, Plectrathus rugosus, Pogostemon benghalensis, Anisomeles indica occur conspicuously along with scanty growth of grass species along forest margins. *Hyptis suaveolens* is gregarious at places in Dhakna, Dabhya, Rangubeli, Malur, Raipur and some other localities. The buffer area of the Reserve is more than four times the core in extent and is dotted all over with small villages. Forests around these villages are cleared and agriculture is practiced by the tribals. The area as such is thinly populated. The economy of the tribal societies is partly agriculture based. The crop pattern of this hilly terrain is somewhat different from the plains of Amravati district. The rainy season spread over the period of June-October is most favorable period from agricultural point of view. The short duration crops and varieties are given preference. Rabi crops under dry-land conditions are taken up on a moderate scale in most of the areas where the soils have a good water retaining capacity. Although the total land under cultivation in this reserve is very small, a wide variety of crops are taken up for cultivation viz. Sorghum, paddy, maize and wheat etc. Inferior millets *Echinochloa frumentacea, Panicum miliare, Paspalidium scrobiculatum, Eleusine coracana, Setaria italica* are also commonly grown. The cultivation of *Glycine wightii* and *Guizotia abyssinica* is gradually picking up. Chillies and tomato also give good returns. Depending upon the locality, the characteristic weeds of the agricultural lands are *Argemone mexicana, Cardamine trichocarpa, Hibiscus lobatus, Sida acuta, Biophytum sensitivum, Alysicarpus* spp., *Indigofera* spp., *Psoralea corylifolia, Cassia pumila, C. tora, Ammania baccifera, Spermacoce stricta, Oldenlandia corymbosa, Ageratum conyzoides, Caesulia axillaris, Launaea procumbens, Tridax procumbens, Vernonia cinerea, Catharanthus pusillus, Mollugo pentaphylla, Enicostemma hyssopifolium, Merremia gangetica, Solanium nigrum, Striga angustifolia, Justicia simplex, Lepidagathis cristata, Leucas cephalotes, L. nutans, Achyranthes aspera, Celosia argentea, Euphorbia geniculata, E. hirta, E. parviflora , Phyllanthus maderaspatensis, Cyanotis fasciculata, Murdannia nudiflora, Cyperus rotundus, Aristida depressa, Brachiaria eruciformis, Chloris virgata, Coix aquatica, Cynodon dactylon, Eleusine aegyptiaca, Echinochloa colonum, Eragrostis ciliaris, E. namaquensis, E. tenella, Iseilema laxum, Paspalidium flavidum, Setaria intermedia, S. pallide-fusca, Sporobolus diander,* etc.

Gardens and nurseries maintained by the forest department at Chikhalda and other places in the territory of the reserve possess a collection of many horticultural varieties. The luxurious growth at Chikhalda of introduced species like *Cryptomeria japonica, Podocarpus* spp., *Pinus longifolia, Cupressus sempervirens, Prunus persica, Alstonia scholaris, Dillenia indica, Michelia champaca, Grevillea robusta, Ficus elastica,* etc. gives an idea of climatic and edaphic conditions prevailing there and at similar locations elsewhere in Melghat. The successful cultivation of

Coffea arabica on Chikhalda plateau is to be noted in this context. Coffee plantations raised by Britishers on the Chikalda plateau are about 150 years old. The produce obtained from these plants is considered tobe as good as any given in India. Britishers also tried Tea cultivation at Chikalda but without success.

The introduced horticultural species *Solanum seaforthianum, Stachytarpheta jamaicensis, Thunbergia laevis* as garden escapes are, however, restricted to Chikalda plateaux.

The parasitic flowering plants represented 'in the flora of this Reserve are not many. *Dendrophthoe falcata* is common and occurs on a wide range of hosts. *Viscum articulatum* is rare and occurs only in Dhargad, Bori and Kelpani areas. *Cuscuta reflexa* is rare. *Cuscuta chinensis* is frequent with a wide host range but is restricted in distribution to Chikhalda plateau. *Striga angustifolia* and *S. gesneroides* occur throughout amongst grasses.

The number of aquatics and semi-aquatics as a component of the flora of the Reserve is also limited. The aquatics *Ceratophyllum demersum, Hydrilla verticillata, Vallisneria spiralis, Crinum defixum* occur in bigger rivers like Tapti, Sipna, Dolar etc. The standing pools of water in the river and stream beds and temporary ponds in low lying situations facilitate the growth of species like *Aeschynomene indica, Sesbania bispinosa, Smithia conferta, Ammonia baccifera, Rotala serpyllifolia, Dopatriam junceum, Limnophila indica, Caesulia axillaris, Polygonum glabrum, Typha angustata, Commelina* spp., *Cyperus* spp., *Fimbristylis* spp., *Elaeocharis capitata, Scirpus* spp., *Echinochloa colonum, Coix aquatica,* etc.

Orchid flora of the reserve is also poor. Vanda tessellata is common occurring on a variety of trees and in almost all areas. *Aerides maculosum,* very beautiful in flower occurs mostly on *Mangifera indica* in Semadoh locality. The terrestrial species *Habenaria grandifloriformis* and *H. roxburghii* occur in open situations at higher elevations, whereas *H. plantaginea* is fairly common on the moist hill slopes throughout the Reserve.

Dioscorea bulbifera

Contrary to expectations, the diversity of bryophytes and pteridophytes growing in the Melghat is less. It may be due to a long, dry period during the year.

The most favorable period of vegetation growth in the reserve corresponds to the active period of July-October. The entire area gives a lush green look from August onwards to November. The herbaceous ground cover dries up almost completely by December. Majority of the tree species are of deciduous type. Thus the entire vegetation of the area gives a totally dry and greyish-brown look during summer.

Floristic Composition in the Melghat Tiger Reserve

	Families		Genera		Species	
	Total no.	%	Total no.	%	Total no.	%
Polypetalae	45	46.4	135	33.9	230	35.5
Gamopetalae	25	25.8	142	35.7	202	31.2
Monocotyledons	16	16.5	89	22.4	160	23.7
TOTAL	97		398		648	

Genera Represented each by five and above Species

Genera	No. of species	Genera	No. of species	Genera	No. of species
Sida	5	**Blumea**	6	**Commelina**	5
Grewia	5	**Ipomoea**	10	**Cyperus**	7
Alysicarpus	8	**Justicia**	5	**Fimbristylis**	6
Desmodium	5	**Leucas**	6	**Brachiaria**	5
Indigofera	8	**Euphorbia**	6	**Eragrostis**	9
Bauhinia	5	**Ficus**	7		
Cassia	7	**Dioscorea**	5		

Dhargad, Kelpani and Bori sectors of the Reserve show least disturbance in vegetation, and good diversity in the terrestrial and tree flora is seen. These localities are on the border of Akola district and very close to the plains, however, they are cut off from the latter by a huge and very high, wall-like east- west outer ridge of Satpuras. Kolkaz, Belkund, Dolar, Dhakan localities are also rich so far as the floristic composition is concerned. Perhaps the maximum variety of the'herbaceous and tree species occurs on the highest plateaus of Chikhalda, Vairat and Makhala. However, the vegetation of Chikhalda and its neighborhood is much influenced in the last fifteen years due to biotic disturbance. Chaurakund, Rangubeli and Malur localities constitute the northwest sector of the Reserve and is floristically somewhat different from the rest of the Reserve.

RECENT ADDITIONS

CAPPARIDACEAE

Cleome papillosa Steud.

POLYGALACEAE

Polygala persicariaefolia DC.

MALVACEAE

Sida rhombifolia L. ssp. **retusa** (L.) Bross.

STERCULIACEAE

Waltheria indica L.

GERANIACEAE

Geranium mascatense Boiss.

OXALIDACEAE

Biophytum candolleanum Wight

B. reinwardtii Walp.

Oxalis pubescens Kunth

FABACEAE

Alysicarpus ovalifolius (Schumach.) J. Leonard.
Atylosia platycarpa Benth.
A. rugosa Wight & Arn.
Eleiotis monophylla (Burm. f.) DC.
Macrotyloma uniflorum (Lam.) Verde.
Stylosanthes fruticosa (Retz.) Alston
Sesbania bispinosa (Jacq.) Steud.

CAESALPINIACEAE

Cassia hirsuta L.

CUCURBITACEAE

Cucumis prophetarum L.
C. setosus Cogn.
Momordica balsamina L.

APIACEAE

Apium graveolens L.

ASTERACEAE

Blumea jacquemontii Hook.
B. oxyodanta DC. var. **erecta** Naik et Zate.
B. virens DC.
Conyza canadensis (L.) Cronquist
Gnaphalium pensylvanicum Willd.
Centratherum phyllolaenum Benth. ex Hook. f.
Pulicaria wightiana (DC.) C.B. Clarke
Vicoa cernua Dalz.
Senecio belgumensis C.B. Clarke
S. chrysanthemoides DC.
S. nudicaulis Buch.-Ham. ex D. Don

CAMPANULACEAE

Campanula benthamii Wall.

APOCYNACEAE

Ichnocarpus ovatifolius A. DC.

ASCLEPIADACEAE

Ceropegia oculata Hook.

Peristylus constrictus - found only in E. Himalayas & Melghat

LOGANIACEAE

Mitreola petiolata (Gmel.) Torr. & Gray

GENTIANACEAE

Exacum bicolor Roxb.
E. lawii C.B. Clarke
E. pumilum Griseb.

CONVOLVULACEAE

Ipomea triloba L.
Merremia tridentata (L.) Hallier.

SOLANACEAE

Solanum torvum Sw.

SCROPHULARIACEAE

Dopatrium lobeliodes (Retz.) Benth.

ACANTHACEAE

Achyranthes coynei Santapau
Andrographis paniculata Wall.
Lepidagathis bandraensis Blatt.
L. lutea Dalz.
Rhinacanthus communis Nees

URTICACEAE

Elatostema surculosum Wight

ORCHIDACEAE

Eulophia pratensis Lindl.
Habenaria digitata Lindl.
H. hollandiana Sant.
H. longicorniculata J.Graham
Nervilia aragoana Gaud.
Peristylus constr ictus (Lindl.) Lindl.
P. plantagineus Lindl.

ZINGIBERACEAE

Curcuma decipiens Dalz.

Clitoria biflora

C. inodora Blatt.
Zingiber nimmonii Dalz.

LILIACEAE

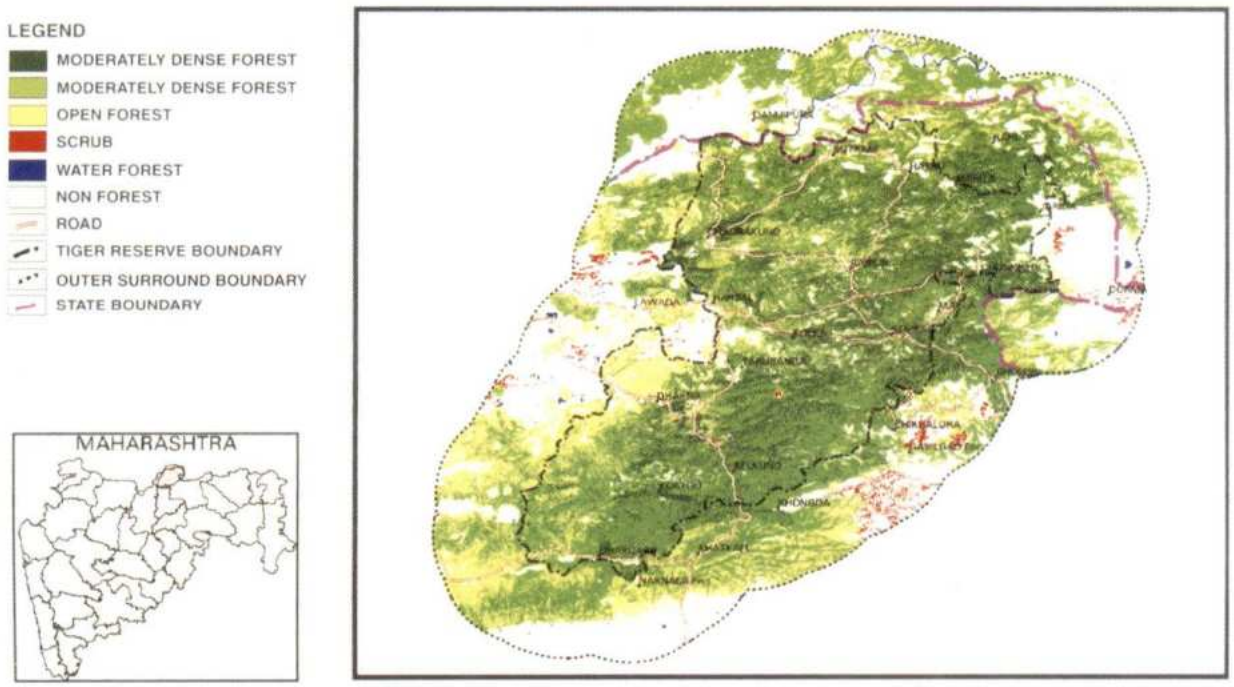
Chlorophytum glaucum Dalz.
Drimia indica (Roxb.) Jessop.

COMMELINACEAE

Murdannia semiteres (Dalz.) Sant.

ARACEAE

Ariopsis peltata Nimmo
Amorphophallus bulbifer Blume
A. commutatus (Schott) Engl.
Sauromatum guttatum Schott
Theriophorum minutum Willd.



Map of Melghat Tiger Reserve

Hymenodictyon orixense

SALIENT FEATURES

Melghat Tiger Reserve is located on southern offshoot of the Satpura Hill Range in Central India, also called Gavilgarh hills. The high ridge running East-West which has highest point at Vairat (1178 m above MSL) forms the South Western boundary of the Reserve. It is a prime habitat of Tiger. The forest is Tropical Dry Deciduous in nature, dominated by Teak *(Tectona grandis)*. The area is catchment to the five major rivers viz. Khandu, Khapra, Sipna, Gadga and Dolar, all of which are tributaries of the river Tapti. The North-Eastern boundary of the Reserve is marked by River Tapti. Melghat is prime biodiversity repository of the Maharashtra State.

Nature has offered protection to Melghat in the form of rugged topography with only few entry points. The Makhala, Chikhaldara, Chiladari, Patulda and Gugamal are the large plateau amidst rugged terrain.Continuity of forests in Satpura Hill Range guarantees long term conservation potential of the area.

Melghat area was declared a Tiger Reserve in 1974. Presently, the total area of the Reserve is 1676.93 sq km. The core area of the Reserve, the Gugarnal National Park with an area of 361.28 sq km and buffer area of the Reserve, the Melghat Tiger Sanctuary with an area of 788.28 sq km (of which 21.39 sq km is non-forest) were together re-notified by the state government in 1994 as Melghat Sanctuary. The remaining area is management as 'multiple use area'. Previously, Melghat Tiger Sanctuary was created in 1985 with an area of 1597.23 sq km. Gugarnal National Park was carved out of this Sanctuary in 1987.

Archeology

The Gavilgarh fort on the Chikhaldara plateau and Narnala fort abetting South Eastern part of Melghat Tiger Reserve add to the aesthetic values of the area. The visitors to these archaeological monuments enjoy serene forests in the backdrop.

Forest Types

Southern Tropical Dry Deciduous Forests

Flora

More than 700 naturalised plant species have been enlisted in Flora of Melghat. These species belong to about 400 genera representing as many as 97 families. There are 90 tree spp., 66 shrubs spp., 316 herbs spp., 56 climbers, 23 sedges and 99 grass species alongwith 60-70 newly identified species.

Teak is the predominant tree species. The common associate are *Lagerstroemia parviflora, Lannea coromandelica, Emblica officinalis, Terminalia tomentosa, Anogeissus latifolia* and *Ougenia oojeinesis.* Bamboo *(Dendrocalamus strictus)* is wide spread.

Fauna

Tiger, Leopard, Sloth bear, Wild dog, Jackal, Sambar, Gaur, Barking deer, Nilgai, Cheetal, Chousinga, Ratel, Flying Squirrel, Wild boar, Langur, Rhesus monkey, Porcupine, Pangolin, Mouse deer, Python, Otter, Caracal, Black napped hare.

Management

Protection and habitat management are the main inputs. Issues related to high degree of man-animal conflict are tackled on priority basis.

The Reserve area has been divided into three zones for management and to strike a balance between the biodiversity conservation and ecologically sustainable community development.

Special Projects

1. Botanical Survey of India (BSI) was involved in preparation flora of Melghat.
2. Zoological Survey of India (ZSI) has completed a 3-year survey of the area. The survey documentation is in progress.
3. Medicinal plant conservation area has been established with the help of Foundation for Revitalisation of Local Health Traditions (FRLHT), Bangalore.
4. Wildlife Institute of India (WII) has completed 3-year research project on **"Management of Biodiversity in Central India"**.

New Initiatives

Eco-development

Eco-development activities on pilot basis were taken up during 1992-97. The encouraging success was followed up with Eco-development planning under guidance of WII and United Nations Development Programme (UNDP). The response of local people is encouraging.

Village Forest Protection Committees

Village Forest Protection Committee has been established in village Gullarghat, which has taken up the responsibility of Medicinal Plant Conservation. Similar committees will be established soon in few other villages.

Protection Squads / Patrolling

During monsoon special protection squads carry out foot patrolling, to curb hunting of sambar and wild boar by local people. Similar squads are established during summer, for fire protection works.

Infrastructure and Facilities

The Nature education and interpretation centre at Semadoh has 4 dormitories (64 beds) 10 huts (20 beds) and tent facility. Tent facility (6 tents) has been established at 11 different places to facilitate trekking in the Reserve.

Education and Awareness

A Nature Education and Interpretation Centre has been established at Semadoh. Around 50 thousand people visit this centre annually. Two orientation centres at Akot and Harisal, and an interpretation centre at Amravati are also planned.

Livestock population

The livestock population of 22 villages in the buffer zones is 11024 and that of 39 villages in Multiple Use Area is 15642 as per census of 1994.

Weeds

There is gregarious spread of *Lantana camara* and *Hyptis sauveolens*. Lantana is found in almost all valleys and village surroundings, where constant grazing takes place. However it is absent on slopes. Lantana and Hyptis have spread to roughly 30 per cent and 20 per cent of the area respectively.

Encroachment

None in the core area.

Grazing

No grazing exists in the core area. The remaining area is burdened with grazing pressures of 25 to 30 thousand livestock heads. However the grazing is intense around villages and in broad valleys which are also better habitats for wild herbivores as they are the only sites with water availability.

Fire

There are few incidences (on an average 12 cases per annum) of fire in the core area, affecting 10 per cent of the area. Fires in the buffer and multiple use area of the Reserve are frequent. The grassy tops of the hills (locally called 'ballas') are prone to fire. The rugged terrain makes the fire protection a difficult job. Almost 20 per cent of the area gets burns annually.

Poaching is rare in the core. Hunting of sambar and wild boar is done by local people. Collection of medicinal plants like Musli *(Chlorophyllum tuberosum)* is also noticed.

Epidemics

Foot and mouth disease is noticed sometimes. But no epidemic has been recorded.

Control of the Buffer

The buffer and the multiple use area are under dual control of 3 territorial divisions and the Reserve Management.

Conflicts

Man-Animal

Tiger prey base in Melghat includes Gaur, Sambar, Barking deer, Wild boar, Cheetal and Chousinga. However Gaur and Sambar are in low densities. Chital, is found in few pockets and does not contribute much to the prey base. Thus, the domestic cattle substantially contribute towards the prey base, 400-500 cattle are kills by tiger and leopard annually. Quite naturally, this is a matter of conflict.

Man-Forest

People set fire to the forest to facilitate collection of NTFP, use destructive methods of harvesting gums, honey, fruits, flower, roots, tubers, medicinal plants etc. The local people have almost free access for firewood, small timber, bamboo and grasses. All this dependence is not quantified. Presently the dependence on forest produce is not causing any evident impact on the forest.

Pench Tiger Reserve

PSN Rao
Botanical Survey of India, Western Circle, Pune-411001

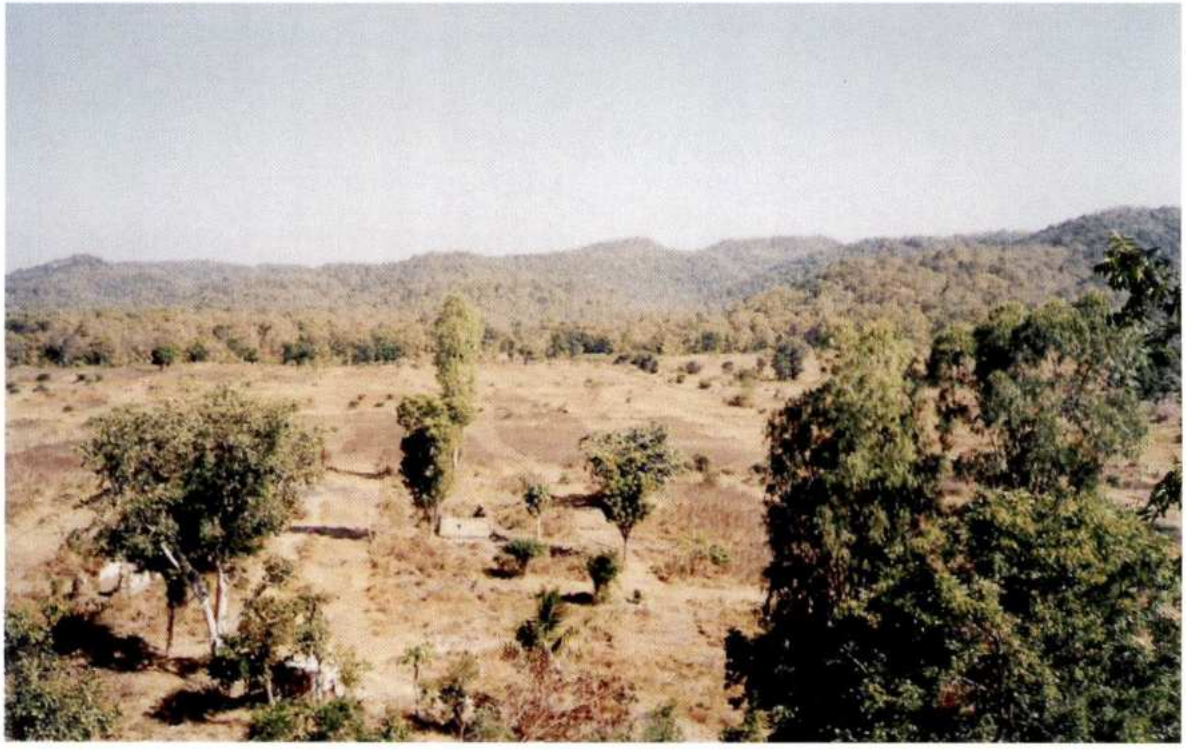
Pench National Park lies in Deolapor, Khapa & Ramtek Ranges of Nagpur Forest Division. It is situated at about 80 km from Nagpur at its North, on Nagpur-Jabalpur National Highway No. 7. This National Park has been established for preservation of wild life for which shooting blocks have been prepared and unauthorised and excessive shooting is checked. Pench National Park measures about 257.97 sq km. There are motorable roads to visit various attractive spots like Totladoh, Ghatpindri, Ranidoh andthe Pench dam on Pench river. The Park is protected by a boundary. It has also a buffer zone.

GEOLOGY

The rock types of the area include varied types like biotic-gneiss, quartz-pyroxene-gneiss, calycyphyre, crystalline limestones, quartzite, micaschist pegmalite and other manganiferous rocks known as gondite.

Climate: Except April to May which are hot months, the weather is pleasant.

National Park Boundary, former Bori Village : late winter



National Park Boundary, former Bori Village : mid monsoon

Monsoon season is from June-September while post monsoon season is October and November.

Summer months are driest, while humidity exceeds highest during monsoon. Past Work:

VEGETATION

In Pench National Park the vegetation is of dry deciduous type.

The main tree species that occur are varied. Some common tree species include *Annona squamosa, Kydia calycina, Thespesia lampas, Bombax ceiba, Helicteres isora, Grewia tiliifolia, Boswellia serrata, Garuga pinnata, Zizyphus mauritiana, Dalbargia paniculata, D. sissoo, Erythrina stricta, Pongamia pinnata, Bauhinia racemosa, Tamarindus indica, Acacia chundra, A. leucophloea, A. nilotica, Anogeissus latifolia, Terminalia cuneata, Haldina cordifolia, Mitragyna parvifolia, Diospyros melanoxylon, Madhuca longifolia* var. *latifolia, Carissa congesta, Holarrhena pubescens, Wrightia tinctoria, Cordia dichotoma, Tectona grandis, Ficus hispida, F. racemosa,* etc. Some common shrubs and small trees occuring in the area are as follows: *Balanites aegyptiaca, Cassine glauca, Bridelia retusa, Catunaregam spinosa, Securinega virosa.* Most common woody lianas and climbers are *Milletia extensa, Cryptolepis buchnani, Argyreia nervosa, Rivea hypocrateriformis, Clematis gouriana, C. heynei, Tinospora cordifolia, Cocculus hirsutus, Cissampelos pareira* var. *hirsuta, Aspidopteris cordata, Cayratia trifolia, C. elongata, Cardiospermum helicacabum, Rhynchosia minima, Teramnus labialis, Vigna radiata, Diplocyclos palmatus, Ipomoea eriocarpa, Dioscorea bulbifera, D. hispida, D. pentaphylla, D. oppositifolia,* etc. The stem parasite that was found to be very common is *Dendrophthoe falcata.*

Common undergrowth flora is rich during the monsoon. The ground is covered with various grasses and herbs. Main ephemerals found are: *Iphigenia indica, Scilla hyacinthina.* Maximum flowering of herbaceous species occurs during August - October. Common species are: *Cleome viscosa, C. gynandra, Flacourtia indica, Polygala erioptera, Portulaca oleracea,*

Tamarix ericoides, Abutilon indicum, Hibiscus lobatus, Sida acuta, S. cordata, Corchorus trilocularis, Triumfetta rhomboidea, Melochia corchorifolia, Tribulus terrestris, Biophytum sensitivum, Oxalis corniculata, Impatiens balsamina, Crotalaria linifolia, Desmodium gangeticum, D. laxiflorum, D. triflorum, Goniogyna hirta, Indigofera linifolia, I. trifoliata, Smithia conferta, Tephrosia purpurea, Cassia pumila, C. tora, Glinus lotoides, Oldenlandia corymbosa, Spermacoce pusilla, Ageratum conyzoides, Blumea membranacea, Caesulia axillaris, Cyathocline purpurea, Anagalis arvensis, Canscora diffusa, Trichodesma indicum, T. inaequale, Heliotropium ovalifolium, Lindernia crustacea, Sutera dissecta, Justicia betonica, J. quinqueangularis, Lavandula bipinnata, Leucas biflora, Boerhavia, diffusa, Achyranthus aspera, Aerva lanata, Alternanthera sessilis, Acalypha indica, Euphorbia hirta, E. heterophylla, Curculigo orchioides, Chlorophytum laxum, Commelina benghalensis, Isoetes indica (New record for Maharashtra).

The hill ranges in Pench National Park are covered with the trees like *Tectona grandis* (common), *Mitragyna parvifolia, Madhuca longifolia* var. *latifolia, Cordia dichotoma, Ficus hispida, Bauhinia racemosa* etc. and shrubs like *Balanites aegyptiaca, Securinega virosa,* etc. Common herbs on hills are *Hibiscus lobatus, Abutilon indicum, Impatiens balsamina, Triumfetta rhomboidea, Blumea mollis, Trichodesma indicum,* etc. Common climbers on hills are *Dioscorea pentaphylla, D. bulbifera, Teramnus labialis,* etc.

The aquatic vegetation includes common plants like *Nelumbo nucifera, Nymphaea nouchali, N. pubescens, Nymphoides hydrophylla, N. indica, Vallisneria spirallis,* etc. The moist loving common plants are *Hygrophila serpyllum, H. auriculata, Polygonum plebeium, Typha angustata, Sopubia delphinifolia, Bacopa monnieri.*

The Park shelters a variety of animals like tiger, panther, bison, sloth-bear, sambar, chital, barking deer, four horned antolope, blue-bull and chinkara. There is bird life too of which jungle fowl and fowl are prominent.

Floristic Analysis :

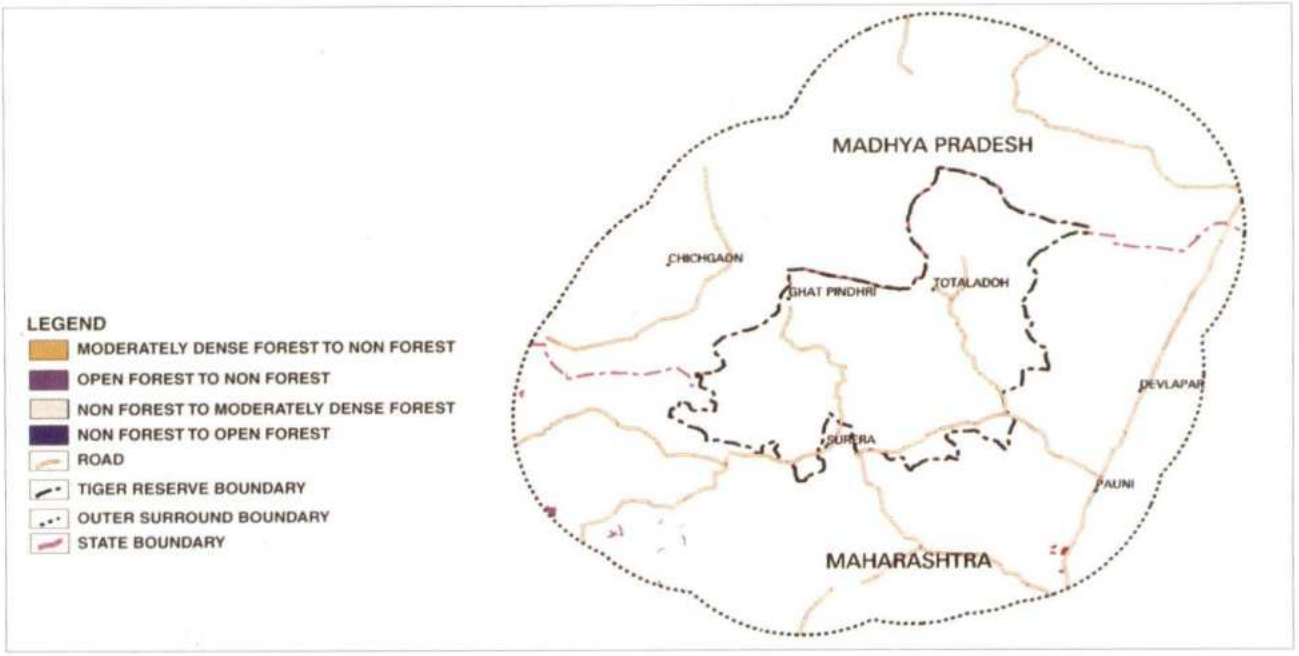
The plants include both the Angiosperms and Pteridophytes, comprising 106 families, 385 genera and 635 species. The ten dominant families in the area are: Poaceae, Fabaceae, Asteraceae, Euphorbiaceae, Acanthaceae, Caesalpiniaceae, Lamiaceae, Cyperaceae, Rubiaceae and Convolvulaceae. Poaceae represented by 94 species and 55 genera is the most dominant family of the area and Convolvulaceae with only 16 species and 6 genera is less represented. The genera and species of the above dominant families is as given below.

Ten Diminant Families or Angiosperms in Pench

S.No	Name of family	Genus	Species
1.	Poaceae	55	94
2.	Fabaceae	26	63
3.	Asteraceae	28	36
4.	Euphorbjaceae	16	27
5.	Acanthaceae	11	22
6.	Caesalpiniaceae	8	21
7.	Lamiaceae	12	20
8.	Cyperaceae	8	19
9.	Rubiaceae	13	18
10.	Convolvulaceae	6	16

National Park Interior Area : Forest streams in late winter

National Park Interior Area : Forest streams in mid monsoon



Map of Pench Tiger Reserve (Maharashtra)

Chrysopogon tufts along rocky stream banks

FOREST COVER IN THE OUTER SURROUND

The Outest Surround of the Tiger Reserve has a geoprapic area of 1,120 km^2 out of which 356 km^2 falls in Pench Tiger Reserve (Madhya Pradesh), 610km^2 in Maharashtra and 154 km^2 in Madhya Pradesh. The forest cover in Outer Surround lying in Madhya pradesh and Maharashtra (area 764 km^2) for three assessments is given in the Table below.

Forest Cover in the Outer Surround of Pench Tiger Reserve (1997-2002).

(Area in km^2)

Forest Cover in the Outer Surround of Pench Tiger Reserve (1997-2002)

Category	Assessment year			Net Change (1997-2002)
	1997	2000	2002	
(A) Very dense Forest	153	153	153	-
(B) Moderately Dense Forest	221	221	221	-
(C) Open Forest	89	88	88	-1
Total Forest (A+B+C)	**463**	**462**	**462**	**-1**
Scrub	-	-	-	-
Non-Forest	301	302	302	1
Total Area	**764**	**764**	**764**	

The table shows that there is a decrease of 1 km^2 in open forest which has resulted in an increase of 1km^2 in non-forest during the period 1997-2002. The likely reasons for the change are the rotational fellings in plantation areas *(Forest Survey of India, Report* 2006).

Taroba-Andhari Tiger Reserve

PSN Rao
Botanical Survey of India, Western Circle, Pune-411001

Taroba-Andhari Tiger Reserve situated at a distance of about 45 km from Chandrapur City in Maharashtra is the most attractive spot in the heart of the reserve forests of Chandrapur forest division. It was created in 1993-94 by merging Taroba National Park and Andhari Wildlife Sanctuary. Total area of the Reserve is 620 km^2. There is a motorable road, leading from Chandrapur City to the Taroba National Park. After covering about 12 km from Chandrapur, the road plunges into the forests making a zig-zag path. The protected boundary of the National Park begins after 10 km from Khatoda village. From Khatoda the forests of Taroba begin and at some places they are very dense. After crossing the 'Kumbhi nala', the road climbs up a hillock unfolding a beautiful view of a big lake with forested hills providing an excellent background. The lake called the 'Taroba Lake' is formed by a bunding up a stream and joining three hillocks which surround it. There is also a shrine of Taroba where on every Sunday of the Pausa (December-January) month a festival is held and many Adivasis visit the temple. There is also a shrine of Maruti. People still believe in the sanctity of the water and take to sprinkle their crops with the belief that it would keep the crops free from the pests (Malhotra and Moorthy, 1992).

The area surrounding the Taroba Lake was restricted for entry in 1905 and later in 1935 it was made a sanctuary. In 1955, it was declared a National Park and 116.5 sq km belt with an additional buffer zone of 57 sq km was created around the park where shooting is also prohibited. Visitors are not allowed to carry firearms inside and a mobile squad is posted to check any pilferage. Due to the various protective measures adopted by the forest department, the wildlife of both the animals and plants has increased much. Herds of cheetal, bison etc. are a common sight in the early mornings and evenings in the vicinity of lake.

The lake itself contains a few crocodiles and a variety of fishes. In order to enlighten the tourists about the animals and plants of the area a net work of 88 km of fair weather roads have been constructed in the park leading to different points, of these the most important is the circular road around the lake at whose vantage points 'machans' or towers have been erected from where tourists can observe the animals approaching the lake, drinking water and relaxing.

Most of the area surveyed is undulating. Geologically the area has varied rocks ranging from granite, quartz and quartzite on the upper and steeper slopes of the hills. The rocks are generally exposed resulting in denudated and shallow soils. Climate

The weather is quite pleasant for the greater part of the year with only a short span of hot weather from April to May. The southwest monsoon is active from June to September, October and November constitute the post-monsoon season.

The air is generally dry except during monsoon when the humidity exceeds 70%, the summer months are the driest when the relative humidity in the afternoon is 20° to 25°.

Haines (1916) has mentioned a few plants from Taroba. There is no other published work except

Cleidion spiciflorum

those of Malhotra and Moorthy (1972, 1973, 1974 and 1977) who have attempted to update the vegetation of the area briefly in a floristic form in order to be of help to the National Park lovers, forest officers, research workers and general public.

VEGETATION

The vegetation of the area is of mixed deciduous type. In the forests of Taroba lake vicinity at Pandarpani, Khantundi, Ramdegi, Kantejhari, Khatoda etc., the prominent tree species occurring frequently are *Albizia lebbeck, Anogeissus latifolia, Bauhinia racemosa, Dalbergia latifolia, Diospyros melanoxylon, Haldina cordifolia, Mitragyna parvifolia, Sterculia urens, Tectona grandis, Terminalia bellirica, T. chebula, T. crenulata.* The other small trees and shrubs are often represented by *Acacia chundra, Bridelia retusa, Cleistanthus colinus, Semecarpus anacardium, Xeromphis spinosa,* etc. The lianas and slender climbers like *Cissampelos pareira,* var. *hirsuta, Cryptolepis buchananii, Mucuna pruriens, Pergularia daemia,* etc. are often noticed. Several trees are infested by stem parasites like *Dendrophthoe falcata, Viscum nepalense,* etc., while on a few others orchids like *Vanda tessellata* occur as epiphytes.

The undergrowth is generally rich after the monsoon. In the deep interiors of the forests, herbs, grasses and a few under-shrubs like *Abutilon indicum, Alternanthera sessilis, Andrographis paniculata, Barleria cristata, Biophytum sensitivum, Canscora diffusa, Cassia absus, Chrysopogon fulvus, Coldenia procumbens, Corchorus aestuans, Costus speciosus, Cyperus cyperoides, C. iria, Dactyloctenium aegyptium, Desmodium triflorum, Eclipta prostrata, Goniogyna hirta, Heteropogon contortus, Hibiscus lobatus, Launaea fallax, Paspalidium flavidum, Peristrophe paniculata, Phyllanthus maderaspatensis, Pupalia*

lappacea, Scleria spp., *Sida* spp., *Triumfetta rhomboidea,* etc. are frequently met with.

On the hillocks, distinctive vegetation can be noticed along the base, slopes and the top. Amongst the plants at the base of hillocks are trees like *Aegle marmelos, Melia azadirach, Tamarindus indica* and shrubs like *Adhatoda zeylanica, Calotropis, Dadonaea viscosa,* etc. Amongst the herbs like *Cassia tora, Peristylis plantaginea, Sida acuta, Sphaeranthus indicus, Triumfetta rhomboidea* are common.

The slopes of the hillocks harbour trees like *Anogeissus latifolia, Buchanania lanzan, Mitragyna parvifolia;* shrubs like *Balanites aegyptiaca, Cleistanthus collinus, Ehretia laevis, Gardenia resinifera, Holarrhena antidysenterica, Woodfordia fruticosa,* and herbs like *Curculigo orchioides, Desmodium velutinum, Indigifera astragalina, Smithia conferta,* etc. The plants on the top of the hillocks are represented by trees like *Bridelia retusa, Lannea coromandelica, Soymida febrifuga,* etc., shrubs like *Clerodendrum multiflorum, Grewia hirsuta, G. rothii, Lagerstroemia indica,* etc., and herbs like *Acrocephalus hispidus, Anisomeles heyneana, Cassia pumila, Dipteracanthus prostratus, Trichodesma sedgwickianum, Turnera ulmifolia, Waltheria indica,* etc. Besides, Bamboos are also not of an uncommon occurrence in the area.

There are also ponds and ditches, at places stagnant waters rich in aquatic vegetation. The plant species frequently noticed are *Blyxa octandra, Ludwigia hyssopifolia, Nymphaea nouchali, Ottelia alismoides, Pistia stratioites,* etc. Roadside and avenue trees include *Albizia lebbeck, Mangifera indica, Tamarindus indica, Tectona grandis,* etc.

At certain seasons when the green herbage is low, various domestic or wild animals such as buffalos, goats, deers, bisons, blue bulls, etc. browse and graze down any green tree seedlings that may be available, in the shrub stratum grazing of the palatable species endanger them unless they are sufficiently thorny as in the case of *Zizyphus* and *Acacia* spp.

Most of the tree species in the area are used for shelter purposes. Bisons generally prefer a tree with a thick canopy of branches over it while a deer can avail even the tall grasses as its source of shelter. Some of the plants used as shelter by animals are *Aegle marmelos, Albizia odoratissima, Bauhinia racemosa, Bridelia retusa, Cleistanthus collinus, Dalbergia latifolia, Diospyros melanoxylon, Mangifera indica, Sterculia urens, Tamarindus indica,* etc.

UTILIZATION OF PLANT RESOURCES

There are many species yielding several forest products including timber and are used by the residents of the area as follows:

(a) Timbers used for carpentary and cabinet work:

Some of the trees and shrubs which are used for carpentary and cabinet works are *Albizia lebbeck, Anogeissus latifolia, Boswellia serrata, Gardenia latifolia, Lagerstroemia parviflora, Mangifera indica, Mitragyna parvifolia, Pterocarpus marsupium, Tectona grandis, Terminalia bellirica,* etc.

(b) Plants used in the manufacture of Bidis, Match boxes and in paper industry:

The leaves of *Diospyros melanoxylon* are extensively used for wrapping the Bidis. The collection of 'tendu' leaves as it is commercially known, is quite common and is a big trade in the area. The plants such as *Bombax ceiba, Buchanania lanzan,* etc. are used in the manufacture of match boxes. *Dendrocalamus strictus* is extremely used in the manufacture of paper. The collection and sale of this bamboo also is a big trade in the area.

(c) Plants used for agricultural implements:

Trees such as *Anogeissus latifolia, Bridelia retusa, Emblica officinalis, Lagerstroemia parviflora, Mitragyna parvifolia, Pterocarpus marsupium,* etc., are used for agricultural implements.

(d) Plants used for tanning:

Terminalia chebula is the main source for tanning purposes. However, the bark of the tree species such as *Acacia chundra, Angeissus latifolia, Boswellia serrata, Bridelia retusa, Cassia fistula, Cleistanthua collinus* and *Emblica officinalis* is also used for such purposes.

(e) Gum and resin yielding plants:

Anogeissus latifolia, Bauhinia racemosa, Butea monosperma, Gardenia gummifera, Sterculia urens are some of the gum yielding plants. Resin is obtained from the trees of *Boswellia serrata* and *Mitragyna parvifolia*

(f) Plants used for medicinal purposes:

Many plants in the area are used for medicinal purposes in one way or the other. Such important species are: *Aegle marmelos, Cassia fistula, Emblica officinalis,Helicteres isora, Holarrhena antidysenterica, Mitragyna parvifolia, Tamarindus indica, Terminalis bellirica* and *Vitex negundo.*

ANTHROPOGENIC EFFECT ON THE VEGETATION

Fire and grazing have played an extremely influential part in determining the forest type occupying the land. These practices invariably have the effect of rendering the site less favourable to tree growth through a reduction of moisture levels in air and soil and often through erosion of the topsoil. Grazing has an indirect effect on the standing trees in that associated with it are the practices of lopping for fodder and burning both to reduce the density of the canopy cover and to induce grass growth. The vital direct effect is in the inhibition of regeneration.

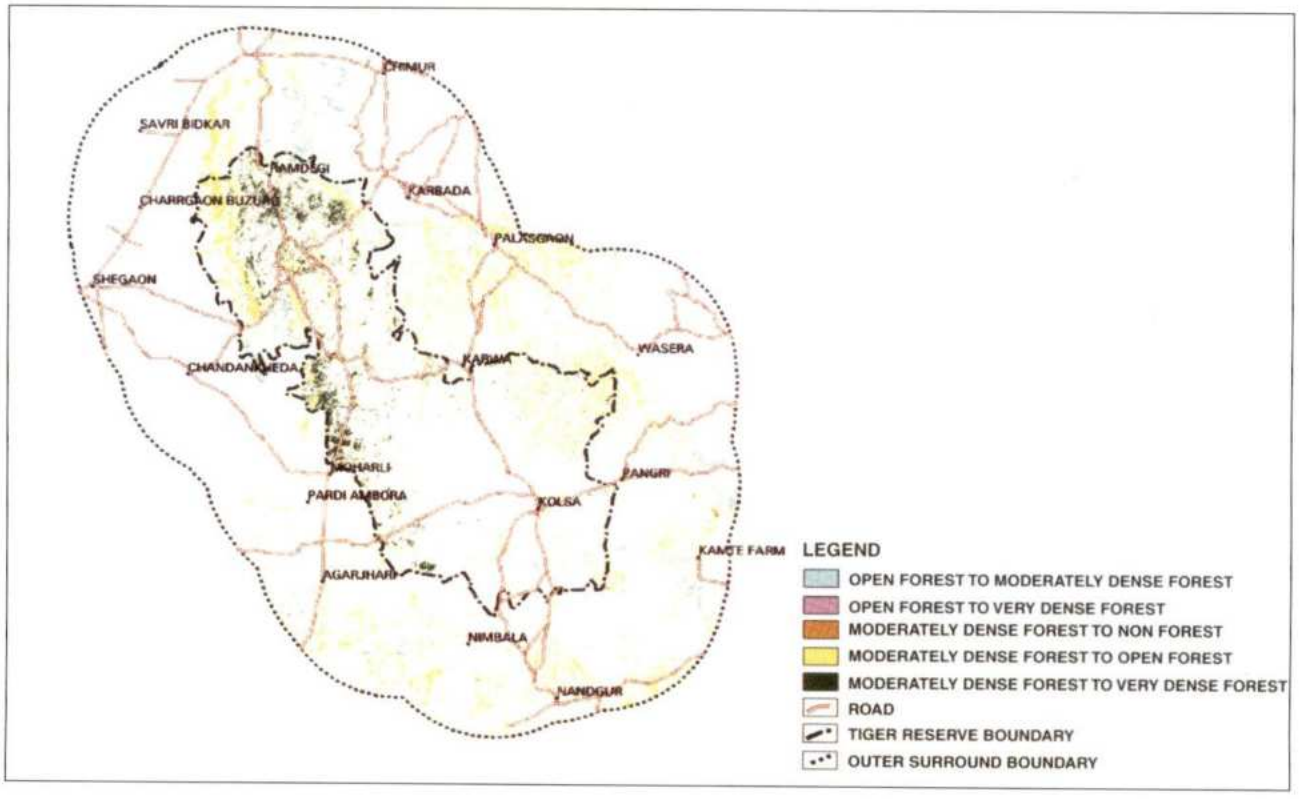
The tree felling has become more significant as the human population pressures have increased and the demand for fuel and timber augmented correspondingly. Due to the road building and mining activities the vegetation is not just damaged in the direct vicinity but has a serious effect on the development of soil and regeneration in the area.

Floristic analysis

Both the Angiosperms and Pteridophytes comprise a total of 667 species, 393 genera and 110 families. Phenological data covering only the flowering, fruiting period has also been mostly followed by frequency of their occurrence within the area and the habitat. The ten dominant families in the area in the order of their highest representation of species are Fabaceae, Poaceae, Cyperaeeae. Euphorbiaceae, Asteraceae, Acanthaceae, Rubiaceae, Scrophulariaceae, Lamiaceae and Amaranthaeceae. The genera and species representation of the same is as follows:

S.No.	Name of the Family	Genera	Species
1.	Fabaceae	32	77
2.	Poaceae	45	76
3.	Cyperaceae	11	37
4.	Euphorbiaceae	15	35
5.	Asteraceae	22	26
6.	Acanthaceae	16	26
7.	Rubiaceae	13	21
8.	Scrophulariaceae	12	19
9.	Lamiaceae	8	14
10.	Amaranthaceae	9	12

Fabaceae is represented by 77 species and is thereby the dominant family in the area and Amaranthaceae represented by only 12 species.



Map of Taroba-Andhari Tiger Reserve

Dendrobium sp.

SALIENT FEATURES

Area

Core	:	218.76 sq km
Buffer	:	357.02 sq km
Total	:	575.78 sq km
Longitude	:	79°13' and 79°34' E
Latitude	:	20°4' and 20°27' N
Altitude	:	Average 284.07 m above M.S.L.
Rainfall	:	1175 m

Temperature

Minimum	:	3°C
Maximum	:	48°C

Seasons

Monsoon	:	July to September
Winter	:	October to January
Summer	:	February to June

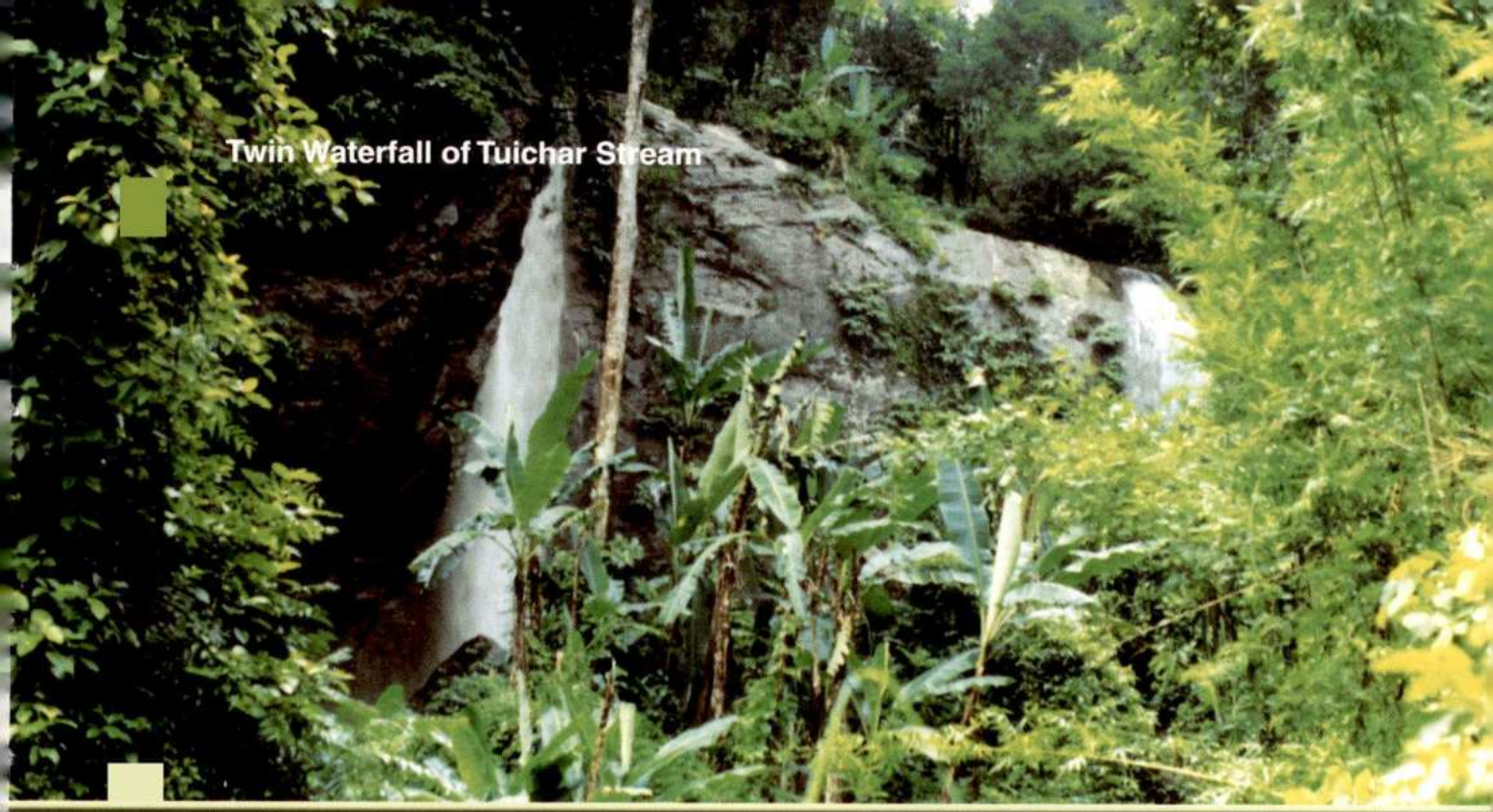
INTERPRETATION FACILITIES

A visitor centre cum museum is situated at Tadoba. 16mm film projector, LCD projector and a slide projector are available for different interpretation programs at Tadoba. Nature Trail for enjoyment of real nature is there at Tadoba and Kolsa.

Binoculars for better viewing, torches, light clothing that covers the entire body, glasses, sun caps and mosquito repellent.

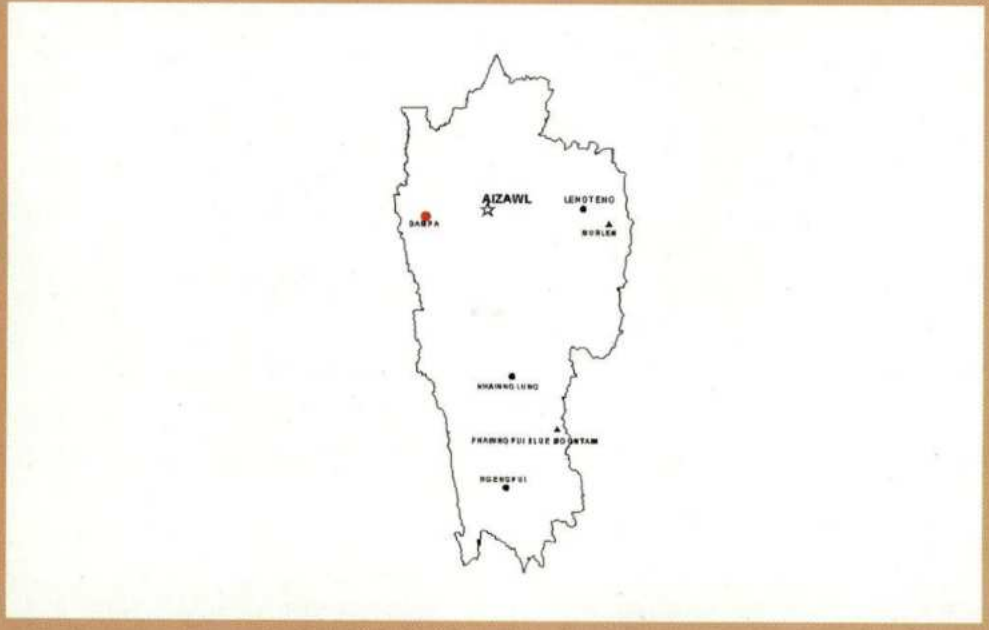
On the shore of Tadoba lake, is a shrine underneath the canopy of a large tree, that is held in high regard by the adivasis. A well attended fair is held here annually, between December and January (Pushya maasa). A walk to Panchdhara (5 km), with an exclusive water hole, is also recommended. Also worth a walk is Jamunbadi (5 km), with grasslands and thick jungles intermingling, providing you with just the right touch of nature at its best.

MIZORAM



Twin Waterfall of Tuichar Stream

Dampa Tiger Reserve



Dampa Tiger Reserve

N Odyuo & BBT Tham
Botanical Survey of India, Eastern Circle, Shillong - 3

Mizoram, a rugged mountainous state in northeast India lies between 21°57' to 24° 30' N latitude and 92° 15' to 93° 29' E longitude covering an area of 21081 sq km. The length of the state from North to South is about 277 km, while East-West width extends over 121 km. It has a long inter-state boundary with Assam (123 km), Tripura (66 km) and Manipur (95 km). Besides, the state shares international borders on three sides, with Myanmar in the East and South (ca 404 km) and Bangladesh in the West (ca 306 km). It is surrounded in the North by the Cachar district of Assam, in the East by the state of Manipur, in the East-South and Southwest by the Chin and Arkan hills of Myanmar and the Western side by the state of Tripura and Chittagong hill tracts of Bangladesh.

The tropic of Cancer passes through the middle of the state (just South of Aizawl town). Initially there were three districts in Mizoram. Aizawl in the North has an area of 12,588 sq km, while central district Lunglei occupies 4,536 sq km and Southern most district of Chimtuipui extends over an area of 3,957 sq km. Recently for, administrative convenience, Aizawl district has been divided into five districts, viz. Aizawl (with district headquarter at Aizawl), Aizawl North (with district headquarter at Kolasib), Aizawl East (with district headquarter at Champhai), Aizawl West (with district headquarter at Mamit) and Aizawl South (with district headquarter at Sherchip); Lunglei remains undivided, while Chimtuipui has again been divided into two districts Chimtuipui East (with district headquarter at Saiha) and Chimtuipui West (with district headquarter at Lawngtalai). Thus, today there are 8 districts in the state. The state has about 681 villages and three autonomous district councils, viz. Lai, Mara and Chakma in Chimtuipui district.

The total forest cover of the state is 15825 sq km, which is about 75 % of the total area, out of which Reserved forests covers 5509 sq km and Wildlife Sanctuaries covers 200 sq km, Wet evergreen forests, Tropical wet evergreen forests and Sub-tropical semi evergreen forests (Champion & Seth 1968) are the forest types of the state.

Mamit District which was declared as one of the eight district in Mizoram in 1998 is located between 23°23' to 23° 44' N latitude and 92°16' to 92°28' E longitude and covers an area of 3015.57 sq km. The total forest cover is 2588.62 sq km. The district includes 102 villages with a population of 59,102. The district is sparsely populated with a population density of 19 per sq km. The main system of agriculture is Jhum cultivation (Shifting cultivation). The total area under Jhum cultivation is around 291.42 sq km. This agricultural practice has let to severe degradation of forest and *Melocanna baccifera, Mikania micrantha, Eupatorium odoratum, Saccharum spontaneum, Imperata cylindrica,* etc. now replace the native plants species. Primary forests are now confined to protected areas.

Dampa Tiger Reserve established in 1985 is the biggest Wildlife Sanctuary in Mizoram, covering an

Lianas

area of 500 sq km, located in Mamit district. The natural features of the Reserve are forest interpolated with steep precipitous hills, deep valleys, jungle streams rippling rivulets waterfalls and natural salt licks. The Reserve has two range headquarters one at Terei on the north and another at Phuldungsei on the west. The western site is bordered with Bangladesh. The altitude ranges from 200 to 900 msl. Temperature varies from 9°C to 32°C. The soil is sandy loam and rainfall is high (2000 to 2500 mm). Maximum rainfall occurs during June to August, which covers 89 percent of the total annual rainfall.

The Reserve consists of tropical wet semi-evergreen to deciduous forests. Vegetation of the forest is a mixture of virgin forest, mixed bamboo forest and pure bamboo stands with bamboos as the dominant vegetation, Common species among them being *Melocanna baccifera, Bambusa tulda, Dendrocalamus hamiltonii* and *Schizostachyum polymorphum.* The western part bordering Bangladesh is mainly a bamboo forest. The occurrence of pure bamboo stands stretching up to 2-3 km from the periphery to the core zone and in patches between two virgin forests at Dampa hill and Chhawrpial hill suggests that Jhuming was practiced here prior to the establishment of this Reserve. According to information from the locals there was once a village but was deserted because only male members survived. The hill is now called "Pathlawi lunglen tlang" meaning hill of longing/remembrance for the women folks (in Mizo). The presence of two graves believed to be that of the village chief and

Pure Bamboo stand

another member of the chiefs relative clearly indicates that a part of the Reserve was once inhabited.

The major flora consists of a mixture of several species such as *Dipterocarpus turbinatus, Dipterocarpus retusus, Terminalia myriocarpa, Michelia doltsopa, Artocarpus chama, Sterculia villosa, Chukrasia tabularis, Syzygium cumini, Haldina cordifolia, Sumbaviopsis albicans,* etc. and different species of bamboos, palms, orchids, varieties of herbs and shrubs, lianas wild bananas in gaps and near streams and rivers.

The canopy species consists of *Aphanamixis wallichii, Bischofia javanica, Dipterocarpus retusa, Duabanga grandiflora, Firmiana colorata, Haldina cordifolia, Mesua ferrea, Syzygium cumini, Schima wallichii, Sapium baccatum, Lindera pulcherrima, Persea villosa, Castanopsis indica, Elaeocarpus aristatus, E. floribundus.* Some canopy species such as *Dipterocarpus indicus, Toona ciliata, Michelia doltsopa* and *Tetrameles nudiflora* reaches upto 35 m in height.

The second canopy consists of *Knema angustifolia, Vitex glabra, V. peduncularis, Gmelina arborea, Premna milleflora, P. bengalensis, Styrax serrulatum, Ligustrum robustum, Diospyros grata, D. cacharensis, Syzygium cerasoides, Symplocos javanica, S. lucida, Oxyceros longiflora, Stereospermum colais, Elaeocarpus lanceaefolius, Ardisia colorata, A. paniculata, Turbinia pomifera, Hydnocarpus kurzii, Heritiera papilio, Mangifera sylvatica, Garcinia cowa,* etc.

Mixed bamboo forest

The third storey consists of smaller trees and shrubs with maximum floristic diversity. The common species of this storey are *Ficus subincia, Leea indica, Meliosma simplicifolia, Litsea meissneri, Saurauia napaulensis, Garcinia sopsopia, Eurya cerasifolia, Maesa paniculata, Clausena heterophylla, Mycetia longifolia, Pandanus foetidus, Symplocos lucida, Diospyros lanceaefolia, Cyathea gigantea, Ficus cryptophylla, F. hispida, F. racemosa,* etc. and palms such as *Caryota urens, Calamus erectus, C. latifolius, C. tenuis, C. leptospadix, Licuala peltata,* etc.

The ground vegetation consists of *Hedychium angustifolium, H. acuminatum, Curcuma* sp., *Mantisia spathulata, Peperomia pellucida, Phyllanthus debilis, Elatostema caveanum, Euphorbia indica, Phrynium capitatum, Curculago latifolia, Globba clarki, Costus speciosus, Begonia balsamina, Viola betonicifolia, Sonerila maculata, Alchornea tiliaefolia,* etc.

Dependence on forest in the form of shelter, food, fuel wood, clothing and medicine by local tribes for their economic livelihood and quality of life has been going on since time immemorial. Even today after the advent of civilization, this trend is continuing giving immense pressure to the forests and forests are becoming degraded at an alarming rate due to anthropogenic activities. The villages surrounding Dampa Tiger Reserve are far from urban areas with very poor economic condition; as such people have to depend mainly on the forests for their livelihood. The common wild plants present in the Reserve as food source used by the people in the area listed below.

Wild Edible plants of Dampa Tiger Reserve, Mizoram

Sl. No.	Scientific name	Family	Habit	Parts eaten
1.	*Adiantum caudatum*	Adiantaceae	Herb	Young shoots
2.	*Adiantum phillipense*	Adiantaceae	Herb	Young shoots
3.	*Amomum dealbatum*	Zingiberaceae	Herb	Tuber, Fruits eaten
4.	*Anodendron paniculatum*	*Apocyanaceae*	Climber	Fruits eaten
5.	*Arisaema leschenaulti*	Araceae	Herb	Rhizome
6.	*Artocarpus chama*	Moraceae	Tree	Fruits eaten
7.	*Artocarpus heterophylla*	Moraceae	Tree	Fruits eaten
8.	*Caryota urens*	Palmae	Tree	Pith of the stem
9.	*Capsicum frutescens*	Solanaceae	Herb	Leaves
10.	*Centella asiatica*	Apiaceae	Herb	Leaves
11.	*Cephalostachyum capitatum*	Gramineae	Tree	Tender shoots
12.	*Clerodendrum colebrookianum*	Verbenaceae	Shrub	Leaves
13.	*Dioscorea alata*	Dioscoreaceae	Climber	Tuber
14.	*Dysoxylum gobara*	Meliaceae	Tree	Young shoots and leaves
15.	*Diospyros grata*	Ebenaceae	Tree	Fruits eaten
16.	*Dillenia indica*	Dilleniaceae	Tree	Fruits eaten
17.	*Embelia subcoriacea*	Myrsinaceae	Climber	Fruits eaten
18.	*Emblica officinalis*	Euphorbiaceae	Tree	Fruits eaten
19.	*Eurya cavinervis*	Theaceae	Tree	Young leaves
20.	*Ficus prostrata*	Moraceae	Tree	Fruits eaten
21.	*Ficus semicordata*	Moraceae	Tree	fruits eaten
22.	*Garcinia lancifolia*	Clusiaceae	Herb	Young leaves
23.	*Garuga pinnata*	Burseraceae	Tree	Fruits eaten
24.	*Hodgsonia machycarpa*	Cucurbitaceae	Climber	Fruits eaten
25.	*Litsea cubeba*	Lauraceae	Tree	Leaves (condiment)
26.	*Lycianthes laevis*	Solanaceae	Herb	Leaves
27.	*Mangifera indica*	Anacardiaceae	Tree	Fruits eaten
28.	*Melocanna baccifera*	Poaceae	Tree	Young hoots & fruits edible
29.	*Morus australis*	Moraceae	Tree	Fruits eaten
30.	*Musa paradiasica*	Musaceae	Tree	Fruits eaten
31.	*Polygonum barbatum*	Polygonaceae	Herb	Leaves
32.	*Rhus acuminata*	Anacardiaceae	Tree	Young shoots and leaves

Sl. No.	Scientific name	Family	Habit	Parts eaten
33.	*Rhus semialata*	Anacardiaceae	Tree	Fruits eaten
34.	*Spilanthes oleracea*	Asteraceae	Herb	Leaves
35.	*Spondias pinnata*	Anacardiaceae	Tree	Fruits eaten
36.	*Syzygium cumini*	Myrtaceae	Tree	Fruits eaten
37.	*Trevesia palmata*	Anacardiaceae	Tree	Fruits eaten
38.	*Ziziphus mauritiana*	Rhamnaceae	Tree	Fruits eaten

The Reserve also supports numerous timber plants of great economic potential. Some species such as *Dipterocarpus indicus, Toona ciliata, Michelia doltsopa* and *Tetrameles nudiflora* have straight boles measuring ca 5 to 10 m in girth and ca 35 to 40 m high (N. Odyuo, personal observation July 2004). Some of the timber species found in the Reserve are given below:

Timber species of Dampa Tiger Reserve, Mizoram

Sl. No.	Scientific name	Family
1.	*Acer laevigatum*	Aceraceae
2.	*Aglaia hiernii*	Meliaceae
3.	*Anogeissus acuminata*	Combretaceae
4.	*Artocarpus lacucha*	Moraceae
5.	*Derris robusta*	Fabaceae
6.	*Duabanga grandiflora*	Sonaritaceae
7.	*Chukrasia tabularis*	meliaceae
8.	*Castanopsis echinocarpa*	Fagaceae
9.	*Dipterocarpus indicus*	Dipterocarpaceae
10.	*Dysoxylum gobarum*	Meliaceae
11.	*Gmelina arborea*	Verbenaceae
12.	*Mesua ferrea*	Clusiaceae

Sl. No.	Scientific name	Family
13.	*Michelia doltsopa*	Magnoliaceae
14.	*Morus australis*	Moraceae
15.	*Premna milleflora*	Verbenaceae
16.	*Schima wallichii*	Theaceae
17.	*Sterospermum colais*	Bignoniaceae
18.	*Tectona grandis*	Verbenaceae
19.	*Terminalia myriocarpa*	Combretaceae
20.	*Terminalia bellerica*	Combretaceae
21.	*Tetrameles nudiflora*	Datiscaceae
22.	*Toona ciliata*	Verbenaceae
23.	*Vitex peduncularis*	Verbenaceae
24.	*Xylia xylocarpa*	Mimosaceae

In India, the history of medicinal Plants can be traced back to the vedic period (4500 B.C. to 1500 B.C.). The Rigveda mentions the identidy of several plants used in various medicines in ancient times, while the Atharveda, contains detailed information on approximately 2,000 medicinal plants and their uses (Kala 2003). Though there is no proper history and record of the use of plants as medicines in this region, the tradition might have been handed down orally from generation to generation. So, far, about 500 species under 383 genera have been recorded from the state of Mizoram, possessing medicinal and ethnobotanical uses (Mahanti 1994; Lalramnghinglova & Jha 1996: Singh 1997). People mainly if not wholly depends on plants as medicine for almost any kinds of ailment or diseases specially in a remote area like the villages adjoining Dampa, due to lack of proper health care facilities. This area is also very rich in medicinal plants and the Reserve supports many such plants of medicinal importance used by the local people.

Medicinal plants of Dampa Tiger Reserve, Mizoram

Sl. No.	Scientific name	Family	Habit	Parts used and mode
1.	*Acer laevigatum*	Aceraceae	Tree	Decoction of bark is applied on sprain.
2.	*Achyranthes bidentata*	Amaranthaceae	Herb	Leaf extract applied to sores of leech bites.
3.	*Adiantum phillippense*	Adiantaceae	Herb	Infusion of the whole plant is taken for fever and dysentery.
4.	*Adiantum caudatum*	Adiantaceae	Herb	Front paste applied on skin diseases.
5.	*Aeginetia indica*	Orobanchaceae	Climber	Juice of rhizome is applied on mumps.
6.	*Aegle marmelos*	Rutaceae	Tree	Decoction of fruit is taken for dysentery.
7.	*Amomum dealbatum*	Zingiberaceae	Herb	Bark juice is applied as antiseptic.
8.	*Ananas comosus*	Bromeliaceae	Herb	Juice of leaves and barks taken for remedy in convulsion.
9.	*Anogeissus acuminata*	Combretaceae	Tree	Juice of bark used as antiseptic.
10.	*Artocarpus lacucha*	Moraceae	Tree	Seeds used as purgative & powdered bark applied to sores to draw out purulent matter.
11.	*Artocarpus* sp.	Moraceae	Tree	Decoction of bark is taken for Dysentery.
12.	*Averrhoa* sp.	Averrhoaceae	Climber	Three to four slices per day of fruits are taken for jaundice, bleeding piles and as anti-scorbutic.
13.	*Bombax ceiba*	Bombacaceae	Tree	Root is used as stimulant and tonic, root and bark used for emetic, gum is used as aphrodisiac demulcent, homeostatic astringent, tonic alternative used in diarrhea, dysentery.
14.	*Callicarpa arborea*	Verbenaceae	Tree	Juice of bark is taken for remedy of stomach pain, dysentery and vomiting.
15.	*Catharanthus roseus*	Apocynaceae	Herb	Leaves taken raw for remedy of high blood pressure.
16.	*Centella asiatica*	Apiaceae	Herb	Decoction of the leaves taken for remedy of asthma and eye problems.
17.	*Chukrasia tabularis*	Meliaceae	Tree	Roots are taken raw for remedy of stomach pain.
18.	*Citrus sinensis*	Rutaceae	Tree	Decoction of the leaves taken.
19.	*Costus speciosus*	Zingiberaceae	Herb	Whole plant taken raw for for remedy in malaria.
20.	*Curcuma longa*	Zingiberaceae	Herb	Juice of rhizome is used as antiseptic.
21.	*Dendrocnide sinuata*	Utricaceae	Small tree	Roots boiled with crabs. and the decoction is taken for remedy of Jaundice.
22.	*Dillenia indica*	Dilleniaceae	Tree	Decoction of the fruit is taken for stomach problems.
23.	*Dioscorea alata*	Dioscoreaceae	Climber	Tuber is used for leprosy and piles.

Sl. No.	Scientific name	Family	Habit	Parts used and mode
24.	*Elaegnus caudata*	Elaegnaceae	Shrub	Women take decoction of the tuber in case of retained placenta.
25.	*Embelia subcoriacea*	Elaegnaceae	Climber	Decoction of leaves used for bathing in treatment of smallpox.
26.	*Emblica officinalis*	Euphorbiaceae	Tree	Fruits taken raw for remedy against stomach problems.
27.	*Erythrinia variegata*	Leguminosae	Tree	Bark used as astringent and antidote to snake bite.
28.	*Chromolaena odorata*	Asteraceae	Shrub	Plants used as fish poison, juice of leaves applied on cuts and wounds as haemostatic.
29.	*Ficus bengalensis*	Moraceae	Tree	Latex is applied for Rheumatism & Lumbago. Infusion of bark is used as tonic, remedy for diarrhoea, dysentery and diabetes.
30.	*Ficus prostrata*	Moraceae	Tree	Roots juice is applied in snake bites.
31.	*Ficus hispida*	Moraceae	Tree	Fruits, seeds and barks as purgative and emetic.
32.	*Garuga pinnata*	Burseraceae	Tree	Juice of bark is used for the cure of conjunctivitis. Juice of leaves mixed with sugar is taken for remedy in asthma.
33.	*Gmelina arborea*	Verbenaceae	Tree	Roasted fruits are applied on itches.
34.	*Hedychium* sp.	Zingiberaceae	Herb	Rhizome is taken as carminative, tonic, stimulant, expectorant.
35.	*Hoya griffithii*	Asclepiadaceae	Herb	Leaf sap is applied on burns and covered with the leaves.
36.	*Imperata speciosa*	Poaceae	Grass	Roots juice is taken to expel intestinal worms.
37.	*Lagerstroemia speciosa*	Lythraceae	Tree	Decoction of roots sis taken for jaundice for dysentery and diarrhoea.
38.	*Leea compactiflora*	Vitaceae	Shrub	Roots are taken for stomach problems.
39.	*Lepionurus sylvestris*	Opiliaceae	Shrub	Decoction of leaves taken for diabetes.
40.	*Litsea cubeba*	Lauraceae	Tree	Fruits taken for hysteria, headache and Paralysis.
41.	*Lobelia niwtianaefolia*	Lobeliaceae	Herb	Juice of the plant is applied to boils and warts.
42.	*Lylia cylocarpa*	Mimosaceae	Tree	Decoction of bark is used in ulcer, gonorrhea & diarrhoea.
43.	*Melocalamus compactiflorus*	Gramineae	Climber	Juice of stem taken against influenza.
44.	*Mesua ferrea*	Clusiaceae	Tree	Flower is used as astringent, stomachache while flowers and leaves are used for snake bite and scorpion sting.

Sl. No.	Scientific name	Family	Habit	Parts used and mode
45.	*Michelia doltsopa*	Magnoliaceae	Tree	Infusion of leaves is taken with honey for colic. Paste of fruits and seeds are applied to cracks on the feet.
46.	*Mimosa pudica*	Mimosaceae	Herb	Leaves and roots are used for pile and fistula. Poultice of leaves is applied to cracks on the feet.
47.	*Morus australis*	Moraceae	Tree	Bark is used as purgative, decoction of leaves is used as gargle in inflammation of throat while roots are used as astringent.
48.	*Musa paradisiaca*	Musaceae	Tree	Sap of the stem is used as antiseptic.
49.	*Passiflora nepalensis*	Passifloraceae	Climber	Decoction of the roots used as anti malaria.
50.	*Plantago major*	Plantaginaceae	Herb	Leaves in medicine, seeds in inflammation of alimentary canal and in haematuria.
51.	*Palygonum barbatum*	Polygonaceae	Herb	Seeds are taken to relieve colic.
52.	*Pratia nummularia*	Campanulaceae	Herb	Juice of leaves taken for remedy of dysentery and vomiting.
53.	*Pteridium acquilinum*	Polypodiaceae	Herb	Rhizome and fruits taken in chronic visceral and spleen problems.
54.	*Saraca asoca*	Caesalpinaceae	Tree	Bark as astringent, in gonor and scorpion sting.
55.	*Schima wallicii*	Theaceae	Tree	Decoction of barks used in snake and insect bite.
56.	*Scoparia dulcis*	Scrophulariaceae	Herb	Juice of the whole plant for remedy of kidney stones.
57.	*Securinega* sp.	Euphorbiaceae	Shrub	Decoction of leaves used for bathing children having scabies and measles.
58.	*Smilax perfoliata*	Smilacaceae	Climber	Crushed roots mixed with milk or old molasses in blood dysentery.
59.	*Solanum torvum*	Solanaceae	Herb	Crushed seeds applied to toothache and tooth decay.
60.	*Spondias pinnata*	Anacardiaceae	Tree	Bark in dysentery and Rheumatism; leaves in ear pain; fruits in dyspepsia.
61.	*Stereospermum colais*	Bigoniaceae	Tree	Leaves and flowers as febrifuge, leaves juice applied on itch, fruits for scorpion sting.
62.	*Syzygium cumini*	Myrtaceae	Tree	Fruit/pulp in stomachache and as diuretic.
63.	*Terminalia bellirica*	Combretaceae	Tree	Fruits as astringent, laxative, tonic, in diarhoea, dyspepsia, leprosy and headache.
64.	*Terminalia chebula*	Combretaceae	Tree	Bark as cardiotonic and diuretic, fruits in diarrhoea and dysentery, as laxative, alternative and tonic.
65.	*Toona ciliata*	Meliaceae	Tree	Barks as astringent, tonic, antiperiodic, dysentery and applied externally on ulcers.

Sl. No.	Scientific name	Family	Habit	Parts used and mode
66.	*Trevesia palmata*	Araliaceae	Tree	Juice of leaves taken for colic, stomachache and high blood pressure.
67.	*Vitex peduncularis*	Verbenaceae	Tree	Stem bark boiled in water and taken for malarial fever, black fever and typhoid fever.
68.	*Zanthoxylum armatum*	Rutaceae	Tree	Young stems and fruits as fish poison, in stomachache and tooth problems, seeds and barks in fever, cholera and dyspepsia
69.	*Ziziphus mauritiana*	Rhamnaceae	Tree	Decoction of roots for fever and powdered roots applied on chronic ulcers.

Owing to its high plant species richness serving as food source in the form of fruits, leaves, roots etc. and presence of varied conducive habitats for animals, the Reserve has very rich faunal diversity including many rare and endangered animals in abundance. The comprehensive list of Fauna found in the sanctuary (Source: Basic Information Pamphlet published by Office of the Chief Wildlife Warden, Tuikhuahtlang, Aizawl, Mizoram) are:

i. Arboreals:

Rhesus macaque, Leaf monkey, Pigtail macaque, Stumptail macaque, Hollock gibbon, Assamese macaque, Slow lorries, Giant squirrel, Civet cat.

ii. Ground animals:

Tiger, Leopard, Indian elephant, Gaur, Serow, Barking deer, Wild boar, Porcupine, Sloth bear, Himalayan black bear.

*According to information from forest officials, at present there are seven tigers and two elephants (2004 - N. Odyuo).

iii. Avian Fauna :

Great Indian hornbill, Malabar pied hornbill, Peacock pheasant, Red jungle fowl, Crested serpent eagle, Emerald dove, Hill Mynah.

iv. Reptiles:

Python, King cobra, varieties of snakes, Monitor lizard, Hill tortoise.

The small streams and rivulets are also home to various frogs, Crabs, Prawns and Snails. These animals though seem insignificant are also an important part of the food chain. At present the Reserve is well protected and there is least anthropogenic disturbance as compared to other parts of the district mainly due to low human population near the vicinity and remoteness of the area. There is no immediate threat to the Reserve except for some collections of bamboo shoots for food and minor collection of fuel wood from the periphery. With increase in population, encroachment will ultimately start from the surrounding villages and more pressure will be exerted to the forest and forest produce in the form of collection of fuel wood, medicinal plants, fruits, vegetables and grazing by domestic animals. The most important threat will be Jhuming in the near future as cultivable land becomes scarce. Therefore proper precautionary measures to protect the Reserve should be formulated to conserve the forests in its present well-preserved status before any irreparable damage is done to the rich biodiversity of the Reserve. To prevent poaching, an inevitable future threat to the Reserve, adequate well-armed Wildlife Guards are required as the present Wildlife Guards are unarmed and helpless in the event confrontation with poachers.

Another aspect, which will be helpful in protecting the Reserve, is by creating awareness to the inhabitants

surrounding the area through education on importance of environment and its conservation. The Government through the concerned department in collaboration with Non-Governmental Organisation can do this. Two TSTGO's worth mentioning are "Young Mizo Association" (YMA) and "Centre for Environment Protection" (CEP), which are actively involved in environmental protection throughout Mizoram. They believe that a strong economy and a healthy environment can co-exist.

ENUMERATION

GYMNOSPERMS

GNETACEAE

Gnetum scandens Roxb.

ANGIOSPERMS

DILLENIACEAE

Dillenia indica L.

MAGNOLIACEAE

Michelia doltsopa Buch.-Ham. ex DC.

Rippling rivulet

Tuichar Stream

MENISPERMACEAE

Cissampelos pareira L.
Parabaena sagittata Miers.
Stephania glabra (Roxb.) Miers.

BERBERIDACEAE

Mahonia nepalensis DC. ex Dippel.

VIOLACEAE

Viola betonicifolia Sm.

FLACOURTIACEAE

Hydnocarpus kurzii Warb.

CLUSIACEAE

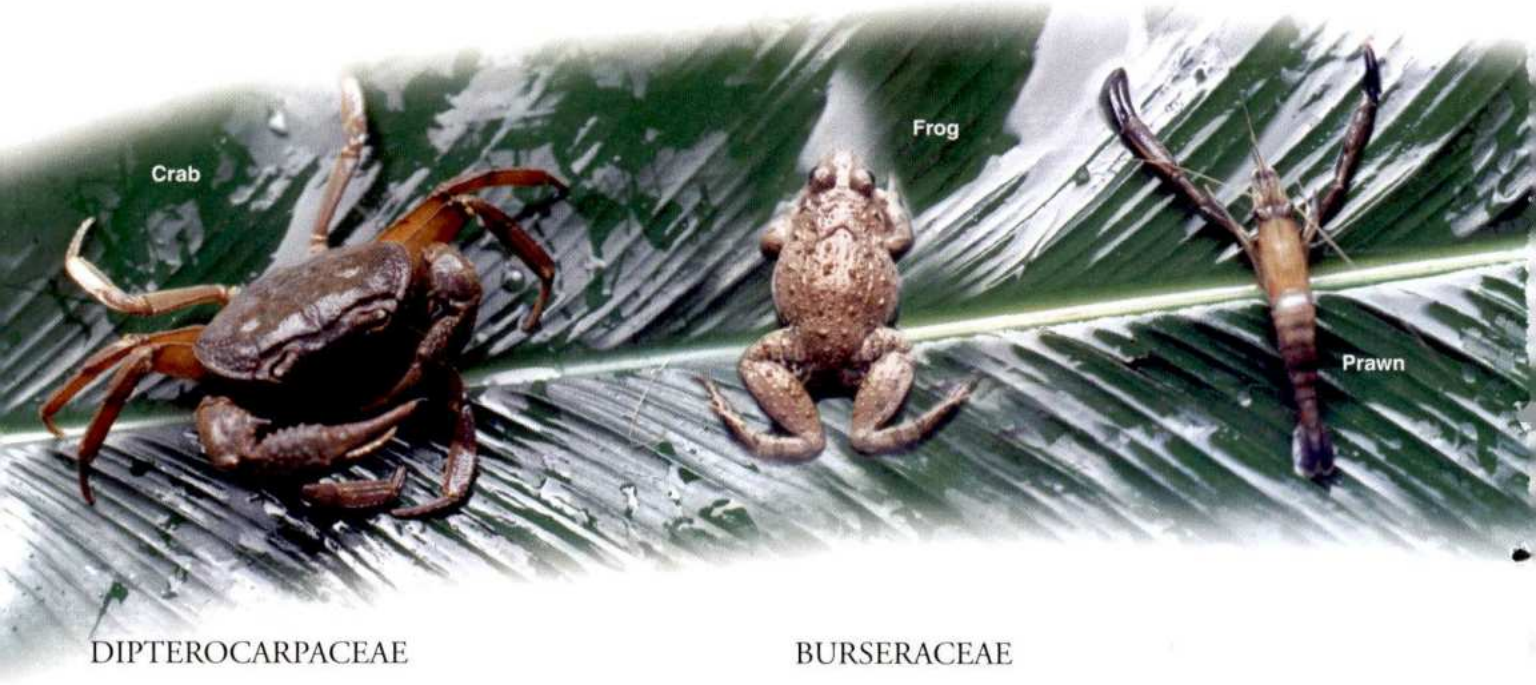
Garcinia cowa Roxb.
G. lanceaefolia Roxb.
G. sopsopia (Buch.-Ham.) J.D. Mabb.
Mesua ferrea L.

THEACEAE

Eurya cavinervis Vesque
E. cerasifolia (D. Don) Kobuski
Schima wallichii Choisy

SAURAUIACEAE

Saurauia napaulensis DC.
S. punduana Wall.



DIPTEROCARPACEAE

Dipterocarpus indicus Bedd.
D. retusus Blume
D. tuberculatus Roxb.
D. turbinatus Gaertn. f.

MALVACEAE

Abelmoschus moschatus Medik.
Bombax ceiba L.
Sida acuta Burm. f.

STERCULIACEAE

Firmiana colorata R. Br.
Heritiera papilio Bedd.
Sterculia villosa Roxb.

TILIACEAE

Elaeocarpus aristatus Roxb.
E. floribundus Blume
E. lanceaefolius Roxb.

RUTACEAE

Citrus sinensis Pers.
Clausena heptaphylla (DC.) Steud.
Zanthoxylum armatum DC.

BURSERACEAE

Garuga pinnata Roxb.

OXALIDACEAE

Oxalis carrilculata L.
Aegle marmelos Correa.

MELIACEAE

Aglaia hiernii M.V. Viswan. & K. Ramach.
Aphanamixis wallichii (King) Harid. & R.R. Rao
Dysoxylum alliarum (Buch.-Ham.) N.P. Balakr.
D. gobara (Buch.-Ham.) Merrill.
Toona ciliata M. Roem.

OLACACEAE

Lepionurus sylvestris Blume

RHAMNACEAE

Ziziphus mauritiana Lam.

VITACEAE

Vitis bracteolata Wall.

LEEACEAE
Leea compactiflora Kurz
L. crispa Willd.
L. indica Merill.

ACERACEAE

Acer laevigatum Wall.

SABIACEAE

Meliosma simplicifolia Walp.

ANACARDIACEAE

Mangifera indica L.
M. sylvatica Roxb.
Rhus acuminata DC.
Spondias pinnata Kurz

LEGUMINOSAE-PAPILIONOIDAE

Derris robusta Benth.
Erythrina variegata L.

LEGUMINOSAE-CEASALPINIDAE

Saraca asoca (Roxb.) W.J. de Wilde

LEGUMINOSAE-MIMOSOIDAE

Acacia pinnata Link.
Mimosa pudica L.
Xylia xylocarpa Taub.

COMBRETACEAE

Anogeissus acuminata Wall.
Terminalia bellerica Roxb.
T. chebula Retz.
T. myriocarpa Heurck & Muell. Arg.

MYRTACEAE

Syzygium cerasoides Raiz.
S. cumini Skeels
S. salignum (Miq.) N.C. Rathakrishnan & N.C. Nair

MELASTOMATACEAE

Osbeckia crinata Benth.
Sonerila maculata Roxb.

LYTHRACEAE

Lagerstroemia speciosa Pers.

SONNERATIACEAE

Duabanga grandiflora Walp.

PASSIFLORACEAE

Adenia cordifolia Engl.
Modecca trilobata Roxb.
Passiflora nepalensis Walp.

CUCURBITACEAE

Hodgsonia machycarpa Cogn.
Momordica dioica Roxb. ex Willd.

BEGONIACEAE

Begonia balsamina Ruix. ex Klotzsch
B. pedunculosa Wall.

DATISCACEAE

Tetrameles nudiflora R. Br.

APIACEAE

Centella asiatica Urban

ARALIACEAE

Trevesia palmata (Roxb.) De Vis.

RUBIACEAE

Haldina cordifolia (Roxb.) C.E. Ridsdale
Morinda angustifolia Roxb.
Mussaenda roxburghii Hook. f.
Mycetia longifolia Kuntze
Ophiorrhiza tingens C.B. Clarke ex C.E.C. Fisch.
O. oppositifolia Hook. f.
Oxyceros longiflora (Lam.) Yamazaki

ASTERACEAE

Bidens pilosa L.
Chromolaena odorata (L.) R.M. King & H. Robinson
Eupatorium odoratum L.
Mikania micrantha Kunth
Spilanthes oleracea L.

CAMPANULACEAE

Pratia nummularia Kuntze

Curcuma sp..

LOBELIACEAE

Lobelia nicotianaefolia Heyne

MYRSINACEAE

Ardisia colorata Roxb.
A. paniculata Roxb.
Embelia ribes Burm. f.
E. subcoriacea Mez.
Maesa indica Forst.
M. paniculata A. DC.

EBENACEAE

Diospyros cacharensis (Das & Kanjilal) H.B. Naithani
D. grata Wall.
D. lanceaefolia Roxb.

STYRACACEAE

Styrax serrulatum Roxb.

Symplocos javanica Kurz
S. lucida Brongn. & Gris ex Miers

OLEACEAE

Erythropalum scandens Blume
Ligustrum robustum Bedd.

APOCYNACEAE

Anodendron paniculatum A. DC.
Catharanthus roseus G. Don

ASCLEPIADACEAE

Hoya griffithii Hook. f.

BUDDLEJACEAE

Buddleja minima S.Y. Bao

CONVOLVULACEAE

Ipomoea vitifolia Sw.

SOLANACEAE

Capsicum frutescens L.
Lycianthes laevis (Dun.) Bitter
Physalis minima L.
Solanum torvum Buch.-Ham. ex Wall.

SCROPHULARIACEAE

Bonnaya reptans Spreng.
Mecardonia dianthera (Sw.) Pennell
Scoparia dulcis L.

OROBANCHACEAE

Aeginetia indica L.

BIGNONIACEAE

Stereospermum colais (Buch.-Ham. ex Dillw.) Mabb.
Stereospermum personatum (Hassk.) Chatterjee

VERBENACEAE

Callicarpa arborea Wall.
Gmelina arborea Roxb.
Premna bengalensis C.B. Clarke
P. latifolia Roxb.
P. milleflora C.B. Clarke
Stachytarpheta indica Vahl
Tectona grandis L.
Vitex glabrata R. Br.
V. peduncularis Wall.

PLANTAGINACEAE

Plantago major L.

AMARANTHACEAE

Achyranthes bidentata Blume

POLYGONACEAE

Polygonum barbatum L.
P. caespitosum Blume
P. chinense L.

PIPERACEAE

Peperomia pellucida Kunth.

MYRISTICACEAE

Knema angustifolia Warb.

LAURACEAE

Lindera pulcherrima (Wall.) Benth.
Litsea cubeba Pers.
L. meissneri Hook. f.
Persea villosa (Roxb.) Kosterm.

ELAEAGNACEAE

Elaeagnus caudata Schlecht.

EUPHORBIACEAE

Alchornea tiliaefolia Muell. Arg.
Antidesma diandrum Heyne ex Roth
Baliospermum calycinum Muell. Arg
Bischofia javanica Blume
Breynia retusa (Dennst.) Alston
Croton caudatus Geisel.
Emblica officinalis Gaertn.
Euphorbia hirta L.
E. indica Lam.
E. thymifolia L.
Fluggea microcarpa Blume
Macaranga denticulata Muell. Arg.
Phyllanthus debilis Willd.
P. urinaria L.
Sapium baccatum Roxb.
Securinega virosa Baill.
Sumbaviopsis albicans J.J. Sm.

MORACEAE

Artocarpus chama Buch.-Ham. ex Wall.
A. heterophylla Lam.
A. lacucha Roxb.
Ficus bengalensis L.
F. subulata Blume
F. hirta Vahl
F. hispida Roxb. ex Wall.
F. prostrata Buch.-Ham. ex Wall.
F. racemosa L.
F. roxburghii Wall.

Ficus semicordata Buch.-Ham. ex J.E. Smith
F. subincia Buch.-Ham ex J.E. Smith
Morus australis Poir.

URTICACEAE

Dendrocnide sinuata (Blume) Chew.
Elatostema caveanum A.J.C. Grierson & D.G. Long
E. dissectum Wedd.
E. sesquifolium Hassk
Pouzolzia indica Gaudich.
Pilea smilacifolia Wedd.
Trema politoria Planch.
Villebrunea integrifolia Gaud.

FAGACEAE

Castanopsis echidnocarpa A. DC.
C. indica A. DC.

ORCHIDACEAE

Bulbophyllum affine Lindl.
B. leopardianum (Wall.) Lindl.
Calanthe sylvatica (Thou.) Lindl.,
Coelogyne prolifera Lindl.
C. punctulata Lindl.
Dendrobium anceps Sw.
D. aphyllum (Roxb.) Fischer
D. acinaciforme Roxb.
D. densiflorum Wall. ex Lindl.
D. fimbriatum Hook.
D. formosum Roxb.
Eria paniculata Lindl.
Papilionanthe teres (Roxb.) Schltr.
Pholidota imbricata (Roxb.) Lindl.
Rhynchostylis retusa (L.) Blume
Vanda coerulea Griff. ex Lindl.

ZINGIBERACEAE

Alpinia malaccensis (Burm.) Roscoe
Amomum dealbatum Roxb.
Costus speciosus Sm.
Curcuma longa L.
Gastrochilus longiflora Wall.
Globba clarki Baker
Hedychium acuminatum Rosc.
H. angustifolium Roxb.
Mantisia spathulata Schult.

MARANTACEAE

Phrynium capitatum Willd.

MUSACEAE

Musa paradisiaca L.

HYPOXIDACEAE

Curculago latifolia Dryand.

DIOSCOREACEAE

Dioscorea alata L.

SMILACACEAE

Smilax perfoliata Blume

COMMELINACEAE

Pollia hasskarlii Roxb.

ARECACEAE

Calamus erectus Roxb.
C. latifolius Roxb.
C. erectus Roxb.
Calamus latifolius Roxb.
C. leptospadix Griff.
C. tenuis Roxb.
Caryota urens L.
Licuala peltata Roxb. ex Buch.-Ham

PANDANACEAE

Pandanus foetidus Roxb.

ARACEAE

Arisaema leschenaultii Blume

CYPERACEAE

Kyllinga brevifolia Rottb.

POACEAE

Axonopus compressus (Sw.) P. Beauv.

Bambusa tulda Roxb.
Cephalostachyum capitatum Munro
Dendrocalamus hamiltonii Nees & Arn. ex Munro
Imperata cylindrica Beauv.
Melocalamus compactiflorus Benth.
Melocanna baccifera (Roxb.) Kurz
Saccharum spontaneum L.
Schizostachyum polymorphum (Munro) R.B. Majumdar

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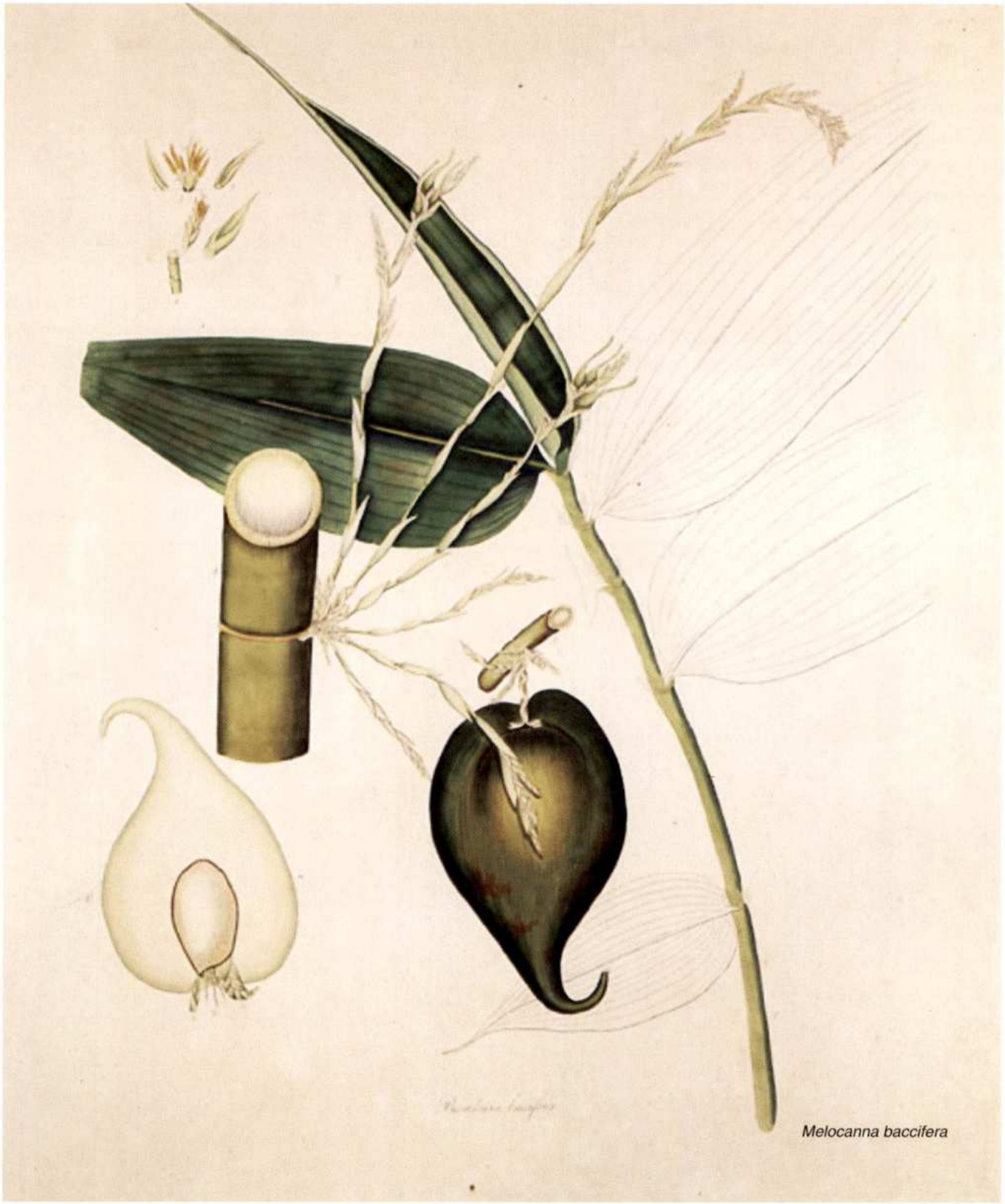
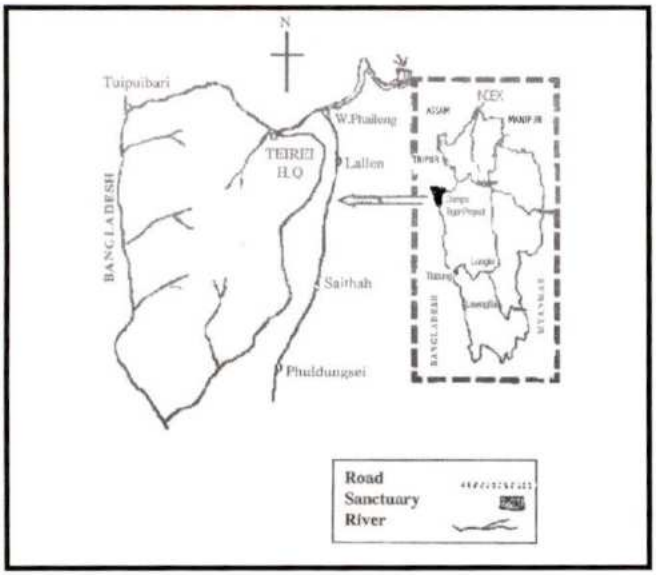
Musa sp.



Melocanna baccifera



Map of Dampa Tiger Reserve

SALIENT FEATURES

Area

Core	:	340 sq km
Buffer	:	160 sq km
Total	:	500 sq km

Longitude	:	92°16' to 92°28' East
Latitude	:	23°23' to 23°44' North
Altitude	:	200 m to 1200 m above M.S.L.
Rainfall	:	2000 mm to 2500 mm

Temperature

Minimum	:	3.5°C
Maximum	:	35°C

Flora

The broad classification of the forest types in the Reserve according to Champion & Seth are :

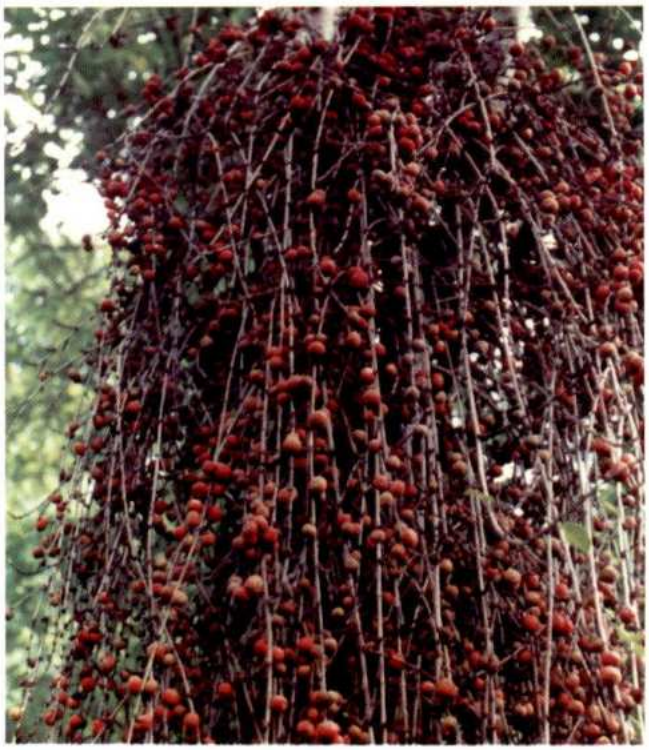
- Tropical Evergreen and Semi-Evergreen Forest
- Tropical Moist Deciduous Forest
- Sub-Montane type Forest

Fauna

The area is also biologically rich and provides an ideal habitat for large mammals such as Elephant, Gaur, Leopard, and Tiger. As many as 215 species of birds and 5 species of endangered primates have also been recorded in this area.

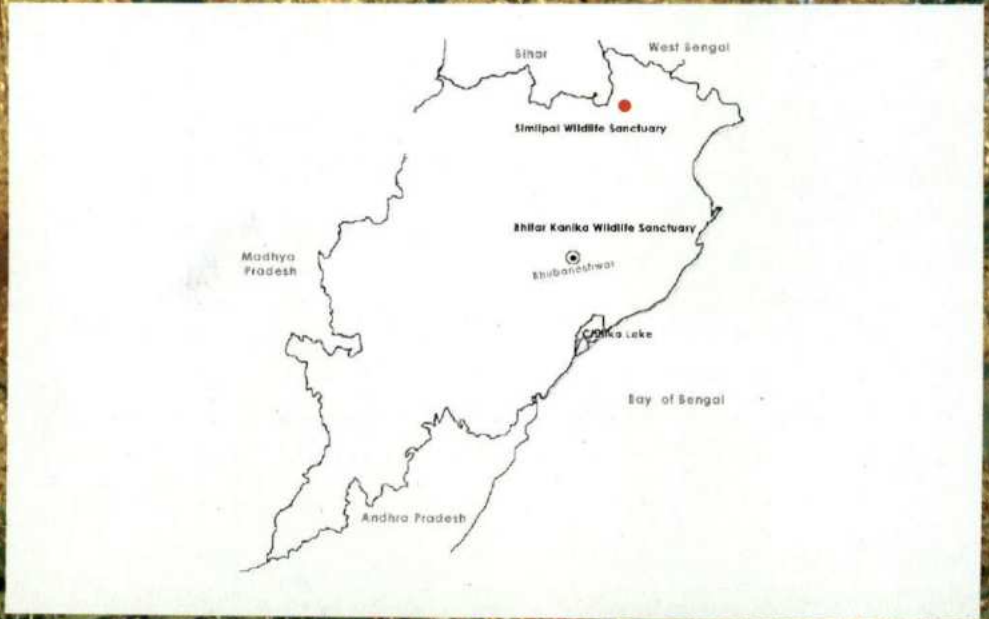
Melocanna baccifera Courtesy : P. Singh

Ficus racemosa



ORISSA

Similipal Tiger Reserve



Similipal Tiger Reserve

DD Bahali, DK Agrawala & HJ Chowdhery
Central National Herbarium, Botanical Survey of India
Howrah -711103

Similipal Biosphere Reserve (SBR) is located in the Mayurbhanj district at the north-eastern corner of Orissa, which lies in the tri-junction of three states - Orissa, West Bengal and Jharkhand. It lies between 21° 29' to 22° 08' N latitude and 86° 04' to 86° 38' E longitude, covers major portion in the central part of Mayurbhanj district. It is immediately surrounded by the small townships of Udala and Thakurmunda in south, Bangiriposi in north, Baripada and Bisoi in the east, and Jashipur and Karanjia in the west.

The Similipal Tiger Reserve extends over an area of ca 2750 km^2 with a core area of ca 846 km^2, buffer zone ca 1904 km^2 and transition zone ca 1624 km^2., which is exactly the sum of core and buffer zones of SBR.

Similipal is considered as Himalayas of Orissa because of its enormous influence over the climate of the state and its neighbourhood (Parida, 1997) and is a treasure house of floristic diversity of Orissa. It acts as a barrier to south-western monsoon causing heavy rain and diverts the moisture laden wind to south westerly direction to cause rainfall in western Orissa. It is claimed that but for it, most part of Orissa and the surrounding region lying on the same latitude as many deserts of the world would have been a desert (Patro, 1988). Eastern Orissa usually does not suffer from any drought because of this hill range.

The Similipal Biosphere Reserve owes its name to 'Simili' in Oriya means *Bombax ceiba,* which was once upon a time very common in SBR. The name indicates the nature of the forest vegetation as deciduous like 'Simili plant'. The area harbours enormous diversity of tropical flora and fauna and provides shelter to many rare as well as endangered species of the state. The forest is a natural habitat of Royal Bengal Tiger, Asiatic Elephant, Bear, Deer and many animals and birds. The aboriginal tribes, mainly Santal, Kol, Bhomij, Bhuiya, Bhuyan, Bathudi, Kharia, Ho, Gond, Mankida, Pari-Bhuyan, Dharua, Kisan, Orang, Paraja, Rajuar, Saora, Mahali and Sounti solely depend on this forest for their food, medicine and other requirements.

Physiography

Geographically Similipal lies almost on the tropic of cancer forming the north-eastern limit of Deccan plateau adjoining Chhotanagpur highlands in Bihar and southern limit of lower gangetic plains in West Bengal. It is sometimes considered as the northern discrete section of Eastern Ghats. It is a high plateau with steep slopes all around its lenticular outline overlooking the relatively plane surfaces. The hills are steeper towards south and east and gradually sloping towards north and west. The area has innumerable crests and valleys, perennial streams and rivers. The altitude varies from 500 to 600 m on the outer areas to 1000-1165 m along the central area. The highest elevations in Similipal are Meghasani, means the seat of clouds (1165 m), Ganapati (1114 m), Berahuri (1092 m), Amjhori (1082 m) and Bisaldanga (1080 m). The hills rise abruptly from coastal plains of southern Udala and eastern Baripada sides and rise steeply up to heights of 700 - 800 m, extend towards north and north-western side and merge with the Chhotanagpur plains. On the western side a large number of isolated hills exist.

Geological formations: There are three concentric bowls of impervious quartzite layers formed of

Eria meghasaniesis - Endemic to Similipal

Courtesy : Sarat Misra

sedimentary rocks and their interspaces filled with pervious volcanic rocks made of Spiltic lava (fig.2). These formations dip towards centre forming a basin structure. The concentric accretions of rings of quartzite and volcanic lava helps in holding large amount of ground water and feeds to the river systems and water falls. Similipal complex on land is located in such a way that this structure acts as a water tower of Orissa, West Bengal, Jharkhand, Bihar and Madhya Pradesh (Pujari, 1997). It is believed that during deposition of sediments in the basin, there were repeated submerine volcanic activities giving rise to thick lava flows resulting in alternating sequence of sediments and lava and the Amjhori sill at the centre of the plateau was introduced towards the closing phase of sedimentation. The rocks of Similipal are sedimentary, igneous and metamorphosed. Extensive weathering of volcano-sedimentary suite of rocks under humid tropical climate has produced thick soil cover favouring luxuriant growth of vegetation (Mahalik, 1997). The soils of Similipal vary from red loam, clay and clayey loam to reddish sandy soil and the percentage of sand decreases with increasing elevation. The west of the plateau is the Baitarani peneplained country on Singbhum granites, and the laterite soil mixed with alluvium on the east extends to Baripada Udala plains. The soils of SBR are generally acidic in nature, the pH varies between 4.8 to 6.8 in most of the areas (Prusty, 1997) and the acidity of soil is more at lower elevations than higher reaches.

Drainage system: The topography, water retentivity and moderately high rainfall in the area have resulted in giving birth to some perennial streams and nalas, which radiate in all directions from the central higher ground and ultimately join to form three river

systems, namely, Budhabalang from north and east, Baitarani from south and west and Salandi from the south. Khairi, Bhandhan, west Deo, Bhirol, Salandi, Gobarighora, Tel and Sim tributaries drain into Baitarani; Sonai, East Deo, Sanjo, Gangahara and Palpala flow into Budhabalang. The Khadkhai drain into Subarnarekha and the Sona tributary pass through Kaptipada forest area. The rivers originated from Similipal serves as arteries of agriculturally rich eastern Orissa. The plateau is deeply dissected by drainage systems giving rise to narrow deep valleys and waterfalls. Barheipani falls (217 m) and Joranda falls (181 m) are two important falls on Burhabalang course. Besides, there are several falls on the eastern flank of Meghasani peak.

Climate: The climate of Similipal is tropical warm and humid. The temperature ranges from 4°C in winter to about 37°C in summer and the mean temperature varies between 20°C to 28°C (the mean minimum temperature 7°C to 11°C and mean maximum 33.4°C to 37.4°C). Three distinct seasons, viz., summer, rainy and winter are felt in the year. Rainy season lasts from middle of June till October. Storms and depressions from the bay of Bengal in the pre and post monsoon season often cause heavy rain with high velocity winds. The area gets an annual average rainfall of 185 cm (maximum being 225 cm and minimum 110 cm) from south-western monsoon (June to September) and the retreating north-eastern monsoon (November). Most of the rain received in the rainy season and the rainfall is not well distributed throughout the area. South Similipal receives higher precipitation than north Similipal and there is a general decrease of rainfall from south-west to north-east. The mean number of rainy days at different places in Similipal is 113 to 134 (Srivastava & Singh, 1997). Relative humidity is generally high throughout the year and varies between 74 % and 93 %. Winter season is experienced between mid October to January and is severe during December. Some pockets of the high altitude areas in southern Similipal experience frost during winter. The spring season is pleasant and the summer is tolerable, when the temperature never goes above 40°C. High humidity and decomposing organic matter in the area provides breeding ground for mosquitoes, as a result of which malaria is a perennial malady in the area, especially during summer months.

Vegetation

Vegetation of SBR is basically a tropical moist deciduous forest interspersed by some patches of semi-evergreen and mixed deciduous forest. Besides, the natural and biotic influences on forests at varied topography have given rise to some intermediate forest types within the main vegetation, the scrublands and grasslands. Sal *(Shorea robusta)* is the dominant species in many areas although mature Sal trees have dwindled in number. Regular annual fires, forest clearings and perhaps damage of forest cover by storms and cyclones in the past has resulted grassland formations in several places and abundance of grasses in Similipal. The edaphic conditions in the moist valleys are favourable to soil bacteria, fungi, etc. which accelerate the process of decomposition of organic matter in the soil. A number of epiphytes, mushrooms, bryophytes and pteridophytes grow in moist forests. The perennial streams and nalas harbour many aquatic plants including several freshwater algae. Thus, the total vegetation of SBR may be classifed as 1) Forests, 2) Grasslands and 3) Aquatic vegetation.

Forest vegetation

The forests of the area are among the most luxuriant and valuable tropical forests of Orissa. Rich floristic diversity of the forests is evident from its vertical stratification into 3 storeyed vegetational profile with upper and middle storey consisting of tree species associated with climbers, lianas and epiphytes, and the ground flora with shrubs, herbs, grasses, etc. Remote sensing data by Raut and Behera (1997) reveals 3 different density class of forests viz., closed (>40%), open (10-40%) and degraded (<10%) in SBR. The transition zone of SBR has totally lost the forest character and almost turned into agricultural land with occasional/accidental presence of species like, *Madhuca longifolia, Shorea robusta, Artocarpus heterophyla, Pongamia pinnata, Mangifera indica, Alstonia scholaris, Dillenia pentagyna, Albizia lebbeck, Azadiracta indica, Macaranga peltata, Adina*

cordifolia, Gmelina arborea, Bombax ceiba, Erythrina variegata, Bauhinia spp. *Tamarindus indica, Butea monosperma, Spondias pinata, Vitex negundo, Streblus asper, Annona reticulata, Mimusops elengi, Ziziphus* sp., *Opuntia dilenii, Jatropha curcas, J. gossipifolia, Agave* sp., *Cassia tora, Calotropis gigantea, Vetiveria zizanioides,* etc. on the bunds of cultivated fields and villages. Occasional plantations of Sal and Eucalyptus are observed in this zone. The buffer zone is represented by broad-leafed moist deciduous forests and grasslands in open areas and is rich in shrubs, herbs and grasses. The core region has more or less well-protected dense forest rich in trees and shrubs. The major types of forests in Similipal are as follows:

a. Tropical moist deciduous forests

It represents the typical vegetation and occurs all over Similipal. The vegetation is stratified into predominantly deciduous species of 25 40 m tall trees in the top storey, deciduous species mixed with some evergreen elements in the middle storey and the forest floor is occupied by shrubby and herbaceous elements. Shorea robusta (Sal) is the dominant species in this forest. The other important constituents of the top storey are *Xylia xylocarpa, Haldinia cordifolia, Mitragyna parvifolia, Terminalia bellirica, T. alata, T. tomentosa, T. chebula, Madhuca indica, Bombax ceiba, Gmelina arborea, Firmiana colorata, Pterocarpus marsupium, Dalbergia latifolia, Schleichera oleosa, Bridelia retusa, Dillenia pentagyna,* etc. The middle storey consists of medium sized trees of evergreen as well as deciduous elements, viz., *Syzygium cumini, Careya arborea, Buchanania lanzan, Dillenia indica, Cleistanthus collinus, Kydia calycina, Premna tomentosa, Emblica officinalis, Ficus racemosa, Polyalthia cerasoides, Mallotus philippensis, Trema orientalis, Ziziphus* spp., *Macaranga peltata, Cassia fistula,* etc. The ground vegetation mainly comprises of shrubby evergreen perennials, herbs and grasses. The important shrubs are *Ixora pavetta, Strobilanthes scaber, Woodfordia fruticosa, Flemingia chappar, Holarrhena pubescens, Helicteres isora, Croton roxburghii, C. bonplandianum, Ardisia solanacea, Justicia adhatoda, Barleria strigosa, Indigofera cassioides, Clerodendrum viscosum, Flacourtia indica,* etc. The herbs include *Atylosia scarabaeoides, Tephrosia purpurea, Blumea* spp., *Ageratum* spp., *Elephantopus scaber, Tridax procumbens, Canscora diffusa, Hemidesmus indicus, Oxalis corniculata, Evolvulus numularis, Commelina* spp. etc. *Apluda mutica, Aristida setacea, Chrysopogon aciculatus, Cymbopogon flexuosus, Eleusine indica, Imperata cylindrica, Panicum brevifolium, Themeda triandra,* etc. are the commonly encountered grasses in the area.

The climbers and lianas are plenty in this forest. The important ones are *Bauhinia vahlii, Butea superba, Combretum roxburghii, Milletia extensa, Acacia pennata, Entada rheedi, Asparagus racemosus, Argyreia speciosa, Premna coreacea, Paederia foetida, Dioscorea* spp., *Tinospora cordifolia,* etc. Some epiphytic species of orchids and ferns also grow in this forest.

b. Tropical semi-evergreen forest

These forests are scattered and occur in patches mainly in southern part of Similipal and in the upper riches in permanently moist valleys with fertile soil innervated by perennial streams. The vegetation differs from typical deciduous forests in having some evergreen species and rarity of Sal in the top storey, mainly evergreen middle storey and rarity of grasses in the ground flora. The climbers, epiphytes, Orchids, Ferns, Bryophytes, Fungi and Lichens are abundant in these forests. These forests provide good ground for propagation of Orchids as the mycorrhizal fungi required for germination of Orchid seeds survive under moist conditions. The nalas and streams in these forests harbour considerable number of aquatic plant species and Algae.

The important constituents of these forests are *Artocarpus lacoocha, Toona ciliata, Mangifera indica, Bridelia retusa, Mesua ferrea, Xylia xylocarpa, Polyalthia cerasoides, Strychnos nux-vomica, Michelia champaca, Biscofia javanica, Cipadessa baccifera, Macaranga peltata, Litsea nitida, Anthocephalus chinensis, Syzygium cumini, Dalbergia latifolia, Mallotus philippensis, Celtis tetrandra, Terminalia alata, Ardisia solanacea, Woodfordia fruticosa, Phoebe lanceolata, Citrus medica, Gnetum ula, Cyathea gigantea, Rubus ellipticus, Carallia brachiata, Elaeocarpus tectorius, Turpinia nepalensis, Nyctanthes*

arbortristis, etc. The climbers of these forests are *Pothos scandens, Smilax macrophyla, Taxocarpus kleinii, Dioscorea* spp., *Bauhinia vahlii, Asparagus racemosus, Cryptolepis buchanani, Argyreia speciosa, Cissus quadrangularis, Premna coriacea, Paederia foetida, Butea superba,* etc. The epiphytes include several species of Orchids, Ferns, Bryophytes. Several wood rotting fungi grow parasitically on old tree trunks. The ground vegetation and grasses are poor due to shady condition under the closed canopy.

c. Tropical dry deciduous forests

These forests occur on steep slopes in hot and dry conditions. Here both the upper and lower stories are composed of deciduous species and poor quality of Sal, although it is abundant in the forest. The important constituents of these forests are *Shorea robusta, Anogeissus latifolia, Terminalia alata, T. chebula, Diospyros melanoxylon, Haldinia cordifolia, Cassia fistula, Mallotus philippensis, Lagerstoemia parviflora, Semicarpus anacardium, Buchanania lanzan, Lannea coromandelica, Protium serratum, Sterculia urens, S. villosa, Cochlospermum religiosum,* etc. A few climbers, viz., *Bauhinia vahlii, Ventilago denticulata, Combretum* spp., *Taxocarpus klenii, Milletia extensa,* etc. grow in this forest. The epiphytes, fungi, bryophytes and ferns are rare in this forest due to dry condition.

Grasslands

These are sometimes referred as 'Moist Sal Savannah'. This vegetation occurs on flat summits of hills, hill slopes, high valleys above 800 m in Similipal, particularly the areas receiving some precipitation, especially frost in winter. The high altitude grasslands are presumed to have been formed due to destruction of forests by cyclonic storms in the past or due to regular frost in winter, which hinders regeneration of Sal seeds. The grasslands in the lower altitude are secondarily formed mainly due to clearing of forests near villages and annual forest fire. The common elements in this vegetation are *Imperata cylindrica, Saccharum* sp., *Themeda* spp., *Cymbopogon flexuosus, Andropogon alsinodis, Apluda mutica, Heteropogon contortus, Capillipedium assimile, Chrysopogon aciculatus, Arundinella setosa, Bothriochloa* spp., *Eragrostis* spp., *Sporobolus indicus, Digitaria* spp., *Cynodon dactylon* and a number of herbaceous species. Some stunted tree species scattered in the grassland are *Shorea robusta, Symplocos racemosa, Dillenia pentagyna* and *Syzygium* sp.

3. Aquatic and wetland vegetation

The streams and nalas have some fresh water hydrophytes and marshy plants in nearby swampy areas. The important aquatic plants are *Hydrilla verticillata, Ottelia alismoides, Valisneria spiralis, Nymphoides hydrophilla, Utricularia* spp., *Aponogeton natans* and some algae. The significant plants in the swampy and marshy habitats include *Ammania baccifera, Arundo donax, Ludwigia octavalvis, Ipomoea aquatica, Polygonum barbatum, Homonoia riparia, Floscopa scandens, Monochoria vaginalis, Commelina benghalensis, Scirpus articulatus, Leersia hexandra, Paspalum* spp., *Sacciolepis indica, Paspalidium flavidum, Hygrorhiza aristata, Fimbristylis* spp., *Carex* spp., *Eriocaulon melaleucum, Colocasia esculenta, Juncus prismatocarpus, Murdannia spirata,* etc.

Floristic Assessment

Pioneering botanisation of area was done by Haines (1921, 25), who reported 348 species under 265 genera and 99 families of vascular plants from Similipal and Mayurbhanj district. Bal (1942) listed 551 species under 377 genera and 104 families from Mayurbhanj state (now district) including 281 useful species of economic plants from Similipal. Mooney (1950) though recognised it as floristic rich but did not explore the area. Panigrahi al. (1964) contributed a list of 841 species of vascular plants and 16 species of fungi to the Botany of Orissa. This report included 413 species of vascular plants from Similipal. Rath al. (1979) surveyed Cyperaceae of Orissa and included 5 species from Similipal in their report. Misra (1986, 1989 & 1997) surveyed Orchidaceae of Similipal and reported 93 species of Orchids including 19 Himalayan and 4 south Indian Orchids. Saxena and Brahmam (1989) reported 1076 species (including 64 cultivated species) of vascular plants under 168 families. Mishra (1997) assessed 2 endemic and 50 threatened (8 endangered, 8 vulnerable, 29 rare and 5 insufficiently known) species from Similipal.

Acanthus ilicifolius

Banerjee and Sastry (1998) have given a birds eye view of the vegetation of Tiger Reserve area of SBR. Swain and Nanda (1997) studied plant population in a preservation plot of 23 ha inside Similipal and reported 790 trees, 9400 shrubs and 81000 herbs per hectare with *Shorea robusta* as dominant species in the top storey, *Mallotus philippensis* in the middle storey and *Cyperus rotundus* in its ground flora. Mohanty (2001) studied phytosociology in 18 different localities of Similipal and found significant difference in density and basal area cover of the trees in core and buffer areas. According to him *Shorea robusta, Terminalia alata, Syzygium cumini, Proteum serratum, Anogeissus latifolia* and *Dillenia pentagyna* contribute 55.6 % basal area in comparision to other tree species.

Present assessment of botany of the area is based on our collection from the south and eastern Similipal (depostited at CAL), available herbarium specimens and published literature. All these collectively reveal the occurrence of 180 families, 720 genera, 1276 species, 12 subspecies and 39 varieties of vascular plants including 73 cultivated or naturalised taxa.

The flora of Similipal is considerably diverse and may be considered as mini flora of Orissa, except the coastal mangroves. The SBR accounts for only 1.76 % area of Orissa and ca 38 % protected areas of the State but harbours ca 48 % angiospermic, 40 % gymnospermic and 47 % Pteridophytic flora of the state. A comparison in this regard is given in Table 1. There are about 1206 species, 11 subspecies and 39 varieties of angiosperms distributed within 675 genera and 149 families. Of these ca 885 species, 10 subspecies and 31 varieties under 499 genera and 117 families are dicots and 320 species, 1 subspecies and 8 varieties under 176 genera and 32 families are monocots. The percentage ratio of dicotyledonous to monocotyledonous species in the Flora is 73.4:26.6 as against 71.0:29.0 in Flora of Orissa and 74.81:25.19 in Flora of India. The higher percentage of monocots in Similipal is due to higher number of grasses (124 spp. of Poaceae), Orchids (98 spp.) and sedges (50 spp. of Cyperaceae). The area harbours ca 76 % Orchids, 47 % grasses, 36 % sedges of the flora of Orissa. Overall diversity is high at family level, representing 74 % families, ca 64 % genera and 46 % species of vascular plants of Orissa. Diversity of angiospermic genera and species are considerable representing ca 64 % genera and 46 % species of vascular plants of Orissa. In an average there are 4.0 genera per family and 1.8 species per genus as against 5.5 genera per family and 2.5 species per genus of vascular plants in Orissa. The most diverse families in Similipal are Poaceae (124 spp.), Orchidaceae (98 spp.), Fabaceae (90 spp.), Asteraceae (63 spp.), Euphorbiaceae (52 spp.), Cyperaceae (50 spp.), Rubiaceae (46 spp.), Acanthaceae (41 spp.), Lamiaceae (32 spp.) and Scrophulariaceae (25 spp.). These ten dominant families account for c. 48 % vascular plant species diversity in SBR. There are 70 families represented by single species, 54 families by 2-4 species, 24 families by 5-9 species, 16 families by 10-15 species, 5 families by 16-20 species and 11 families by above 20 species. The most diverse genus in SBR is *Cyperus* (16 spp.) followed by *Desmodium* (14 spp.), *Ficus* (13 spp.), *Dendrobium* (12 spp.), *Solanum* (12 spp.), *Ipomoea* (12 spp.), Blumea (11 spp.), *Acacia* (11 spp.) and *Crotalaria* (10 spp.). The species like *Shorea robusta, Anogeissus latifolia, Protium serratum, Terminalia alata, Mangifera indica, Diospyros melanoxylon, Syzygium cumini, Buchanania lanzan, Schleichera oleosa, Haldinia cordifolia, Terminalia chebula, Dillenia pentagyna, Madhuca indica* have large population structure.

The Gymnospermous flora of SBR is indeed least diverse like the state and represented by only 2 species rare in wild and 2 more cultivated species. This accounts for 40 % gymnosperm of Orissa. The species growing in the wild are *Gnetum ula* and *Cycas circinalis* and those cultivated are *Cryptomeria japonica* and *Pinus insularis*. The Pteridophytes represented by 66 species and 1 subspecies under 45 genera and 28 families. It constitutes ca 47 % Pteridophytic flora of Orissa. The most diverse families being Thelypteridaceae (12 spp.), Polypodiaceae (9 spp.), Pteridaceae (5 spp.),

Adiantaceae (4 spp.), Athyriaceae (4 spp.), Aspleniaceae (3 spp.), Dryopteridaceae (3 spp.) and Selaginellaceae (3 spp.). *Equisetum ramosissimum* ssp. *debile*, a rare pteridophyte of Orissa is also found in Similipal. Floristic reports on algae, lichen and bryophytes of Similipal are lacking. Panigrahi (1964) reported 16 species of fungi from Similipal, which represents ca 25 % fungal diversity of Orissa.

The status of various groups of vascular plants, dominant families, dominant genera and conspectus of families of vascular plants are given in Table I - IV in sequence.

Table I - Vascular plant taxa of Similipal as compared to that of Orissa

	Families		Genera		Species	
	Similipal	Orissa	Similipal	Orissa	Similipal	Orissa
Angiosperms	149	194	675	1060	1205	2630
Dicots	117	153	499	799	885	1868
Monocots	32	41	176	261	320	762
Gymnosperm	3	6	4	6	4	10
Pteridophytes	28	41	41	66	66	141

Table II - Dominant families of flowering plants

Family	No. of genera in Similipal / No. of Generain Orissa	No. of species in Similipal / No. of species in Orissa
Poaceae	68/100	124/265
Orchidaceae	37/43	98/129
Fabaceae	38/81	90/245
Asteraceae	37/54	62/117
Euphorbiaceae	28/39	52/108
Cyperaceae	13/19	50/140
Rubiaceae	29/38	46/89
Acanthaceae	19/29	43/82
Lamiaceae	19/24	32/59
Scrophulariaceae	9/21	21/56

Table III - Dominant genera of flowering plants

Genus	No. of species	
	Similipal	Orissa
Cyperus	16	61
Desmodium	14	21
Ficus	13	22+5 var.
Dendrobium	12	19
Ipomoea	12	25
Solanum	12	12
Blumea	11	17
Acacia	11	19
Crotalaria	10	35

Table IV - Conspectus of vascular plants of Similipal

a. Angiosperms

i) Dicotyledons	No. of				
Family	Genera	Species	Subspecies	Varieties	Forma
Ranunculaceae	3	5	-	-	
Dilleniaceae	1	3	-	-	
Magnoliaceae	1	1	-	-	
Annonaceae	7	10	-	-	
Menispermaceae	4	5	-	1	
Nymphaeaceae	2	4	-	1	
Papaveraceae	1	1	-	-	
Brassicaceae	3	4	1	-	
Capparidaceae	2	3	-	-	
Violaceae	2	1	1	-	
Bixaceae	1	1	-	-	
Flacourtiaceae	3	6	-	-	
Cochlospermaceae	1	1	-	-	
Pittosporaceae	1	1	-	-	
Polygalaceae	2	8	-	-	
Caryophyllaceae	1	1	-	-	
Portulacaceae	1	1	-	-	
Clusiaceae	3	6	-	-	
Theaceae	1	1	-	-	
Dipterocarpaceae	1	2	-	-	
Bombacaceae	1	1	-	-	
Malvaceae	9	18	3	1	
Sterculiaceae	6	8	-	-	
Tiliaceae	4	14	-	-	

Family	No. of				
	Genera	Species	Subspecies	Varieties	Forma
Linaceae	2	2	-	-	
Malpighiaceae	2	2	-	1	
Oxalidaceae	2	4	-	-	
Rutaceae	9	13	-	-	
Simarubaceae	1	1	-	-	
Ochnaceae	2	-	-	2	
Burseraceae	3	3	-	-	
Meliaceae	8	9	-	-	
Icacinaceae	1	1	-	-	
Olacaceae	1	1	-	-	
Celastraceae	4	4	-	-	
Rhamnaceae	5	12	-	1	
Vitaceae	3	11	-	-	
Leeaceae	1	4	-	-	
Sapindaceae	5	5	-	-	
Styphyleaceae	1	2	-	-	
Meliosmaceae	1	2	-	-	
Anacardiaceae	7	7	-	-	
Caricaceae	1	1	-	-	
Moringaceae	1	1	-	-	
Caesalpiniaceae	8	21	-	-	
Mimosaceae	6	20	1	-	
Fabaceae	38	90	2	1	
Rosaceae	4	4	-	-	
Crassulaceae	1	2	-	-	
Droseraceae	1	2	-	-	
Rhizophoraceae	1	1	-	-	
Combretaceae	5	10	-	-	
Myrtaceae	4	10	-	-	
Barringtoniaceae	1	1	-	-	
Lecythidaceae	1	1	-	-	
Melastomaceae	4	5	-	1	
Lythraceae	5	9	-	-	
Punicaceae	1	1	-	-	
Onagraceae	1	4	-	-	
Trapaceae	1	-	-	1	
Turneraceae	1	-	-	1	
Cucurbitaceae	12	14	-	2	
Begoniaceae	1	1	-	-	
Cactaceae	2	2	-	-	
Moluginaceae	1	2	-	-	
Apiaceae	8	10	-	1	
Araliaceae	3	3	-	-	

Family	No. of				
	Genera	Species	Subspecies	Varieties	Forma
Alangiaceae	1	1	-	-	
Rubiaceae	29	46	-	3	
Asteraceae	37	62	-	1	
Campanulaceae	1	1	-	-	
Lobeliaceae	1	2	-	-	
Primulaceae	1	1	-	-	
Myrsinaceae	2	3	-	-	
Sapotaceae	4	4	-	-	
Ebenaceae	1	7	-	-	
Styracaceae	1	1	-	-	
Symplocaceae	1	1	1	-	
Oleaceae	4	11	-	-	
Apocynaceae	11	14	-	-	1
Periplocaceae	2	2	-	-	
Asclepiadaceae	5	11	-	-	
Loganiaceae	3	4	-	1	
Budlejaceae	1	1	-	-	
Gentianaceae	5	7	-	1	
Menyanthaceae	1	2	-	-	
Hydrophyllaceae	1	1	-	-	
Boraginaceae	4	7	-	-	
Convolvulaceae	6	17	2	-	
Solanaceae	6	15	-	1	
Scrophulariaceae	9	21	-	-	
Orobanchaceae	1	1	-	-	
Lentibulariaceae	1	5	-	1	
Gesneriaceae	2	2	-	-	
Bignoniaceae	4	4	-	-	
Pedaliaceae	1	1	-	-	
Martyniaceae	1	1	-	-	
Acanthaceae	19	43	-	1	
Verbenaceae	13	22	-	2	
Symphoremataceae	1	2	-	-	
Lamiaceae	19	32	-	2	
Nyctaginaceae	2	3	-	-	
Amaranthaceae	7	10	-	-	
Chenopodiaceae	1	1	-	-	
Polygonaceae	1	8	-	2	
Podostemaceae	1	1	-	-	
Aristolochiaceae	1	1	-	-	
Piperaceae	2	4	-	-	
Lauraceae	6	8	-	-	
Proteaceae	1	1	-	-	

Family	No. of				
	Genera	Species	Subspecies	Varieties	Forma
Loranthaceae	4	7	-	-	
Santalaceae	2	2	-	-	
Euphorbiaceae	28	52	-	-	
Ulmaceae	3	3	-	-	
Moraceae	4	18	-	2	
Urticaceae	4	4	-	-	
Salicaceae	2	2	-	-	
ii) Monocotyledons					
Hydrocharitaceae	5	6	-	-	
Burmaniaceae	1	1	-	-	
Orchidaceae	37	98	-	2	
Musaceae	1	1	-	-	
Zingiberaceae	7	15	-	-	
Costaceae	1	1			
Cannaceae	1	1	-	-	
Agavaceae	2	3	-	-	
Bromeliaceae	1	1	-	-	
Amaryllidaceae	2	4	-	-	
Hypoxidaceae	3	3	-	-	
Taccaceae	1	1	-	-	
Dioscoreaceae	1	8	-	-	
Antheriaceae	1	2	-	-	
Convallariaceae	1	1	-	-	
Dracaenaceae	1	1	-	-	
Colchicaceae	2	2			
Smilacaceae	2	3	-	-	
Asparagaceae	1	1	-	-	
Cuscutaceae	1	1	-	-	
Pontederiaceae	1	2	-	-	
Commelinaceae	6	16	-	-	
Juncaceae	1	1	-	-	
Pandanaceae	1	1	-	-	
Arecaceae	2	4	-	-	
Araceae	8	9	-	-	
Butomaceae	1	1	-	-	
Potamogetonaceae	1	1	-	-	
Aponogetonaceae	1	1	-	-	
Eriocaulaceae	1	7	-	-	
Cyperaceae	13	50	-	3	
Poaceae	68	124	1	3	

b. Gymnosperms

Family	No. of infrafamilial taxa			
	Genera	Species	Subspecies	Varieties
Gnetaceae	1	1	-	-
Cycadaceae	1	1	-	-
Coniferaceae	2	2	-	-
c. Pteridophytes				
Huperziaceae	1	2	-	-
Lycopodiaceae	1	2	-	-
Selaginellaceae	1	3	-	-
Equisetaceae	1	1	1	-
Botrychiaceae	1	1	-	-
Angiopteridaceae	1	1	-	-
Dicranopteridaceae	1	1	-	-
Polypodiaceae	5	9	-	-
Drynariaceae	1	1	-	-
Lygodiaceae	1	2	-	-
Cheilanthaceae	1	2	-	-
Pteridaceae	1	5	-	-
Adiantaceae	1	4	-	-
Hemionitidaceae	2	2	-	-
Antrophyaceae	1	1	-	-
Parkeriaceae	1	1	-	-
Marsileaceae	1	1	-	-
Hymenophyllaceae	1	1	-	-
Cyatheaceae	1	1	-	-
Dennstaedtiaceae	1	1	-	-
Pteridaceae	1	1	-	-
Lindsaeaceae	1	1	-	-
Thelypteridaceae	10	12	-	-
Aspleniaceae	1	3	-	-
Athyriaceae	2	4	-	-
Dryopteridaceae	2	3	-	-
Blechnaceae	1	1	-	-
Salviniaceae	1-	1	-	-

Phytogeographic affinity

The flora of the region is very old and rears many primitive angiosperm genera, viz., *Alphonsea, Annona, Atrabotrys, Miliusa, Polyalthia, Unona, Uvaria, Actinodaphne, Litsea, Persea,* etc. During long course of time its flora has influenced and being influenced by the flora of the surrounding phytogeographic regions, the gangetic plain in the east, Deccan Plateau in the north and west and coastal plain on the south. Besides, it is evident that its flora is enriched by the Himalayan elements in the long past. As a whole the flora of Similipal exhibit some affinities to a number of phytogeographical regions of the country. A precise account of the floristic affinities are given below.

Affinity with Himalayan flora

The flora of SBR show least affinity with the flora of the Himalayas located in the north. Some Himalayan elements (both temperate and subtropical) elements occur on several hills in SBR believed to have come from Himalayas during glaciation period. Himalayan elements in SBR are : *Ajuga macrosperma, Aerides odorata, Alpinia malaccensis, Baccaurea ramiflora, Bulbophyllum cariniflorum, Clematis roylei, Crinum amoenum, Commelina appendiculata, Elaeocarpus tectorius, Globba racemosa, Goodyera fumata, G.hispida, Helinus lanceolatus, Hedychium coccineum, Liparis nervosa, Lepidagathis purpuricaulis, Malaxis purpurea, Peristrophe speciosa, Phoebe lanceolata, Pilea scripta, Plectranthus japonicus, Psychotria denticulata, Rhamnus nepalensis, Rubia cordifolia, Rubus ellipticus, Thalictrum foliolosum, Turpinia nepalensis* and *Toddalia asiatica.*

Some plants common with Gangetic plains: The area shares many species with that of the Gangetic plain. Some common species are: *Indigofera atropurpurea, Syzygium cerasoides, Oenanthe javanica, depteracanthus beddomei, Desmodium gangeticum, Dillenia aurea, Cleome viscosa, Mesua ferrea, Shorea robusta, Kydia calycina, Helecteres isora, Ochna obtusata, Boswellia serrata, Toona ciliata, Celastrus paniculatus, Lannea coromandelica, Mangifera indica, Bauhinia purpurea, Senna alata, Elephantopus scaber, Ageratum conyzoides, Diospyros melanoxylon, Olenlandia* spp., *Eranthemum purpurescens, Butea monosperma, Tephrosia purpurea, Barrintonia acutangula, Melastoma malabathricum, Begonia picta, Anthocephallus chinensis, Coffea bengalensis* and *Commelina benghalensis.*

Some plants common with Eastern Ghats: *Cipadessa baccifera, Mollugo pentaphylla, Bupleurum ramosissimum, Exacum bicolor, Gmelina arborea, Cyanotis tuberosa, Ischaemum indicum.*

Some plants common with coastal plains: *Barringonia acutangula, Acacia nilotica, Abrus precatorius, Pongamia pinnata, Lawsonia inermis, Hygrophila* spp., and most grasses, and sedges.

Endemism

Of the 29 endemic taxa in Orissa, only 3 taxa, viz. *Aspidopterys tomentosa* (Bl.) A. Juss. var. *hutchinsonii* (Haines) Srivastava (Malpighiaceae), *Bulbophyllum panigrahianum* S.Misra (Orchidaceae) and *Eria meghasaniensis* S.Misra (Orchidaceae) occur in Similipal. While *B. panigrahianum* is confined only to Similipal *E. meghasaniensis* has an extension of its range to Rebana forest of the adjoining Keonjhar district (Misra, 1997).

Threatened plants

Regular forest fire, Jhum cultivation, over exploitation, indiscriminate tee felling and habitat destruction have threatened survival of some species in the Biosphere Reserve. So far no systematic survey of the threatened plants have been made except Mishra (1997) reported 50 threatened species from Similipal. Present analysis reveals ca 75 taxa belonging to 59 genera and 29 families of vascular plants as possibly rare or endangered in SBR. This accounts for ca 6 % of flora of Similipal. The Orchids are the first victims of habitat loss, which constitutes ca 50 % of all the threatened species of SBR. The concerned taxa, their probable threat status are given in Table V.

Table V - Threatened plants of Similipal

Family	Threatened taxa	Probable threat status
Acanthaceae	*Justicia nilgherrensis* Wall. ex T. Anderson	Rare
Amaryllidaceae	*Crinum amoenum* Roxb.	Rare
	Pancratium triflorum Roxb.	Rare
Anacardiaceae	*Rhus semialata* Murray	Rare
Annonaceae	*Alphonsia ventricosa* Hook. f. & Thomson	Rare
	Uvaria hamiltonii Hook. f. & Thomson	Rare
	Polyalthia simiarum Benth. & Hook. f.	Rare
Apocynaceae	*Rauvolfia serpentina* (L.) Benth.ex Kurz	Endangered
Araceae	*Raphidophora glauca* Schott	Endangered
Araliaceae	*Trevesia palmata* (DC.) Vis.	Rare
Asclepiadaceae	*Cynanchum tunicatum* (Retz.) Alston.	Rare
Asparagaceae	*Asparagus racemosus* Willd.	Rare
Asteraceae	*Tanacetum cinerarifolium* (Trev.) Sch.-Bip.	Rare
	Anaphalis adnata DC.	Rare
	Dichrocephala integrifolia (L.f.) Kuntze	Rare
Bignoniaceae	*Radermachera xylocarpa* (Roxb.) K.Schum	Rare
Boraginaceae	*Cyanoglossum glochidiatum* Wall. ex Benth.	Rare
Clusiaceae	*Garcinia cowa* Roxb.	Endangered
	Hypericum gaitii Haines	Rare
	Mesua nagassarium (Burm.f.) Kostermans	Endangered
Colchicaceae	*Gloriosa superba* L.	Endangered
Costaceae	*Costus speciosus* (Koen.) J.E.Smith	Rare
Cycadaceae	*Cycas circinalis* L.	Endangered
Dracaenaceae	*Dracaena terniflora* Roxb.	Rare
Gesneriaceae	*Aeschynanthus parasiticus* (Roxb.) Wall. [=Trichosporum grandiflorum D.Don]	Rare
Gnetaceae	*Gnetum ula* Brongn.	Endangered
Lamiaceae	*Ajuga macrosperma* Wall.	Rare
Lauraceae	*Neocinnamomum caudatum* (Nees) Mer.	Rare
	Persea villosa (Roxb.) Kosterm	Rare
	Phoebe wightii Meissn.	Rare
Malpighiaceae	*Aspidopteris hutchinsonii* Haines	Endangered
Melastomaceae	*Sonerilla tenera* Royle	Rare
Meliaceae	*Walsura trifolia* A.Juss.	Rare
Orchidaceae	*Acanthephippium bicolor* Lindl.	Rare
	Bulbophyllum macraei (Lindl.) Reichb.f.	Rare
	B. panigrahianum S.Misra	Rare
	B. polyrhizum Lindl.	Rare
	B. umbellatum Lindl.	Rare
	Calanthe triplicata (Willem)Ames	Rare
	Dendrobium bicameratum Lindl.	Rare
	D. macrostachyum Lindl.	Rare

Family	Threatened taxa	Probable threat status
	D. peguanum Lindl.	Rare
	Diploprora championii (Lindl.) Hook.f.	Rare
	Eria meghasaniensis (S.Misra) S.Misra	Endangered
	Eulophia explanata Lindl.	Rare
	E. graminea Lindl.	Rare
	Goodyera fumata Thw.	Endangered
	G. hispida Lindl.	Endangered
	Habenaria crassifolia A.Rich.	Rare
	H. gibsoni var. foetida Blatt. & Mc Cann.	Rare
	Kingidium deliciosum (Reichb. f.) Sweet	Rare
	Liparis elliptica Wight	Endangered
	L. viridiflora (Bl.) Lindl.	Rare
	Luisia zeylanica (Lindl.) Blume	Rare
	Malaxis ophrydis (Koen) Ormerod	Rare
	M. purpurea (Lindl.) Kuntze	Rare
	Micropera pallida (Roxb.) Lindl.	Rare
	Nervilia aragoana Gaud	Rare
	N. infundibulifolia Blatt. & McCann.	Rare
	Oberonia iridifolia Roxb.	Rare
	O. proudlockii King & Pantl.	Rare
	O. pyrulifera Lindl.	Rare
	Pecteilis gigantea (Sm.) Rafin.	Endangered
	Peristylus goodyeroides (D.Don) Lindl.	Rare
	P. constrictus (Lindl.) Lindl.	Rare
	P. lawii Wight	Rare
	P. parishii Reichb.f.	Rare
	P. plantagineus (Lindl.) Lindl.	Rare
	Spiranthes sinensis (Pers.) Ames	Rare
	Tainia hookeriana King & Prantl.	Rare
	Tropidia angulosa Lindl.	Rare
	Zeuxine affinis Lindl.	Rare
	Z. nervosa (Lindl.) Benth.	Rare
Pittosporaceae	*Pittosporum nepaulense* (DC.) Rehd. & Wilson	Rare
Poaceae	*Bambusa nutans* Wall.	Rare
Polygalaceae	*Salomonia cantoniensis* Lour	Rare
Rosaceae	*Rubus niveus* Sm.	Rare

Economic plants

The Biosphere Reserve harbours many economic plant species of timber, medicine, food, fibre, etc. and sustains large mass of tribal people of the area. The important plant products include, mahua, gums, resins, wax, roots, tubers, flowers, fruits, seeds (Sal, Mahua, etc.), leaves (Sal, Tendu, etc), edible fungi, etc. The secondary products like honey, lac, and silk cucoons are also collected by the local people from the forest to earn their livelihood.

a. Medicinal plants

Similipal Biosphere Reserve rears 552 species of medicinal plants including 70 species of commercially important species (Saxena & Brahmam, 1989). This accounts for Ca. 43 % vascular plant flora of SBR. Some common medicinal plants are given here against corresponding ailments. The abbreviations used to express the parts used are rt=root, st=stem, lf= leaves fl=flower, fr=fruit, sd=seed, brk=bark, wp=whole plant.

Anthelmintics: *Justicia adhatoda* (rt), *Alangium salvifolium* (rt), *Alstonia scholaris* (brk), *Andrographis paniculata* (wp), *Annona squamosa* (sd), *Azadirachta indica* (lf, sd), *Argemone maxicana* (rt), *Bauhinia purpurea* (brk), *Canthium dicoccum* (brk), *Butea monosperma* (sd), *Carica papaya* (lf, fr-latex), *Curcuma longa* (rh), *Solanum xanthocarpum* (wp), *Sphaeranthus indicus* (rt), *Terminalia chebula* (fr), *Tragia incolucrata* (rt), *Vernonia cineria* (sd), *Vitex negundo* (rt), *Mucuna prurita* (fr), *Piper chaba* (fr), *Rhinacanthus nasuta* (rt, lf).

Antidotes: *Abrus precatorius* (rt), *Alangium salvifolium* (rt), *Oxalis corniculata* (lf), *Tephrosia purpurea* (wp), *Aristolochia indica* (rt), *Achyranthes aspera* (fr), *Vanda tessellata* (rt), *Bidens biternata, Cissampelos pareira, Oroxylum indicum.*

Antidiabetics: *Butea monosperma* (lf); *Cassia fistula* (fr), *Senna sofera* (brk, sd), *Curcuma longa* (rh), *Emblica officinalis* (sd), *Ficus benghalensis* (brk), *Ficus glomerata* (brk), *Helecteres isora* (rt, brk), *Syzygium cumini* (sd), *Streptospermum chelonioides* (brk), *Ziziphus xylocarpus* (lf).

Antiseptic : *Gardenia gummifera* (gum), *Tridax procumbens* (lf), *Eclipta prostata* (wp).

Antidiarrhoeics & antidysenterics: *Abutilon indicum* (lf), *Acacia arabica* (lf, brk), *Achyranthes aspera* (wp), *Aristolochia indica* (wp), *Justicia adhatoda* (lf), *Aegle marmelos* (lf, fr), *Albizia lebbeck* (brk, sd), *Alstonia scholaris* (brk), *Annona squamosa* (brk), *Anogeisus latifolia* (twig), *Barringtonia acutangula* (brk), *Kalanchoe pinnata* (lf), *Butea monosperma* (lf), *Centella asiatica* (lf), *Cissampelos pareira* (rt), *Cyperus rotundus* (rh), *Canthium dicoccum* (rt), *Holarrhena pubescens* (brk), *Mangifera indica* (brk), *Mesua ferrea* (fl), *Murraya koenigii* (lf), *Saraca asoca* (brk, fl), *Soymida febrifuga* (brk), *Terminalia chebula* (fr), *Vitex negundo* (fl), *Woodfordia fruticosa* (fl), *Ziziphus jujuba* (brk), *Hemidesmus indicus* (rt), *Streblus taxoides* (latex).

Bone fracture, dislocation, etc.: *Alangium salvifolium* (sd), *Ampelocissus latifolia* (wp), *Cissus quadrangularis* (wp), *Scindaspus officinalis* (wp), *Rubia cordifolia* (rt), *Cuscuta reflexa* (wp).

Cough, bronchitis & asthma: *Justicia adhatoda* (lf), *Flacourtia jangomas* (lf), *Eclipta alba* (lf), *Moringa oleifera* (brk), *Ocimum sanctum* (lf), *Opuntia dilenii* (fr), *Calotropis procera* (fl, lf), *Sphaeranthus indicus* (wp), *Terminalia bellirica* (fr), *Oxalis corniculata* (rt), *Pergularia daemia* (fl), *Clitoria ternatea* (rt), *Desmodium triquetrum* (lf), *Curculigo orchioides* (rh), *Alstonia scholaris* (brk).

Tooth & gum complaints : *Smilax lanaefolia* (rt), *Erycibe paniculata* (wp), *Azadirachta indica* (lf, st), *Vitex negundo* (lf), *Streblus taxoides* (latex).

Cut, wound, sores and boils: *Buchanania lanzan* (brk), *Croton roxburghii* (rt-brk), *Dendropthoe falcata* (lf), *Haldinia cordifolia* (lf), *Vanda testacea* (lf), *Cynodon dactylon* (wp), *Musa paradisiaca* (st, petiole).

Ear complaints: *Allium sativum* (clove), *Vanda testacea* (lf), *Clitoria ternactea* (lf), *Pterospermum acerifolium* (fl), *Ventilago denticulate* (fl), *Curculigo orchioides* (rh).

Emmenagogues & menstrual disorder: *Alstonia scholaris* (brk), *Azadirachta indica* (lf), *Boerhaavia diffusa* (wp), *Cyperus rotundus* (rh), *Gmelina arborea* (rt), *Lawsonia inermis* (brk), *Michelia champaca* (rt), *Mucuna prurita* (sd), *Rauvolfia serpentina* (rt), *Saraca asoca* (brk), *Urtica dioeca* (wp), *Vitex negundo* (lf), *Woodfordia fruticosa* (fl), *Hymenodictyon excelsum* (st-brk), *Asparagus racemosus* (rt), *Euphorbia hirta* (wp), *Lygodium flexuosum* (lf), *Emblica officinalis* (brk).

Eye diseases: *Floscopa scandens* (lf-sap), *Pavetta tomentosa* (lf), *Alternanthera sessiles* (lf), *Commelina benghalensis* (latex).

Febrifuge: *Chlorophytum arundinaceum* (rt), *Croton caudatus* (lf), *Justicia adhatoda* (lf), *Alangium salvifolium* (rt, brk), *Andrographis paniculata* (wp), *Aristolochia indica* (rt, st), *Barringtonia acutangula* (brk), *Calotropis procera* (lf), *Cassia fistula* (rt), *Curculigo orchioides* (rh), *Emblica officinalis* (sd), *Holarrhena pubescens* (brk, sd), *Michelia champaca* (brk), *Moringa oleifera* (rt), *Nyctanthes arbor-tristis* (lf), *Solanum xanthocarpum* (rt), *Soymida febrifuga* (brk), *Strychnus nux-vomica* (brk, sd), *Tephrosia purpurea* (rt), *Terminalia arjuna* (brk), *Toddalia asiatica* (lf, rt-brk), *Vernonia cineria* (wp), *Vitex negundo* (rt, lf, fl), *Rauvolfia serpentina* (rt), *Erycibe paniculata* (brk), *Indigofera cassioides* (rt).

Rheumatism & sciatica: *Asteracantha longifolia* (rt, lf), *Abrus precatorius* (lf), *Asparagus racemosus* (rt), *Calotropis procera* (lf), *Ficus benghalensis* (latex), *Madhuca indica* (sd-oil), *Mesua ferrea* (sd-oil), *Michelia champaca* (brk, sd-oil), *Oroxylum indicum* (rt-brk), *Pergularia extensa* (rt-brk), *Semicarpus anacardium* (fr-oil), *Sida cordifolia* (rt-brk), *Soymida febrifuga* (brk), *Strychnos nux-vomica* (sd), *Tinospora cordifolia* (wp), *Mucuna prurita* (rt), *Vitex negundo* (rt), *Desmodium oojenensis* (brk), *Nyctanthes arbor-tristis* (lf), *Martynia annua* (fr), *Schleichera oleosa* (sd-oil), *Clerodendrum viscosum* (resin), *Acampe papillosa* (rt).

Sedatives: *Acampe oleracea* (lf-juice), *Datura metel* (lf), *Randia dumentorum* (brk), *Rubia cordifolia* (rt), *Semecarpus anacardium* (fr), *Sida cordifolia* (rt), *Solanum nigrum* (wp), *Tectona grandis* (brk), *Xanthium strumarium* (wp), *Elephantopus scaber* (rt)

Skin diseases: *Abrus precatorius* (sd), *Ageratum conyzoides* (lf), *Anacardium occidentale* (sd-oil), *Argemone maxicana* (sd-oil), *Aristolochia indica* (rt), *Butea monosperma* (gum), *Cisampelos pariera* (lf, rt), *Euphorbia nerifolia* (latex), *Jatropha curcas* (sd), *Luffa acutangula* (lf), *Hoya pendula* (lf), *Milletia extensa* (rt), *Schleichera oleosa* (sd), *Stachytarpheta jamaicensis* (rt), *Calotropis procera* (lf, fl, latex), *Martynia annua* (fr), *Clerodendrum viscosum* (lf), *Curcuma longa* (rh), *Azadirachta indica* (lf, brk), *Centella asiatica* (wp), *Vernonia cinerea* (sd), *Madhuca indica* (sd-oil), *Pongamia pinnata* (sd-oil), *Rubia cordifolia* (rt), *Tragia involucrata* (rt), *Barleria strigosa* (lf), *Celastrus paniculata* (fr-oil), *Gnaphalium luteo-album* (lf), *Macaranga indica* (Gum), *Melastoma malabathricum* (lf), *Randia uliginosa* (fr).

Venereal diseases: *Acacia arabica* (brk), *Achyranthes aspera* (rt, lf), *Justicia adhatoda* (rt), *Argyreia nervosa* (rt), *Thespesia lampas* (lf), *Albizia lebbeck* (sd), *Asteracantha longifolia* (rt, sd), *Calotropis procera* (latex), *Clitoria ternatea* (rt), *Elaeodendron glaucum* (brk), *Curcuma zedoaria* (rh), *Ficus religiosa* (brk), *Gmelina arborea* (rt), *Hemidesmus indicus* (rt), *Sida cordifolia* (rt), *Solanum nigrum* (lf), *Strychnos potatorum* (sd), *Tinospora cordifolia* (wp), *Scoparia dulcis* (wp), *Hybanthus enneaspermus* (wp)

Veterinary medicine: *Acacia torta, Alstonia scholaris, Calotropis procera, Clerodendrum viscosum, Colebrookea oppositifolia, Costus speciosus, Martynia annua, Mimosa pudica, Semecarpus anacardium, Vitex negundo, Woodfordia fruticosa.*

b. Timber yielding plants

The main timber plants of the Biosphere Reserve are *Shorea robusta, Schleichera oleosa, Anogeisus latifolia, Terminalia alata, T. arjuna, T. bellirica, Dillenia pentagyna, Haldinia cordifolia, H. latifolia, Mytragyna parvifolia, Mallotus philippensis, Dalbergia latifolia, Desmodium oojeinensis, Xylia xylocarpa, Madhuca longilolia, Mangifera indica, Mesua ferrea, Michelia champaca, Phoebe lanceolata, Pterocarpus marsupium, Sterculia urens, S. villosa, Stereospermum chelonoides, Syzygium cumini, Tamarindus indica, Albizia chinensis, Alstonia scholaris, Diospyros* spp., *Garuga pinnata, Gmelina arborea, Bischofia javanica, Bridelia retusa, Holoptelea integrifolia, Hymenodictyon orixense, Canthium dicoccum, Carallia brachiata, Careya arborea, Cassia fistula, Bombax ceiba, Cochlospermum religiosum, Lagerstroemia parviflora* and *Lannea coromandelica.*

c. Fibre yielding plants

Bauhinia vahlii, Cryptolepis buchananii, Grewia tiliifolia, Ichnocarpus fructescens, Themeda arundinacea, Trema orientalis, Helicteres isora, Kydia calycina, Careya arborea, Eulaliopsis binata, Sida acuta, Urena lobata and *Grewia tiliifolia.*

d. Gum and resin yielding plants

Acacia farnesiana, Bombax ceiba, Anogeisus latifolia, Shorea robusta, Buchanania lanzan, Cochlospermum religiosum, Ficus benghalensis, Sterculia urens, S.villosa, Teminalia bellirica, Lannea coromandelica, Pterocarpus marsupium, Bauhinia roxburghiana, Limonia acidicima.

e. Edible plants

Fruits: *Dillenia aurea, Madhuca indica, Spondias pinnata, Schleichera oleosa, Buchanania lanzan, Citrus medica, Emblica officinalis, Mangifera indica, Tamarindus indica, Ficus glomerata, Artocarpus heterophyllus.*

Seeds: *Bauhinia vahlii, Sterculia urens, Terminalia bellirica.*

Roots and rhizomes: *Colocasia esculenta, Costus speciosus, Curcuma aromatica.*

Flowers: *Indigofera cassioides, Woodfordia fruticosa.*

Leaves and shoots: *Bauhinia purpurrea, Portulaca oleracea, Leucas aspera, Ipomoea aquatica.*

f. Fodder yielding plants

Apluda mutica, Bothriochloa pertusa, Brachiaria ramosa, Capillipedium assimile, Cynodon dactylon, Digitaria spp., *Eleusine indica, Eragrostis tenella, Isachne globosa, Panicum* spp., *Paspalum scrobiculatum, Setaria* spp., *Themeda* spp.

g. Oil yielding plants

Madhuca indica, Pongamia pinnata, Riccinus communis, Jatropha curcas, Schleichera oleosa, Shorea robusta, Celastrus paniculatus, Mallotus philippensis, etc. yield oil, which is used for cooking, lighting, soap making and other purposes. essential oil from *Hyptis suaveolens, Michelia champaca, Cymbopogon martinii, C. flexuosus, Vetiveria zizanioides, Cymbopogon* sp., *Pandanus odoratissimus,* etc. yield essential oil mainly used in perfumes and cosmetics.

h. Dye yielding plants

Acacia fernesiana (brk), *Butea monosperma* (fl), *Mallotus philippensis* (fr), *Morinda coreia* (rt-brk), *Nyctanthes arbor-tristis* (fl), *Rubia cordifolia* (rt) and *Terminalia alata* (brk).

i. Piscicidal plants

Barringtonia acutangula, Careya arborea, Cleistanthus collinus, Milletia extensa, Strychnos nux-vomica are some piscicidal plants.

j. Wild ornamentals

Aerides multiflora, Cleisostoma appendiculatum, Cymbidium aloefolium, C. bicolor, Dendrobium

aphyllum, D. crepidatum, D. formosum, D. moschatum, D. nobile, D. transparens, Rhyncostylis retusa, Thunia bractiata, Vanda tesselata, V.testacea, Acanthephippium bicolor, A. sylhetense, Calanthe triplicata, Goodyera hispida, Habenaria comelinifolia, H. plantaginea.

k. Avenue plants

Albizia lebbeck, Azadirachta indica, Cassia fistula, Senna siamea, Ficus benghalensis, F. religiosa, Lagerstroemia parviflora, Polyalthia longifolia, Pongamia pinnata, Syzygium cumini, Tamarindus indica, etc.

Major threats

The ruthless exploitation ravages done to the SBR during British period (for ennerating revenue and supplying timber for rail road construction as well as killing of tigers to provide security to the wood cutters) perhaps opened all the doors of this inaccessible forest of past to receive all kinds of threats from different directions as well as from inside by the settled villagers. The 65 villages inside SBR and 1121 villages around 10 km of its boundary exsert tremendous biotic pressure on SBR as they depend upon this forest for fuel wood and other daily requirements. Fire is an usual feature and always deliberately set by people to facilitate cultivation (Jhum), hunting, cattle rearing, collection of Sal seeds, Mahua flowers, etc. The regular fire not only destroys the ground vegetation but also pushes the habitat specific herbs into verge of extinction. Illicit felling of trees is a usual phenomenon in SBR and the unscrupulous wood traders take tons of fuel wood and timber out of the forest every day. Lack of practical check on over exploitation of drug plants and threatened species may further aggravate the situation. Habitat loss due to cleaning of forests in turn leads to disappearance of the supported epiphytes, climbers and lianas on the trees. Openness of vegetation, forest fire and soil erosion all adversely affect the microflora on soil and tree trunk and this in turn leads to failure of germination in mycorrhiza dependant seeds like that of Orchids. Poaching of animals and birds and killing of insects by forest fire adversely affects pollination and fruit dispersal. Construction of roads (for the purpose of tourism) has also brought about considerable loss of vegetation. The mining activities and ceramic industries at the foothills of Similipal also affect its forest resources (Tripathy, 1997). Gradual decrease of rainfall at the rate of 10 cm per every phase of 33-year cycle of rainfall on Mayurbhanj district reported by Pujari (1997) is a concern for the very existence of flora of SBR.

Conservation measures

Despite prolonged exploitation, pernicious practices of 'Jhum', forest fire and poaching the Biosphere Reserve represents the richest gene pool of the state and harbours high taxic diversity due to representation from all groups of plants and animals. The area harbours c. 50 % species and genetic diversity of vascular plants of the state, many threatened plant taxa, wild relatives of crop plants, economic plants and most of the medicinal plant species of Orissa. While the change in species diversity is least realised due to meagre survey reports in the past, drastic reduction in resources and consequent habitat loss is evident from the historical genesis of SBR. The conservation measures started with the protection of the tigers in the northern part of SBR, which was declared as 'Similipal Tiger Reserve' in 1973. Subsequently the core area of the Tiger Reserve was declared as 'Similipal National Park' (SNP) in August 1980 and in 22nd June 1994 the whole Similipal forest area was declared as the 8th Biosphere Reserve in India for the conservation of entire range of living resources and the ecosystem. Thus, SBR includes both the Tiger Reserve and National Park and this has enhanced its national value. In addition to Tiger Project, the project of Crocodile and Project Elephant run side by side within the area. The main emphasis on conservation

within SBR is the species (Tiger) in STR, habitat in SNP and finally the ecosystem and sustainable utilisation of natural resources in SBR. The forest dwellers are allowed for collection of forest products for their daily requirements from the Biosphere Reserve.

A detail history of management of SBR and list of present management practices and needs are given by Prusty (1997), Patnaik (1997), Raut & Behera (1997) and the ways of sustainable utilisation of forest rsources is suggested by Parida (1997). Successful conservation of ecosystem, habitat and species is possible through reduction of dependency of local people on the forests and enforcement of the laws (protection acts) in right earnest to curb the desctuctive and counteractive forces. This requires efficient administration supplemented by people participation towards sustainable utilisation of natural resources. An up to date status and distribution of the endangered and commercially exploited species must be documented and maintained for all areas and their illegal exploitation need to be curbed. Unscrupulous tree felling, forest fire, illegal poaching; practice of 'Jhum', over exploitation of medicinal and commercial plants, unscientific plantations, etc should be guarded to save SBR. Effective measures to prevent and fight forest fire is required to save valuable resources from burning out, degradation of habitat and loss of species. Networking of SBR with other protected areas of the country should be done allowing free flow of genes and equilibrium between addition and extinction of species in this Biosphere Reserve.

Generation of awareness among the local communities regarding environment and about the services that forests and wildlife render towards their sustenance in the long run is necessary for conservation of biodiversity. The latest techniques of micropropagation and rehabilation of endangered plants in SBR should also be tried. Partial conservation is also possible through people participation as per the Joint Forest Management Resolution of Govt. of Orissa in 1996, where the "Van Sarankshyan Samities" are empowered to collect and sell the minor forest produce from the portion of forests protected by them.

To reduce dependency of local people on the forests, they are required to be encouraged alternate livelihood though bee keeping, silk moth rearing, rope making (using available Sabai grass), plate making (using Sal leaves), cultivating medicinal plants, Orchids and ornamental plants, etc. They should also be encouraged for scientifically planned social forestry to meet their own fuel wood requirements and the plantations should restore 3-tier microclimate of the forest. Revenue generated through ecotourism can be utilised for the purpose of conservation of biodiversity.

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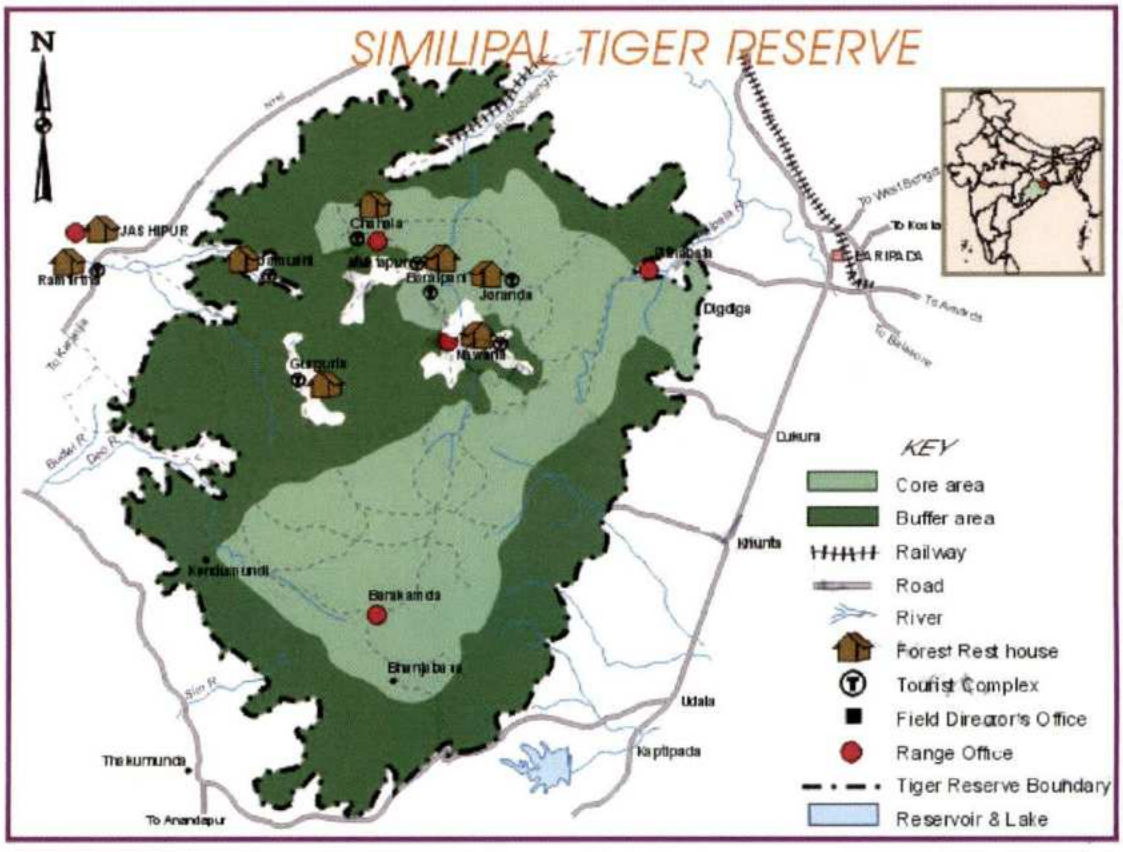


Calotropis procera Courtesy : P Singh

SALIENT FEATURES

The assessment of 2002 data reveals that area under forest cover is 2,658 km^2, which is about 97% of the geographic area of the Reserve. Of this, very dense forest covers 119km^2, moderately dense forest covers 2,304 km^2 and open forest covers 235 km^2. The remaining area is non-forest. The density-wise forest cover for the assessment years 1997, 2000 and 2002 along with the changes during 1997-2002 as assessed in this study is given in Table. It is seen that during the period from 2000-2002, 1 km^2 of moderately dense forest cover changed to open forest cover while during 1997 to 2000 there was no change in the forest cover.

Forest cover in the Outer Surround of Similipal Tiger Reserve (1997-2002)

(Area in km^2)

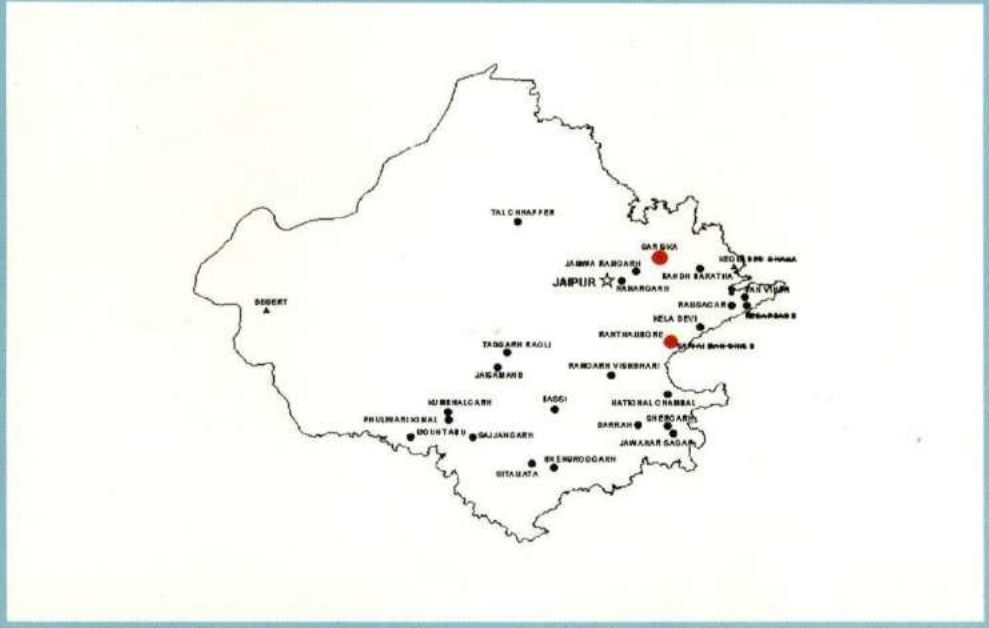
Category	Assessment year			Net Change (1997-2002)
	1997	2000	2002	
(A) Very dense Forest	-	-	-	-
(B) Moderately Dense Forest	423	423	423	-
(C) Open Forest	255	255	255	-1
Total Forest (A+B+C)	**678**	**678**	**677**	**-1**
Scrub	6	6	6	-
Non-Forest	1,911	1,911	1,912	1
Total Area	**2,595**	**2,595**	**2,595**	

The table shows a decrease of 1 km^2 in moderately dense forest during the period 1997-2002. The likely reason for the change is biotic pressure from the settlement.

Forest in Sariska Tiger Reserve
(Courtesy: Sanjeev Kumar, ZSI, Jodhpur)

RAJASTHAN

- **Ranthambhore Tiger Reserve**
- **Sariska Tiger Reserve**



Ranthambhore Tiger Reserve

Anshu Kumar Shrivastava & V Singh
Botanical Survey of India, Jodhpur

Ranthambhore tiger reserve/ national park is about 10 km to the northeast of Sawai Madhopur town, in Rajasthan. It is about 360 km from Delhi and 130 km from Jaipur on Delhi-Mumbai railway line. It lies between Longitude 76°16' to 77°14' E and Latitude 25°41' to 26°22' N. The area is dotted with 15 villages, has subtropical climate. It consists of rolling hills, extending from southwest to northeast direction, interspersing plateaus, seasonal streams, lakes, tanks, artificial bounds etc. The terrain is hilly with numerous valleys (e.g. Kacheda, Anatpura, Kamaldhar, Saleshwar, Darah Dhoondiamal and Bhakola ka bira) and flat hilltop known as '*Dangs*'. It varies from gentle sloping hills to a vertical rocky escarpment, broad valleys with flat and vast plains to narrow and deep gorges, offer an excellent habitation, suitable for rich biodiversity. Prior to independence Ranthambhore forests were the hunting ground of Maharajas of Jaipur. After independence in 1955, the area was declared as Sawai Madhopur wildlife sanctuary and subsequently in 1975 it was included as a potential area under 'Project Tiger'. In 1980, it was notified as a national park. The reserve consisting of five-forest blocks spreading over an area of about 392.5 sq km, is a classic example of rare amalgamation of natural history and archaeology. The famous Jogi mahal on Padma talao and old palace on Raj-bag are noteworthy. The historic fort of Ranthambhore, which enlivens the memory of heroic Hameer, and famous Ganesh temple 'Ranth Bhanwar' add to the grandeur to this reserve.

CLIMATE

The climate of the region is sub-tropical dry, with distinct cold, hot and rainy season. The summer season is from March to the third week of June. May and June being the hottest months when temperature goes up to 47°C. The average temperature during hot season is about 41°C. The rainy season, which follows, lasts till the third week of September. About 92% of total rain is received from June to September. The variation in annual rainfall and the number of rainy days vary from year to year. The average annual rainfall is about 873 mm. The highest annual rainfall recorded was 1475 mm in 1992. October and November months are a transition and may be called the autumn season. The humidity is relatively low in comparison to rainy season. The winter season is from December to February. Fall in temperature is after the middle of the November. January is the coldest month when sometimes the night temperature goes down to 2°C. The average day temperature is about 20°C.

VEGETATION

Ranthambhore national park has a variety of plant communities, which change according to season. The park is luxuriously green during August, with thick undergrowth of ephemerals. The open savannahs are covered with different grass associations providing invincible camouflage to the herbivores. As winter approaches, the grass turns pale and the foliage becomes copper-brown. In the valleys, however, the

Forest of *Anogeissus pendula*

trees have a rich growth of larger evergreen trees and they form a thick canopy throughout the year.

The forest of the reserve falls under the broad category of "Dry Tropical Forest". Vegetation is generally concentrated along the eastern slopes of the Aravallis from south towards north. The forest cover varies in composition and quality. According to Champion & Seth (1968), the forests of the reserve are classified under group 5 & 6 i.e. Tropical dry deciduous and Tropical thorn forest. *Anogeissus pendula* is the most dominant tree species, covering over 80% area of the forests. *Boswellia serrata, Sterculia urens, Lannea coromandelica, Acacia leucophloea, Diospyros montana,* grows on the rocks of Aravallis, Delhi and Vindhyan formations scattered over the reserve.

On the basis of their composition, the forests of Ranthambhore can be grouped as follows :

1. **Tropical dry deciduous forest**
   (A) *Anogeissus pendula* forest
   (B) *Anogeissus pendula* scrub forest
   (C) *Butea monosperma* forest
   (D) Dry mixed deciduous forest
2. **Tropical thorn forest**
   Ziziphus scrub forest

Tropical dry deciduous forest

(A) *Anogeissus pendula* forest:

Anogeissus pendula is the dominant tree species of the reserve, often found in pure stands on the slopes of the hills. The usual trees species associated with it are :

Boswellia serrata, Sterculia urens, Lannea coromandelica, Diospyros montana, Bauhinia racemosa, etc. *Diospyros melanoxylon, Mangifera indica, Mallotus philippensis, Cordia dicotoma, Bridelia retusa, Mitragyna parvifolia, Hollarrhena pubescens, Morinda tomentosa, Wrightia arborea, W. tinctoria* and *Moringa olifera,* etc. are frequently met with it.

On flat hilltops, i.e. on plateaus, the depth of the soil is very shallow and due to continuous erosion of the soil, edges of the hills and hill slopes get exposed with rocky surface of big boulders. The vegetation is very sparse and growth of plant is stunted. The common species in these areas include *Anogeissus pendula, Boswellia serrata, Lannea coromandelica, Sterculia urens,* etc. Stemmed and bushy forms of *Dichrostachys cinerea* var. *indica, Euphorbia caducifolia, Grewia flavescens, G. tenax* and *Ziziphus nummularia* are also commonly found.

The vegetation on steep slopes is very scanty and the plants like *Euphorbia neriifolia, Sterculia urens* are found scattered here and there. The gentle slopes, however, maintain comparatively luxuriant vegetation due to better soil formation and water holding capacity. *Anogeissus pendula* is the most dominant tree species in these habitats. The other typical dry deciduous elements are *Acacia catechu, A. leucophloea, Boswellia serrata, Butea monosperma, Cassia fistula,* etc.

Undergrowth is generally moderate to scanty depending upon the light condition on the forest floor and soil formation. *Grewia flavescens, G. tenax, Capparis separia, Helacteres isora, Dichrostachys cinerea* var. *indica* and *Ziziphus* spp. are generally noticed here. Woody climbers like *Ichnocarpus frutescence, Cocculus hirsutus, Mucuna pruriens, Abrus precatorius, Pergularia daemia, Gymnema sylvestris* and *Asparagus racemosus,* etc. grow luxuriantly and form the forest dense and impenetrable at different points.

(B) *Anogeissus pendula* scrub forest:

Large areas of *Anogeissus pendula* forest have been degraded due to the severe biotic interference in the vicinity of villages and peripheral areas of the reserve. The topsoil of this region has been washed away due to exposure and their productivity has greatly suffered. Regeneration is completely absent in these forests. The growing stock mostly consists of stunted and crooked *Anogeissus pendula* and its associates, the density of them is extremely poor. Due to continuous grazing the intensity of grasses and ground flora is very poor. Inferior species like *Euphorbia neriifolia, Dichrostachys cinerea* var. *indica, Acacia catechu, Grewia flavescens,* etc have invaded these forest.

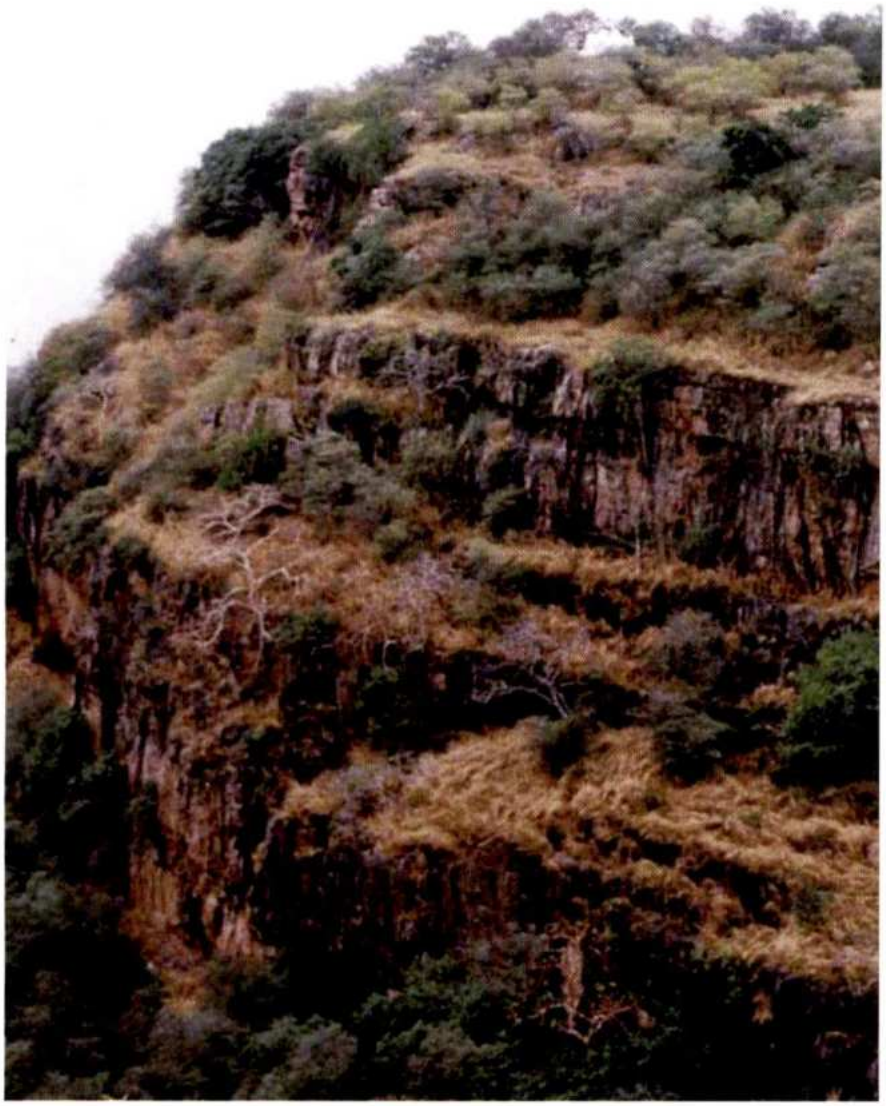
(C) *Butea monosperma* forest:

On lower hill-slopes and flat ground (e.g. near Berda, Anatpura), almost pure associations of *Butea monosperma* are found. The other associates of it are: *Acacia leucopheloea, Anogeissus pendula, Bombax ceiba, Capparis sepiaria, Cassia fistula, Diospyros melanoxylon* and occasionally *Capparis decidua,* etc.

The under growth is thin and chiefly consists of *Grewia flavescens, G. tenax, Ziziphus nummularia,* etc. The ground cover is mostly grassy and consists of *Apluda mutica, Dichanthium annulatum, Eragrostis* spp., *Heteropogon controtus, Iseilema laxum, Themeda quadrivalvis,* etc.

(D) Dry mixed deciduous forest:

The main costituent of this forest is *Anogeissus pendula,* the other associates are: *Boswellia serrata, Bridelia retusa, Diospyros melanoxylon, Flacourtia indica, Lannea coromandelica, Mallotus philippensis, Mitragyna parvifolia, Sterculia urens* and *Terminalia bellerica,* etc. Many shrubby species like *Carissa congesta, Grewia flavescens, G. tiliifolia, Melhania futteyporensis* and *Ziziphus nummularia,* etc. are commonly met with. Common climbers are: *Asparagus racemosus, Cardiospermum halicacabum, Cayratia trifolia, Gymnema sylvestre, Ichnocarpus frutescense,* etc. *Cuscuta hyalina* and *Cuscuta reflexa* stem parasites were also noticed on many species.



Degraded hill with *Anogeissus pendula* at top

The ground cover includes *Alysicarpus vaginalis, Blepharis maderaspatensis, Blumea membranacea, Corchoru.* spp., *Euphorbia* spp., *Evolvulus alsinoides, Indigofera cordifolia, I. linnaei, Leucas cephalotes, Melhania futteyporensis, Peristrophe paniculata, Sida cordata,* etc. The common sedges and grasses are: *Bulbostylis barbata, Cyperus laevigatus, C. pygmaeus, C. rotundus, Eleocharis atropurpurea, Fimbristylis miliacea, Apluda mutica, Aristida adscensionis, Cenchrus ciliaris, Melanocenchris jacquemontii* and *Tragus roxburghii,* etc.

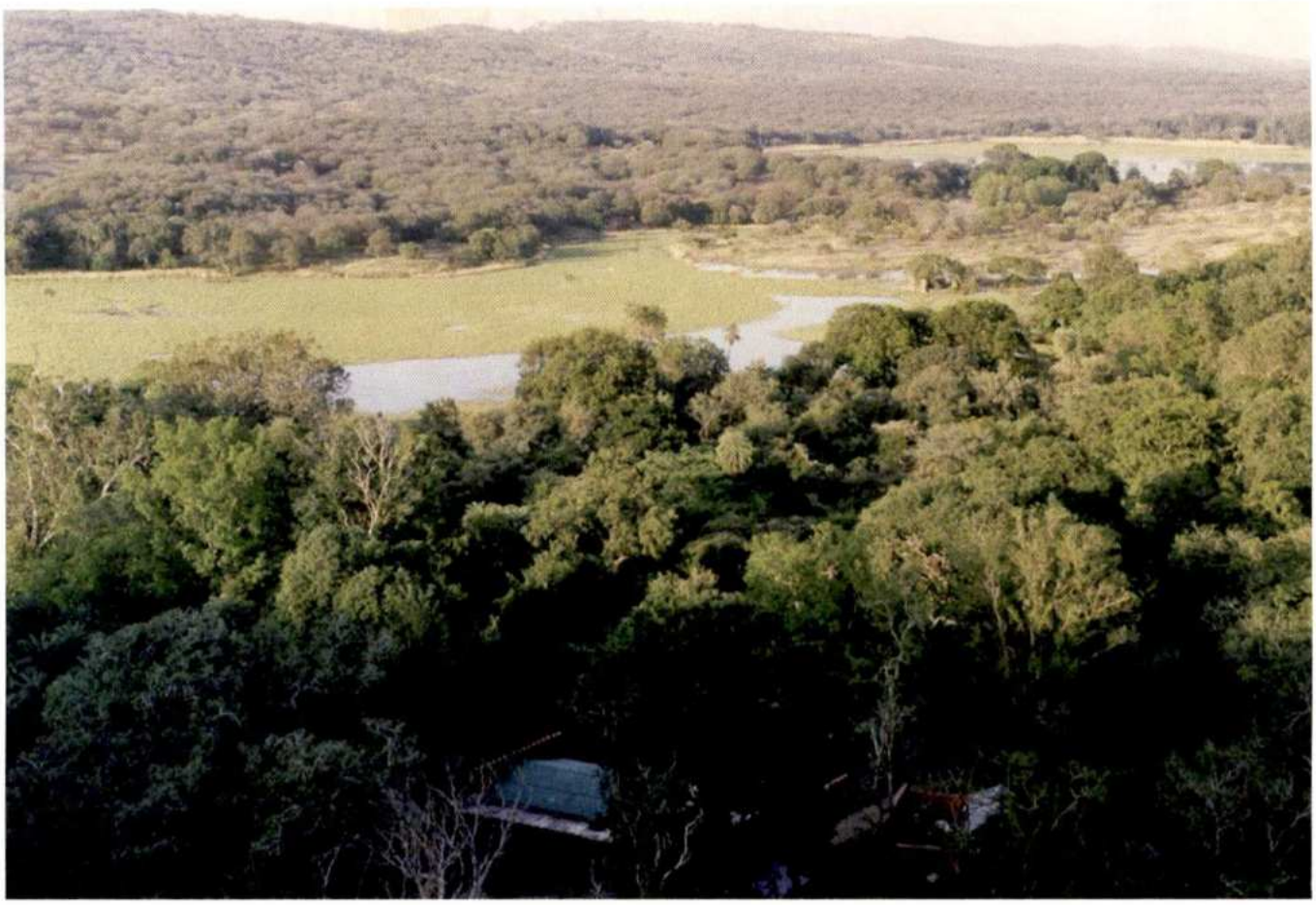
Tropical thorn forest :

This type of forest spreads over the major portion of semi-arid regions of the reserve, 'A' & 'B' block of Khandar comes under this group. The woody growth in this region is of all size from the trees down to dwarf shrubs, with no differentiation in vegetation cover. A thin growth of annual grasses found after rain, perennial grasses mostly grow in clumps. Thorny species like *Acacia nilotica, A jacquemontii, Capparis decidua, Prosopis juliflora, P. cinerarea, Ziziphus nummularia* are predominant.

***Ziziphus* scrub forest:**

The vegetation in this type of forest is generally thorny and woody. The growing stock is irregular and densely erratic which consists of *Ziziphus nummularia* as dominant species. The associates of it are: *Acacia catechu, Acacia leucophloea, Butea monosperma, Capparis decidua, Dichrostachys cinerea* var. *indica, Prosopis juliflora,* etc. The undergrowth is generally moderate and chiefly consists of *Justicia adhatoda, Barleria prionitis, Capparis decidua, Grewia, flavescens, G. tenax* and *Ziziphus nummularia,* etc. Common climbers are: *Asparagus racemosus, Gymnema sylvestre, Pergularia daemia,* etc.

The ground cover is thin due to heavy biotic pressure. Common grasses and herbs are: *Apluda mutica, Aristida adscensionis, Desmostachya bipinnata, Corchorus* spp., *Leucas cephalotes, Ocimum canum* and *Senna tora,* etc. These forests represent a retrogression



Mixed Forest

of mixed deciduous forests due to continuous erosion of the top soil and biotic interference; regeneration of principal species is generally absent in it.

Foot hill / Ground flora:

The foot hills/grounds are characterized with fertile soil, sufficient watercourses and maximum humidity, due to presence of nalahs. As a result, it provides thick and luxuriant vegetation. The trees, shrubs and undershrubs commonly found in these habitats are: *Bauhinia racemosa, Barleria prionitis, Bombax ceiba, Bridelia retusa, Butea monosperma, Cassia fistula, Cordia dichotoma, Diospyros montana, D. melanoxylon, Ficus benghalensis, F. racemosa, Flacourtia indica, Grewia flavescens, Helicteres isora, Hibiscus lobatus, Justicia adhatoda, Mallotus philippenseis, Mangifera indica, Manilkara hexandra, Melhania futteyporensis, Mitragyna parvifolia, Morinda pubescens, Phoenix sylvestris, Plumbago zeylanica, Syzygium cumini,* etc. Many twining and climbing herbs, undershrubs noted are: *Abrus precatorius, Alysicarpus vaginalis, Cardiospermum helicacabum, Cayratia trifolia, Cocculus hirsutus, Ichnocarpus frutescens, Rhynchosia minima* and species of Cucurbits shows better appearance in these habitats. Numerous taxa of Poaceae are noted here, some of the dominant species are : *Aristida adscensionis, Cenchrus ciliaris, Chloris dolichostachya, Dicanthium annulatum, Eragrostis* spp., *Heteropogon contortus, Saccharum spontaneum, Vetiveria Zizanioides,* etc.

AQUATIC / MARSHY VEGETATION

A large number of water reservoirs, tanks, streams and

lakes like Padam tatao, Rajbagh, Malik talab, Lahpur etc and two big dams Galaisagar and Mansarovar provide variable emporia for the growth hydrophytes throughout the reserve. The species which form typical aquatic vegetation of permanent nature are: *Ceratophyllum demersum, Hydrilla verticillata, Ipomoea aquatica, Lagarosiphon alternifolia, Limnophila indica, Ludwigia adscendens, Monocharia vaginalis, Najas graminea, Nymphaea nauchali, N. pubescens, Nelumbo nucifera, Nymphoides hydrophylla, N. indica, Ottelia alismoides, Potomogeton crispus, Spirodela polyrhiza, Potamogeton crispus, Trapa natans* var. *bispinosa, Utricularia stellaris, Zannichellia palustris,* etc. Along the edges of reservoirs *Ammannia baccifera, A. multiflora, Bacopa monnieri, Canscora diffusa, Caesulia axillaris, Coldenia procumbens, Cyperus pongorei, Echinochloa colona, Fimbristylis dypsacea, F. sieberiana, F. squamosa, Hygrophila serpyllum, Murdania nudiflora, Oryza rufipogon, Polygonum barbarum, Rotala densiflora, Typha angustata,* etc are found growing luxuriantly. *Polygonum plebeium* forms dry bed carpet along the edges.

In marshland and low lying habitats, the species like: *Aeschynomene indica, Ammannia baccifera, Bergia ammannioides, Cammelina erecta, C. forskalaei, Dentella repens, Limnophila indica, Phyla nodiflora, Potentilla supina, Sutera dissecta* and many sedges and grasses gorw predominantly.

ENUMERATION

DICOTYLEDONS

ANNONACEAE

Annona squamosa L.

MENISPERMACEAE

Cissampelos pareira L.
var. **hirsuta** (Buch.-Ham. ex DC.) Forman
Cocculus hirsutus (L.) Diels

NYMPHAEACEAE

Nymphaea nauchali Burm. f.
N. pubescens Willd.

NELUMBONACEAE

Nelumbo nucifera Gaertn.

PAPAVERACEAE

Argemone mexicana L.

BRASSICACEAE

Farsetia hamiltonii Royle

CLEOMACEAE

Cleome scaposa DC.
C. viscosa L.

CAPPARACEAE

Capparis decidua (Forssk.) Edgew.
C. sepiaria L.
var. **vulgaris** Hook. f. & Thoms.
Crateva adansonii DC.
Maerua oblongifolia (Forssk.) A. Rich.

VIOLACEAE

Hybanthus enneaspermus (L.) Muell. Arg

FLACOURTIACEAE

Flacourtia indica (Burm. f.) Merr.

CARYOPHYLLACEAE

Polycarpaea corymbosa (L.) Lam.

POLYGALACEAE

Polygala erioptera DC.

PORTULACACEAE

Portulaca oleracea L.
P. quadrifida L.

MALVACEAE

Abelmoschus manihot (L.) Medik. subsp. **tetraphylla** (Roxb. ex Hornem.) Borss.
var. **pungens** (Roxb.) Hochr.

Abutilon bidentatum Hochst. ex A. Rich.
A. bidentatum Hochst. ex A. Rich.
var. **major** (Blatt. & Hallb.) Bhandari
A. indicum (L.) Sweet
A. ramosum (Cav.) Guill. & Perr.
Fioria vitifolia (L.) Mattei
Hibiscus lobatus (J.A. Murr.) Kuntze
H. micranthus L. f.
Malvastrum coromandelianum (L.) Garcke
Pavonia zeylanica Cav.
Sida acuta Burm. f.
S. cordata (Burm. f.) Borss.
S. cordifolia L.
S. mysorensis Wight & Arn.
S. ovata Forssk.
S. rhombifolia L.

BOMBACACEAE

Bombax ceiba L.

STERCULIACEAE

Helicteres isora L.
Melhania futteyporensis Munro ex Mast.
Melochia corchorifolia L.
Sterculia urens Roxb.
Waltheria indica L.

TILIACEAE

Corchorus aestuans L.
C. capsularis L.
C. depressus (L.) Stocks
C. fascicularis Lam.
C. olitorius L.
C. tridens L.
C. trilocularis L.
Grewia asiatica L.
G. flavescens A. Juss.
G. tenax (Forssk.) Fiori
G. tilliifolia Vahl
G. viscosa Willd.
Triumfetta rotundifolia Lam.
T. rhomboidea Jacq.

MALPIGHIACEAE

Hiptage benghalensis (L.) Kurz

ZYGOPHYLLACEAE

Fagonia bruguieri DC.
Tribulus terrestris L.

OXALIDACEAE

Biophytum sensitivum DC.
Oxalis corniculata L.
O. corymbosa DC.

BALSAMINACEAE

Impatiens balsamina L.

RUTACEAE

Aegle marmelos (L.) Corr.
Citrus aurantium L.
Murraya koenigii (L.) Spreng.

SIMAROUBACEAE

Ailanthus excelsa Roxb.

BALANITACEAE

Balanites roxburghii Planch.

BURSERACEAE

Boswellia serrata Roxb. ex Coleb.
Commiphora wightii (Arn.) Bhandari

MELIACEAE

Azadirachta indica A. Juss.

CELASTRACEAE

Maytenus senegalensis (Lam.) Excell.

RHAMNACEAE

Ziziphus glabrata Heyne ex Roth
Z. hysudrica (Edgew.) Hole
Z. mauritiana Lam.
Z. nummularia (Burm. f.) Wight & Arn.
Z. xylopyrus (Retz.) Willd.

VITACEAE

Ampelocissus latifolia (Roxb.) Planch.
Cayratia trifolia (L.) Domin

SAPINDACEAE

Cardiospermum halicacabum L.

ANACARDIACEAE

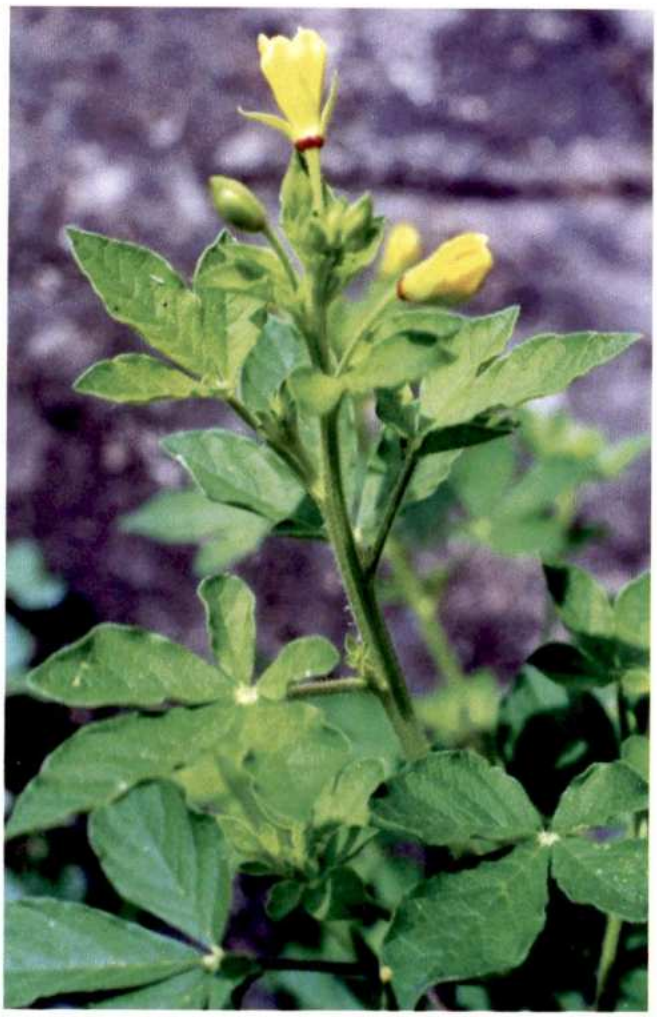
Lannea coromandelica (Houtt.) Merr.
Mangifera indica L.

MORINGACEAE

Moringa olifera L.

FABACEAE

Abrus fruticulosus Wall. ex Wight & Arn.
A. precatorius L.
Aeschynomene indica L.
Alysicarpus bupleurifolius (L.) DC.
A. hamosus Edgew.
A. monilifer (L.) DC.
A. roxburghianus Thoth. & Pramanik
A. scariosus (Rottl. ex Spreng.) Grah. ex Thw.
A. vaginalis (L.) DC.
Butea monosperma (Lam.) Taub.
Cajanus scarabaeoides (L.) A. Thouars.
Crotalaria burhia Buch.-Ham. ex Benth.
C. hebecarpa (DC.) Rudd.
C. hirsuta Willd.
C. Juncea L.
C. medicagenia Roth
C. triquetra Dalz.
Cyamopsis tetragonoloba (L.) Taub.
Dalbergia sissoo Roxb.
Desmodium gangeticum (L.) DC.
D. repandum (Vahl) DC.
D. triflorum (L.) DC.
D. velutinum (Willd.) DC.
Erythrina suberosa Roxb.
Indigokra
I. cordifolia (Heyne ex Roth)
I. hochstetteri Baker
I. asteragalino DC.
I. linifolia (L.f.) Retz.
I. linnaei Ali
I. oblongifolia Forssk.
I. sessiliflora DC.
I. tinctoria L.
I. tirta L. f.



Cleome viscosa

Mucuna pruriens (L.) DC.
Pongamia pinnata (L.) Pierre
Rhynchosia minima (L.) DC.
var. **laxiflora** (Camb.) Baker
Sesbania bispinosa (Jacq.) Wight
Smithia conferta J. E. Smith
Tephrosia purpurea (L.) Pers.
T. strigosa (Dalz.) Sant. & Mahesh.
T. uniflora Pers.
T. villosa (L.) Pers.
Teramnus labialis (L. f.) Spreng.
Vigna aconitifolia (Jacq.) Marechal.
V. radiata (L.) Wilczek
V. trilobata (L.) Verdc.

Zornia gibbosa Span.

CAESALPINIACEAE

Bauhinia racemosa Lam.
B. variegata L.
Caesalpinia bonduc (L.) Roxb.
Cassia fistula L.
Chamaecrista absus (L.) Irwin & Barneby
C. pumila (Lam.) Singh
Delonix regia (Bojer ex Hook.) Raf.
Parkinsonia aculeata L.
Senna obtusifolia (L.) Irwin & Barneby
S. occidentalis (L.) Link
S. tora (L.) Roxb.
Tamarindus indica L.

MIMOSACEAE

Acacia catechu (L.f.) Willd.
A. leucophloea (Roxb.) Willd.
A. nilotica (L.) Del. subsp. **indica** (Benth.) Brenan
A. senegal (L.) Willd.
Albizia lebbeck (L.) Benth.
Dichrostachys cinerea (L.) Wight & Arn.
var. **indica** Brenan & Brummitt
Leucaena latisiliqua (L.) Gillis
Mimosa pudica L.
M. himalayana Gamble
Pithecellobium dulce (Roxb.) Benth.
Prosopis cinerarea (L.) Druce
P. juliflora (Sw.) DC.

ROSACEAE

Potentilla supina L.

COMBRETACEAE

Anogeissus pendula Edgew.
Terminalia bellirica (Gaertn.) Roxb.
T. cuneata Roth

MYRTACEAE

Syzygium cumini (L.) Skeels

LYTHRACEAE

Ammannia baccifera L.
A. multiflora Roxb.
Lawsonia inermis L.

ORAGRACEAE

Ludwigia adscendens (L.) Hara

TRAPACEAE

Trapa natans L. var. **bispinosa** (Roxb.) Makino

CUCURBITACEAE

Blastania garcinii (Burm. f.) Cogn.
Bryonopsis laciniosa (L.) Laud.
Coccinia grandis (L.) Voigt
Cucumis callosus (Rottl.) Cong.
Diplocyclos palmatus (L.) Jeffry
Luffa acutangula (L.) Roxb.
var. **amara** C.B. Clarke
L. echinata Roxb.
Melothria maderaspatana (L.) Cogn.
Momordica balsamina L.
M. charantia L.
M. dioica Roxb. ex Willd.
Trichosanthes bracteata (Lam.) Voigt
T. cucumerina L.

PASSIFLORACEAE

Passiflora foetida L.

CACTACEAE

Opuntia elatior Mill.

AIZOACEAE

Trianthema portulacastrum L.

MOLLUGINACEAE

Glinus lotoides L.
Mollugo nudicaulis Lam.
M. pentaphylla L.

ALANGIACEAE

Alangium salvifolium (L. f.) Wang

RUBIACEAE

Borreria articularis (L.f.) F. N. Will.
B. pusilla (Wall.) DC.
Dentella repens (L.) J. & G. Forst.
Gardenia turgida Roxb.
var. **montana** (Roxb.) Hook. f.

Cassia fistula

Haldina cordifolia (Willd. ex Roxb.) Ridsd.
Hedyotis corymbosa (L.) Lam.
Mitragyna parvifolia (Roxb.) Korth.
Morinda tomentosa Heyne ex Roth
Oldenlandia pumila (L.f.) DC.
Xeromphis spinosa (Thunb.) Keay

ASTERACEAE
Acanthospermum hispidum DC.
Ageratum conyzoides L.
Amberboa ramosa (Roxb.) Jafri
Bidens biternata (Lour.) Merr. & Sherff
Blainvillea acmella (L.) Philip.
Blumea eriantha DC.
B. laciniata (Roxb.) DC.
B. membranacea DC.
Caesulia axillaris Roxb.
Dicoma tomentosa Cass.
Echinops echinatus Roxb.
Eclipta prostrata (L.) L.
Emilia sonchifalia (L.) DC.
Glossocardia bosvallea (L.f.) DC.
Gnaphalium leuto-album L.
G. leuto-album L.
var. **affine** (D. Don) Koster
G. polycaulon Pers.
Grangea maderaspatana (L.) Poir.
Lactuca remotiflora DC.
Launaea aspleniifolia (Willd.) Hook. f.
L. procumbens (Roxb.) Ramayya & Rajgopal
L. residifolia (L.) Kuntze
Parthenium hysterophorus L.
Pulicaria angustifolia DC.
Sclerocarpus africanus Jacq. ex Murr.
Sphalranthus indicus L.
Sonchus wightianus DC.

Tridax procumbens L.
Xanthium strumarium L.

PLUMBAGINACEAE

Dyerophytum indicum (Gibs. ex Wight) Kuntze
Plumbago zeylanica L.

SAPOTACEAE

Mimusops hexandra (Roxb.) Dub.

EBENACEAE

Diospyros melanoxylon Roxb.
D. montana Roxb.

OLEACEAE

Nyctanthes arbortristis L.

APOCYNACEAE

Carissa congesta Wight
Catharanthus pusillus (Murr.) G. Don.
Holarrhena pubescens (Buch.-Ham.) Wall. ex G. Don
Ichnocarpus fratescens (L.) R. Br.
Tabernaemontana divaricata (L.) R. Br.
Thevetia peruviana (Pers.) K. Schum.
Wrightia tinctoria R. Br.
W. arborea (Denst.) Mabb.

ASCLEPLADACEAE

Calotropis procera (Ait.) Ait. f.
Ceropegia bulbosa Roxb.
C.bulbosa Roxb.
var. **lushii** (Grah.) Hook. f.
Gymnema sylvestre (Retz.) R. Br. & Schult.
Leptadenia pyrotechnica (Forssk.) Decne.
Pergularia daemia (Forssk.) Chiov.
P. tomentosa L.

PERIPLOCACEAE

Cryptostegia grandiflora R. Br.

GENTIANACEAE

Canscora diffusa (Vahl) R. Br.
Enicostemma axillare (Lam.) Raynal
Exacum pendunculatum L.

MENYANTHACEAE

Nymphoides hydrophylla (Lour.) Kuntze
N. indica (L.) Kuntze

BORAGINACEAE

Coldenia procumbens L.
Heliotropium marifolium Retz.
H. ovalifolium Forssk.
H. strigosum Willd.
subsp. **brevifolium** (Wall.) Kazmi
H. supinum L.
Trichodesma sedgwickinanum Banerjee

EHRETIACEAE

Cordia dichotoma Forst. f.
C. gharaf (Forssk.) Ehrenb.
C. obliqua Willd.
Ehretia aspera Roxb.

CONVOLVULACEAE

Argyreia nervosa (Burm. f.) Bojer
Convolvulus prostratus (Forssk.)
C.prostratus Forssk. var. **desertii** Hochst. & Steud. ex Baker & Rendle
Evolvulus alsinoides (L.) L.
E. nummularius (L.) L.
Ipomoea aquatica Forssk.
I. carnea Jacq. subsp. **fistulosa** (Mart. ex Choisy) Austin
I. coptica (L.) Roth ex Roem. & Schult.
I. dichroa (Roem. & Schult.) Choisy
I. eriocarpa R. Br.
I. nil (L.) Roth
I. nil(L.) Roth
var. **himalaica** (C.B. Clarke) Johri
I. marginata (Desr.) H. Manitz
I. pes-tigridis L.
I. sindica Stapf
I. turbinata Lag.
Merremia emarginata (Burm. f.) Hall. f.
M tridentata (L.) Hall. f.
Rivea hypocrateriformis Choisy
R. ornata Choisy

CUSCUTACEAE

Cuscuta hyalina Roth

Dense growth of *Nymphaea nouchali* in Rajbagh talab

C. reflexa Roxb.

SOLANACEAE

Datura fastuosa L.
D. innoxia Mill.
Physalis divaricata D. Don
P. micrantha Link.
Solanum nigrum L.
S. virginianum L.
Withania somnifera (L.) Dunal

SCROPHULARIACEAE

Bacopa monnieri (L.) Pennell
Kickxia ramosissima (Wall.) Janch.
Limnophila indica (L.) Druce
Lindenbergia indica (L.) Vatke
Lindernia ciliata (Colsm.) Pennell
L. crustacea (L.) F. Muell.
L. procumbens (Krock.) Philcox
Striga angustifolia (D. Don) Saldanha
S. gesnerioides (Willd.) Vatke
Sutera dissecta (Del.) Walp.
Verbascum chinense (L.) Santapau
Veronica anagallis-aquatica L.

LENTIBULARIACEAE

Utricularia stellaris L. f.

BIGNONIACEAE

Kigelia africana (Lam.) Benth.
Tecomella undulata (Seem.) Sm.

PEDALIACEAE

Pedalium murex L.
Sesamum mulayanum Nair

MARTYNIACEAE

Martynia annua L.

ACANTHACEAE

Andrographis paniculata (Burm. f.) Wall. ex Nees
Barleria cristata L.
B. prionitis L.
Blepharis linariaefolia Pers.
B. maderaspatensis (L.) Roth
Dicliptera verticillata (Forssk.) C. Chr.
Dipteracanthus patulus (Jacq.) Nees
D. patulus (Jacq.) Nees
var. **alba** (Saxton) Bhandari
D. prostratus (Poir.) Nees
Elytraria acaulis (L.f.) Linden
Eranthemum purpurascens Nees
Hemiadelphis polyspermus (Roxb.) Nees
Hygrophila schullie (Buch.-Ham.) Almeida & Almeida
H. serphyllum (Nees) T. Anders.
Indoneesiella echioides (L.) Shreemadh.
Justicia adhatoda L.
J. diffusa Willd.
J. neesii Raman.
J. prostrata (C. B. Clarke) Gamble
Lepidagathis cristata Willd.
L. hamiltoniana Wall. ex Nees
Peristrophe paniculata (Forssk.) Brummitt
Rostellularia procumbens (L.) Nees
R. quinqueangularis Koen. ex Roxb.
R. quinqueangularis Koen. ex Roxb.
var. **peploides** (Nees) Raizada
Ruellia tuberosa L.
Rungia pectinata (L.) Nees

VERBENACEAE

Clerodendrum multiflorum (Burm.) Kuntze
Gmelina arborea Roxb.
Lantana camara L.
var. **aculeata** (L.) Mold.
L. salvifolia Jacq.
Phyla nodiflora (L.) Greene

LAMIACEAE

Anisochilus carnosus Wall. ex Benth.
Anisomeles indica (L.) Kuntze
Leucas aspera (Willd.) Link
L. cephalotes (Roth) Sprengal
L. urticaefolia (Vahl) R. Br.
Ocimum americanum L.
O. basilicum L.
O. gratissimum L.

NYCTAGINACEAE

Boerhavia diffusa L.
B. repens L.

AMARANTHACEAE

Achyranthes aspera L.
Aerva javanica (Burm. f.) Juss. ex Schult.
A. lanata (L.) Juss. ex Schult.
A. sanguinolenta (L.) Blume
Alternanthera paronychioides St. Hill.
A. pungens Kunth
A. sessilis (L.) DC.
Amaranthus palmeri Wats.
A. tenuifolius Willd.
A. tricolor L.
A. viridis L.
Celosia argentia L.
Digera muricata (L.) Mart.
Gomphrena celosioides Mart.
Pupalia lappacea (L.) Juss.
P. lappacea (L.) Juss.
var. **velutina** (Moq.) Hook. f.

CHENOPODIACEAE

Chenopodium album L.
C. murale L.

POLYGONACEAE

Polygonum barbatum L.
P. barbatum L.
var. **gracile** Danser
P. glabra (Willd.) Gomez

ARISTOLOCHIACEAE

Aristolochia bracteolata Lam.
A. indica L.

EUPHORBIACEAE

Acalypha ciliata Forssk.
A. indica L.
A. lanceolata Willd.
A. malabarica Muell. Arg.
Andrachne telephioides L.
Bridelia crenulata Roxb.
B. retusa (L.) Spreng.
Chrozophora prostrata Dalz.
C. prostrata Dalz.
var. **parviflora** Klotz. ex Spreng.
Croton bonplandianum Baill.
Euphorbia clarkeana Hook. f.
E. granulata Forssk.
var. **glabrata** Boiss.
E. heyneana Spreng .
E. neriifolia L.
E. hirta L.
E. indica Lam.
E. chamaesyce L.
E. thymifolia L.
Jatropha gossypifolia L.
Mallotus philippensis (Lam.) Muell.-Arg.
Phyllanthus fraternus Webster
P. maderaspatensis L.
P. urinaria L.
P. virgatus Forst. f.
Ricinus communis L.

ULMACEAE

Holoptelea integrifolia (Roxb.) Planch.

CANNABACEAE

Cannabis sativa L.

MORACEAE

Ficus benghalensis L.
F. infectoria Roxb.
F. infectoria Roxb.
var. **wightiana** King
F. palmata Forssk.
F. racemosa L.
F. religiosa L.
F. rumphii Blume
F. mollis Roxb.

Mimosa hamata

F. virens Ait.
Morus alba L.

CERATOPHYLLACEAE

Ceratophyllum demersum L.

MONOCOTYLEDONS

HYDROCHARITACEAE

Hydrilla verticillata (L. f.) Royle
Lagarosiphon alternifolia (Roxb.) Druce
Ottelia alsimoides (L.) Pers.

HYPOXIDACEAE

Curculigo orchioides Gaertn.

DIOSCOREACEAE

Dioscorea bulbifera L.

LILIACEAE

Asparagus racemosus Willd.
Drimia indica (Roxb.) Jessop

PONTEDERIACEAE

Monochoria vaginalis (Burm. f.) Presl

COMMELINACEAE

Commelina benghalensis L.
C. erecta L.
C. forskalaei Vahl
C. hasskarlii Clarke
Cyanotis cristata (L.) D. Don
C. fasiculata (Heyne ex Roth) Schult. f.
Murdania nudiflora (L.) Brenan
Tanningia axillaris (L.) Kuntze

PANDANACEAE

Pandanus fascicularis Lam.

ARECACEAE

Phoenix sylvestris (L.) Roxb.

TYPHACEAE

Typha angustata Bory & Chaub.

LEMNACEAE

Spirodela polyrhiza (L.) Schleid.

ALISMATACEAE

Sagittaria guayanesis Kunth.
subsp. **lappula** (D. Don) Bogin

POTAMOGETONACEAE

Potamogeton crispus L.

NAJADACEAE

Najas graminea Del.

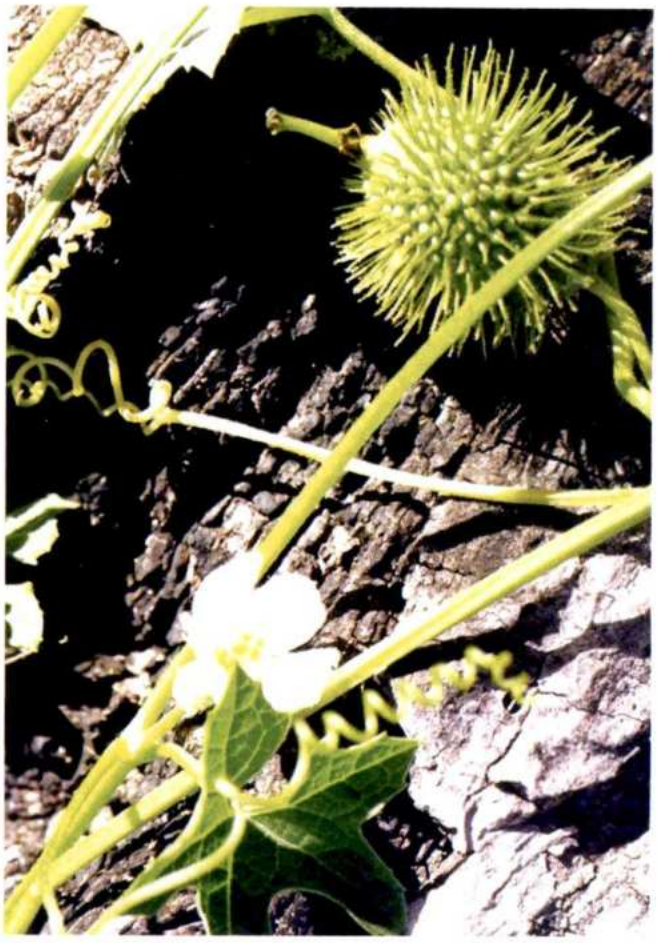
CYPERACEAE

Bulbostylis barbata (Rottb.) C.B. Clarke
Cyperus alopecuroides Rottb.
C. alulatus Kern.
C. atkinsonii C.B. Clarke
C. compressus L.
C. difformis L.
C. iria L.
C. laevigatus L.
C. meeboldii Kuken.
C. niveus Retz.
C. nutans Vahl
C. pangorei Rottb.
C. pygmaeus Rottb.
C. rotundus L.
Eleocharis atropurpurea (Retz.) Presl
E. dulcis (Burm. f.) Trin. ex Hanschel
Eriophorum comosum (Wall.) Wall. ex Nees
Fimbristylis aestivalvis (Retz.) Vahl
F. bisumbellata (Forssk.) Bub.
F. dipsacea (Rottb.) C.B. Clarke
F. ferruginea (L.) Vahl
F. miliacea (L.) Vahl
F. quinquengularis (Vahl) Kunth
F. sieberiana Kunth
F. squarrosa Vahl
Kyllinga bulbosa Beauv.
Mariscus squarrosus (L.) C.B. Clarke
Pycreus flavidus (Retz.) Koyama
P. pumilus (L.) Nees
Rikiella squarrosa (L.) Raynal
Schoenoplectus articulatus (L.) Palla
S. laterifolius (Gmel.) Lye

POACEAE

Apluda mutica L.
Aristida adscensionis L.
A. funiculata Trin. & Rupr.
Arthraxon lancifolius (Trin.) Hochst.
A. hispidus (Thunb.) Makino
Brachiaria lata (Schum.) C.E. Hubb.
B. ramosa (L.) Stapf
Cenchrus biflorus Roxb.
C. ciliaris L.
Chloris barbata Sw.
C. dolichostachya Lag.
C. virgata Sw.
Chrysopogon fulvus (Spreng.) Chiov.

Crypsis schoenoides (L.) Lam.
Cymbopogon martinii (Roxb.) Wats.
Cynodon dactylon (L.) Pers.
Dactyloctenium aegyptium (L.) Willd.
Dsmostachya bipinnata (L.) Stapf
Dendrocalamus strictus (Roxb.) Nees
Dichanthium annulatum (Forssk.) Stapf
D. pertusum (L.) Clayton
Digitaria ciliaris (Retz.) Koeler
Diplachne fusca (L.) P. Beauv. ex Roem. & Schult.
Echinochloa colona (L.) Link
E. crus-galli (L.) P. Beauv
Eleusine indica (L.) P. Beauv
Eragrostis amabilis (L.) Wight & Arn.
E. aspera (Jacq.) Nees
E. ciliaris (L.) R. Br.
E. gangetica (Roxb.) Steud.
E. japonica (Thunb.) Trin.
E. minor Hochst.
E. nigra Nees ex Steud.
E. nutans (Retz.) Nees ex Steud.
E. pilosa (L.) P. Beauv.
E. unioloides (Retz.) Nees ex Steud.
Hemarthria compressa (L. f.) R. Br.
Heteropogon contortus (L.) P. Beauv. ex Roem. Schult.
Imperata cylindrica (L.) Raeuschel.
Ischaemum rugosum Salisb.
Iseilema laxum Hack.
Melanocenchris jacquemontii Jaub. & Spach.
Mnesithea granularis (L.) Koning & Sosef
Oplismenus burmanii (Retz.) P. Beauv.
Oropetium thomaeum (L.f.) Trin.
Oryza ruffipogon Griff.
Panicum maximum Jacq.
P. miliaceum L.
P. paludosum Roxb.
P. trypheron Schult.
Paspalidium flavidum (Retz.) A. Camus
P. geminatum (Forssk.) Stapf
Paspalum scrobiculatum L.
P. vaginatum Sw.
Pennisetum pedicellatum Trin.
P. pedicellatum Trin.
var. **unispiculum** Brunk.



Luffa echinata

Perotis hordeiformis Nees
P. indica (L.) Kuntze
Phragmites vallatoria (Pulk. ex L.) Veldk.
Polypogon monspeliensis (L.) Desf.
Pseudoraphis spinescens (R. Br.) Vickery
Rottboellia exaltata L. f.
Saccharum spontaneum L.
Sehima nervosa (Rottl.) Stapf
Setaria intermedia Roem. & Schult.
S. pumila (Poir.) Roem. & Schult.
S. verticillata (L.) P. Beauv.
Sporobolus coromandelianus (Retz.) Kunth
S. helvolus (Trin.) Durant. & Schinz.
S. indicus (L.) R. Br.
var. **major** (Buse) Baaijens
S. tenuissimus (Sch.) Kuntze
Tetrapogon tenellus (Koen. ex Roxb.) Chiov.
Themeda quadrivalvis (L.) Kuntze

Tragus roxburghii Panigrahi
Tripogon bromoides Roem. & Schult.
Urochloa panicoides P. Beauv.
Vetiveria lawsonii (Hook. f.) Blatt. & Mc Cann
V. zizanioides (L.) Nash

SYNOPSIS OF THE FLORA

The present work is based on a number of exploration tours conducted during the year 1984-85 and 2001-02. In this work, a total number of 548 indigenous and naturalized plant species belonging to 324 genera under 97 families are reported from Ranthambore Tiger Reserve.

Except for the Poaceae (78 species) and Cyperaceae (32 species), the monocotyledons are poorly represented. Remaining 23 species of monocotyledons belong to 13 families.

Among dicotyledons, Fabaceae is the largest family with 48 species and Asteraceae occupy second place with 29 species, the other families having ten or more than ten species are: Acanthaceae (27 spp.), Euphorbiaceae (25 spp.), Convolvulaceae (20 spp.), Malvaceae (16 spp.), Amaranthaceae (16 spp.), Tiliaceae (14 spp.), Caesalpiniaceae and Cucurbitaceae (13 spp. each), Mimosaceae and Scrophulariaceae (12 spp. each), Rubiaceae (11 spp.) and Moraceae (10 spp.).

It is interesting to note that out of 77 families of dicotyledons, 59 families are represented by less than five species and among monocotyledons out of 15 families, 10 families are represented by only a single species.

Butea monosperma

Map of Ranthambhore Tiger Reserve

SALIENT FEATURES

Area

Core	:	274.50 sq km
Buffer	:	1060.14 sq km
Total	:	1334.64 sq km
Longitude	:	76°16' to 77°14' E
Latitude	:	25°41' to 26°22' N
Altitude	:	215 m to 505 m above MSL
Rainfall	:	800 mm

Temperature

Minimum	:	4°C
Maximum	:	47°C

Seasons

Monsoon	:	July to September
Winter	:	November to February
Summer	:	March to June

The nearest rail junction is Sawai Madhopur at a distance of 11 km. It is on the main Delhi-Bombay railway line and major trains stop here. The nearest airport is at Jaipur, which is about 145 km away. A good network of State transport buses connects Sawai Madhopur with destinations across the State.

Sawai Madhopur, which is 11 km from the park, has good communication (post, telegraph, phone and fax) and medical (chemists, hospital) facilities. Internet/e-mail facilities sprung up recently, are also available.

Light cotton garments are recommended for the hot summer months and woolens are suitable for the winters. Entry charges for hired vehicle, guide and photo equipment are separate. These can be reserved at the Project Tiger office in Sawai Madhopur.

A noteworthy site for excursion is the Ranthambore fort. Built by the Chauhan rulers in the 10th century, this fort was the envy of many rulers because of its strategic location between central and northern parts of India. When the Muslim invader Alauddin Khilji laid siege to this fort in 1303, the women of the household performed jauhar (or self-immolation). This historic fort has many temples, tanks, massive gates and curtain walls. This monument has been declared a protected site by the Archeological survey of India.

Sariska Tiger Reserve

PJ Parmar
Botanical Survey of India, Jodhpur

Sariska tiger Reserve is located in the undulating plateau lands and wide valleys of the hill ranges of Aravalli system, near Alwar town, in Rajasthan. In order to save wildlife from wanton destruction sanctuary was created in November 1955 at Sariska village under the Rajasthan wild Animals and Bird Protection Act, 1951. Later on in 1978-79, it was re-established as Tiger Reserve, it is situated about 140 km from Jaipur on Jaipur-Delhi State highway and spreads over a total area of about 800 sq km with a core area of 498 sq km. The reserve consisting of 37 forest blocks is a classic example of a rare amalgamation of natural history and archaeology. The 9th and 10th century ruins of the Siva temple of Grah Rajer, the medieval fort of Kankwari and the Tomb of Lord Bharatrihari add to the grandeur of this reserve, which abounds in wildlife. The present work deals with a short history, topography, vegetation of the area, and enumeration of plant species collected from the area.

TOPOGRAPHY AND PHYSICAL FEATURES

The tract is mainly hilly with two big plateaus i.e. Kankwari and Kiraska, having undulating grounds and numerous valleys like Kaligathi, Pandavpole, Raika, Sariska itself and wide valley ranging from Baran Tal gate to Thana Gazi. The striking characteristics of the hills are their homogenetic regularity of height i.e. about 650 m, level summits and uniform appearance. The hills stretch out from northeast to southwest in more or less parallel lines.

This tract is an ancient base level of denudation; displaying broad alluvial plains where the soft strata have largely been removed and the harder formation stand out in the shape of low hills. The slopes are steeper on their southern aspect than in the other directions.

GEOLOGY AND SOIL

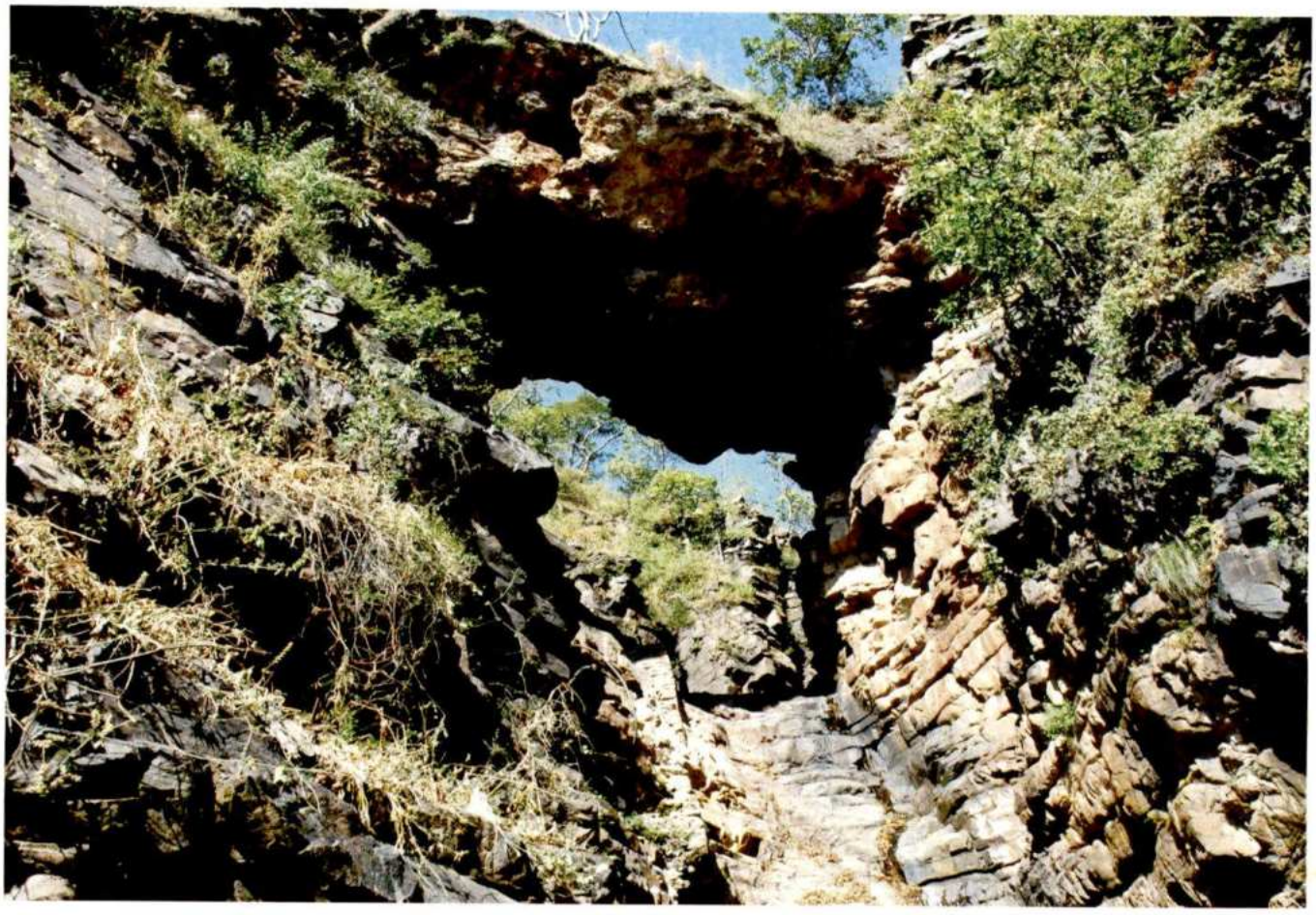
Rocks of the Delhi and Aravalli systems, comprising of quartzites, conglomerates, grits, limestones, phyllites, granites and schists, occupy major parts of the area. Most of the high ridges comprise of quartzite, conglomerates and grits. The inter linking valleys consist of limestone, phyllites and schists. The ancient crystalline and metamorphic rocks with gneisses, schists etc. are generally covered by red sandy soil.

CLIMATE

Except for the short southwest monsoon period, which commences from late June and continues till the middle of October, the climate is dry. The summer begins from the middle of March and extends till June. The winter season is from November and becomes cold during December-January.

The variation in the annual rainfall and the number of rainy days vary from year to year. The average number of rainy days is about 30 and the average annual rainfall is about 650 mm. More than 90% of the rain is received from July to September. The winter showers are few and restricted to the months of January and February.

April, May and part of June are extremely hot, May being the hottest month when the temperature



A view of Pandavpole, Sariska Tiger Reserve (Courtesy: Sanjeev Kumar, ZSI, Jodhpur)

reaches up to 42°C. During this period the humidity is relatively very low and hot westerly winds are common. The fall in temperature during the rainy season is slight, but during winter the night temperature goes down to 0°C.

VEGETATION

According to Champion and Seth's (1960) classification the forest met within the tract fall under group 5 and group 6 i.e. Tropical dry deciduous and Tropical thorn forest.

The forest being scattered and sparse over a large area on various geological and soil formation, vary greatly in composition. In the valleys, where better soil and moisture conditions exist, the vegetation is comparatively denser.

Anogeissus pendula is the most dominant tree species, covering over 90 areas of the forests. *Boswellia serrata* and *Lannea coromandelica* grow on rocks and dry slopes. *Acacia catechu* is common in valleys, whereas *Dendrocalamus strictus* is extremely limited and are found along well-drained reaches of the streams and moist and cooler parts of the hills. The trees are generally slow growing and attain poor height. *Albizia lebbeck, Diospyros melanoxylon, Holoptelea integrifolia, Mangifera indica, Syzygium cumini, Tamarindus indicus* and *Ficus* spp. which are found in moist localities attain large size both in crown spread and height. *Butea monosperma* grows gregariously, where valleys fan out, and become flat and wide.

On the basis of their composition, the forest of Sariska Tiger reserve can be classified as follows:

1. *Anogeissus pendula* forest

2. *Boswellia serrata* forest

3. *Acacia catechu* forest and

Miscellaneous type of forest, which can further be divided in to three categories, namely

(a) *Butea monosperma* forest

(b) Forest along nalahs and

(c) Scrub forest.

1. *Anogeissus pendula* forest

Anogeissus pendula is the principal tree species of the reserve. It is often found in pure stand in the middle slopes of the hills. The usual tree shrubs associated with it are: *Acacia catechu, Capparis sepiaria, Cassia fistula, Commiphora wightii, Cordia dichotoma, Dichrostachys cinerea, Diospyros melanoxylon, Ehretia aspera, Flacourtia indica, Grewia tenax, G. flavescens, Holoptelea integrifolia, Lannea coromandelica, Limonia acidissima, Sterculia urens, Wrightia tinctoria* and *Ziziphus mauritiana* which are found at the foot of the hills, in valleys and along nalahs. Species like *Ficus racemosus, Mallotus philippensis, Mitragyna parvifolia,* and *Syzygium cumini* are found in moist localities. At some places where steep slopes are excessively stony with conspicuous boulders of rock, *Euphorbia caducifolia* and *E. nivulia* are dominant.

2. *Boswellia serrata* forest

Boswellia serrata is another dominant tree species found at the summit of the hills. *Anogeissus pendula* is the common tree species mixed with it up to the middle of slopes. The other common tree species found here are: *Acacia catechu, Anogeissus latifolia, Diospyros melanoxylon, Flacourtia indica, Grewia tiliifolia, Lannea coromandelica, Soymida febrifuga, Sterculia urens* etc. as in Kaligathi, Gamaka area of Sariska range and at Kankwari forest block.

3. *Acacia catechu* forest

Acacia catechu is scattered on hill slopes, mixed with *Anogeissus pendula* and *Boswellia serrata*. The other common species are *Bauhinia racemosa, Crateva adansonii* subsp. *odora, Capparis sepiaria, Grewia flavescens* and *Wrightia tinctoria.* Among climbers mention may be made of *Abrus precatorius, Cissampelos pareira* var. *hirsuta , Cocculus hirsutus, Mucuna prurita,* etc.

4. Miscellaneous forests

(a) *Butea monosperma* forest

Butea monosperma is the dominant tree species found at the foot of the hills and plains throughout the forest. *Acacia senegal, Albizia lebbeck, Bombax ceiba, Capparis decidua, Celastrus paniculatus, Erythrina suberosa, Gmelina arborea, Justicia adhatoda, Maytenus senegalensis, Moringa concanensis, Tecomella undulata, Vitex negundo* are the other notable species of this forest

(b) Forest along nalahs

Dendrocalamus strictus is found along the nalahs in the forest with *Anogeissus pendula* and *Boswellia serrata*. The other common species found along the nalahs and in the cooler parts of the forest are: *Annona squamosa, Cordia dichotoma, Diospyros melanoxylon, Ehretia aspera, Ficus racemosa, F. tomentosa, Flacourtia indica, Grewia flavescens, Ichnocarpus frutescens, Lannea coromandelica, Mimosa himalayana, Mallotus philippensis, Mitragyna parvifolia, Nerium indicum, Phoenix sylvestris, Syzygium cumini, Tamarindus indica, Woodfordia fruticosa,* etc.

(c) Scrub forest

There are some low, rocky hills with very little tops oil in places like Dariba, Bhangarh, Sariska, Narayanijee, and Taalvraksh, etc. The vegetation here is sparse and scattered with the trees assuming stunted, bushy habit. The common trees and shrubs species encountered in this type of forest are: *Aegle marmelos,*

Acacia jacquemontii, A. leucophloea, Butea monosperma, Balanites roxburghii, Capparis decidua, C. sepiaria, Dichrostachys cinerea var. *indica, Grewia flavescens, G. tenax, Justicia adhatoda, Maytenus senegalensis, Nyctanthes arboteristis, Rhus sinuta, Ziziphus mauritiana* and *Z. nummularia.* The notable climbers are: *Coccinia grandis, Cocculus hirsutus, Maerua arenaria, Mucuna prurita, Rivea hypocrateriformis,* etc., and the common herbs are *Achyranthes aspera, Apluda mutica, Boerhavia diffusa, Commicarpus boissieri, Indigofera oblongifolia, I. tinctoria, I. trita, Lepidagathis cristata, Peristrophe paniculata, Themeda quadrivalvis, Urginia indica,* etc.

Ground flora

Since the forest of this tract comes mainly under the category of dry deciduous type, the ground flora is fairly dense only during the rainy season. The common herbs and undershrubs present are: *Abelmoschus pungens, Achyranthes aspera, Anisomeles, indica, Barleria prionitis, Blepharis maderaspatensis, Boerhavia diffusa, Seena tora, Commelina benghalensis, Cyanotis cristata, Desmodium gangeticum, Dipteracanthus patulus, Elytraria acaulis, Hisbicus* spp., *Indigofera cordifolia, Ipomoea pestigridis, Rostellularia procumbens, Kickxia ramosissima, Lantana indica, Lepidagathis cristata, Lindenbergia indica, Melhania futteyporensis, Ocimum americanum, Peristrophe paniculatta, Pupalia lappacea, Rungia parviflora, Sida cordifolia, Tephrosia pumila, Vernonia cinerea,* etc. along with common grasses like *Alloteropsis cimicina, Chloris dolichostachya, Cymbopogon martinii, Dichanthium pertusum, Heteropogon contortus, Oropetium thomaeum, Pennisetum orientale, P. pedicellatum, Perotis indica, Setaria pumila, Tetrapogon tenellus, Urochloa panicoides,* etc. The parasite, *Dendrophthoe falcata* is common on *Boswellia serrata* and the fern species, *Adiantum capillus-veneris, A. incisum* and *Actinoptris radita* are encountered at Bandipul, Kankwari and Sariska growing from moist rock crevices.

The only gymnosperm, *Pinus roxburghii* is found at Bandipul, perhaps introduced long back and now naturalized.

Aquatic / Marshy vegetation

Since there is no any permanent or big lake inside the reserve, the aquatic vegetation is poor. In temporary ponds or nalahas where rainwater stagnates for a few months' aquatic species like *Hydrilla verticillata, Potomogeton crispus, P. pectinatus, P. perfoliatus, Vallisneria spirallis* var. *denseserrulata, Zanichellia palustris* are common. Occasionally, *Nymphoides cristatum, Trapa bispinosa* and *Nelumbo nucifera* are also met with.

Alternanthera sessilis, Ammannia baccifera, Bacopa monnieri, Eclipta alba, Ludwigia perennis, L. prostrata, Potentilla supina, Limnophila indica, Polygonum barbarum, P. glabrum, Veronica anagallis-aquatica, etc. are some of the common species found in marshy habitats around ponds, watercourses and streams. *Typha angustata,* is sometimes associated with these, and a pure population of *Pandus fascicularis* has been noticed at Bhangarh. Sedges like *Cyperus alopecuroides, C. difformis, C. laevigatus, C. pangorei, C. pygmaeus, C. rotundus, Fimbristylis bisumbellata, Schoenoplectus littoralis* subsp. *subulatus* etc. are also commonly found in such habitats. Grasses like *Cynodon dactylon, Echinochloa colonum, Eragrostis minor, Dichanthium annulatum, Imperata cylindrica, Paspalum disticum, Phargmites vallatoria, Polypogon monspeliensis* and *Vetiveria zizanioides* etc. also noticed in marshy habitats.

Phoenix sylvestris is common generally near water bodies, and near Kankwari dam side it forms a pure stand.

Forest plantations

In the plantations and in the close area of the reserve the forest department planted some common trees

Alysicarpus vaginalis

and shrubs i.e., *Acacia leucophloea, A. nilotica, A. senegal, Albizia lebbeck, Azadirachta indica, Dalbergia sissoo, Delonix regia, Eucalyptus* spp., *Leucaena leucocephala, Maytenus senegalenosis, Melia azedarach, Prosopis cinerarea, P. juliflora, Parkinsonia aculeata, Sesbania sesban* etc. Climbers like *Coccinia indica, Ipomoea pes-tigridis, I. sindica, Maerua arenaria, Mukia maderaspatana, Rhynchosia minima,* and *Rivea hypocrateriformis,* etc. are also met with.

ENUMERATION

PTERIDOPHYTES

ADIANTACEAE

Adiantum capillus-veneris L.
A. incisum Forssk.

PTERIDACEAE

Actinopteris radiata (Sw.) Link.

EQUISETACEAE

Equisetum ramosissimum Desf.

GYMNOSPERM

PINACEAE

Pinus roxburghii Sarg.

ANGIOSPERMS

ANNONACEAE

Annona squamosa L.
Miliusa tomentosa (Roxb.) Sinclair

MENISPERMACEAE

Cissampelos pareira L.
var. **hirsuta** (Buch.- Ham. ex DC.) Forman
Cocculus hirsutus (L.) Diels

NELUMBONACEAE

Nelumbo nucifera Gaertn.

PAPAVERACEAE

Argemone mexicana L.
A. ochroleuca Sweet

CAPPARACEAE

Capparis decidua (Forssk.) Edgew.
C. separia L.
Crataeva adansonii DC.
subsp. **odora** (Buch.-Ham.) Jacobs
Maerua arenaria (DC.) Hook. f. & Thomson

FLACOURTIACEAE

Flacourtia indica (Burm. f.) Merr.

PORTULACACEAE

Portulaca pilosa L.

MALVACEAE

Abelmoschus pungens (Roxb.) Voigt
Abutilon bidentatum Hochst. ex A. Rich.
A. indicum (L.) Sweet
A. ramosum (Cav.) Guill. & Perr.
Fioria vitifolia (L.) Mattei
Hisbicus lobatus (J.A. Murr.) Kuntze
H. micranthus L. f.
Kydia calycina Roxb.
Malvastrum coromandelianum (L.) Garcke
Pavonia zeylanica Cav.
Sida acuta Burm. f.
S. cordifolia L.
S. mysorensis Wight & Arn.
S. rhombifolia L.
S. yunnanensis Hu

STERCULIACEAE

Helicteres isora L.
Melhania futtyporensis Munro ex Mast.
Melochia corchorifolia L.
Sterculia urens Roxb.

BOMBACACEAE

Bombax ceiba L.

TILIACEAE

Corchorus aestuans L.
C. depressus (L.) Stocks
C. olitorius L.
C. trilocularis L.
Grewia asiatica L.
G. damine Gaertn.
G. flavescens A. Juss.
G. tenax (Forssk.) Fiori
G. tiliifolia Vahlr
Triumfetta pentandra A. Rich.

ZYGOPHYLLACEAE

Tribulus lanuginosus L.
T. terrestris L.

OXALIDACEAE

Oxalis corniculata L.

RUTACEAE

Aegle marmelos (L.) Corr.
Limonia acidissima L.
Naringi crenulata (Roxb.) Nicolson

BALANITACEAE

Balanites roxburghii Planch.

BURSERACEAE

Boswellia serrata Roxb. ex Coleb.
Commiphora wightii (Arn.) Bhandari

MELIACEAE

Azadirachta indica A. Juss.
Melia azedarach L.
Soymida febrifuga (Roxb.) A. Juss.

CELASTRACEAE

Celastrus paniculata Willd.
Maytenus senegalensis (Lam.) Excell.

RHAMNACEAE

Ziziphus mauritiana Lam.
Z. nummularia (Burm. f.) Wight & Arn.

VITACEAE

Ampelocissus latifolia (Roxb.) Planch.
Cayratia trifolia (L.) Domin

SAPINDACEAE

Cardiospermum halicacabum L.

ANACARDIACEAE

Lannea coromandelica (Houtt.) Merr.
Mangifera indica L.
Rhus sinuata Thunb.

MORINGACEAE

Moringa concanensis Nimmo ex Dalz. & Gibs.

FABACEAE

Abrus precatorius L.
Aeschynomene indica L.
Alysicarpus monilifer (L.) DC.
A. vaginalis (L.) DC.
Butea monosperma (Lam.) Taub.
Crotalaria hirsuta Willd.
C. medicagenia Lam.
Cullen plicata (Delile) C.H. Stirt.
Dalbergia sissoo Roxb.
Desmodium gangeticum (L.) DC.
D. repandum (Vahl) DC.
D. triflorum (L.) DC.
D. velutinum (Willd.) DC.
Erythrina suberosa Roxb.
Indigofera cordifolia Heyne ex Roth
I. asteragalina DC.
I. linnaei Ali
I. tinctoria L.
I. tirta L. f.
Mucuna pruriens (L.) DC.
Rhynchosia minima (L.) DC.
var. **laxiflora** (Camb.) Baker
R. rothii Benth. ex Aitch.
Sesbania sesban (L.) Merr.
Tephrosia pumila (Lam.) Pers.
T. strigosa (Dalz.) Sant. & Mahesh.
T. subtriflora Hochst ex Baker
T. villosa (L.) Pers.
Vigna radiata (L.) Wilczek
subsp. **subulata** (Roxb.) Verdc.
V. ungiculata (L.) Walp.
Zornia gibbosa Span.

CAESALPINIACEAE

Bauhinia racemosa Lam.
C. fistula L.
Chamaecrista alosus (L.) Iroin & Barneby
C. pumila (Lam.) V. Singh
Parkinsonia aculeate L.
Senna obtusifolia (L.) Irwin & Barneby
S. tora (L.) Roxb.
Tamarindus indica L.

MIMOSACEAE

Acacia catechu (L. f.) Willd.
A. jacquemontii Benth.
A. leucophloea (Roxb.) Willd.
A. nilotica (L.) Del.
subsp. **indica** (Benth.) Brenan
A. nilotica (L.) Del.
subsp. **indica**
var. **cupressiformis**
(Stwart) Ali & Faruqi
A. senegal (L.) Willd.
Albizia lebbeck (L.) Benth.
Dichrostachys cinerea (L.) Wight & Arn.
var. **indica** Brenan & Brummitt
Leucaena latisiliqua (L.) Gillis
Mimosa hamata Willd.
M. himalayana Gamble
Prosopis cinerarea (L.) Druce
P. juliflora (Sw.) DC.

ROSACEAE

Potentilla supina L.

COMBRETACEAE

Anogeissus latifolia (Roxb. ex DC.) Wall. ex Guill. & Perr.
A. pendula Edgew.
Terminalia bellirica (Gaertn.) Roxb.
T. cuneata Roth

MYRTACEAE

Syzygium cumini (L.) Skeels

LYTHRACEAE

Ammannia baccifera L.

Barleria prionitis

A. multiflora Roxb.
Woodfordia fruticosa (L.) Kurz

ONAGRACEAE

Ludwigia perennis L.
L. prostrata Roxb.

TRAPACEAE

Trapa natans L.
var. **bispinosa** (Roxb.) Makino

CUCURBITACEAE

Bryonopsis laciniosa (L.) Naud.
Coccinia grandis (L.) Voigt
Cucumis callosus (Rottl.) Cong.
Luffa acutangula (L.) Roxb.
var. **amara** Clarke
Momordica balsamina L.
M. charantia L.
var. **muricata** (Willd.) Chakravarty
M. dioica Roxb. ex Willd.
Trichosanthes cucumerina L.
T. tricuspidata Lour.

CACTACEAE

Opuntia dillenii (Ker-Gawl.) Howorth
O. elatior Mill.

AIZOACEAE

Trianthema portulacastrum L.
Zaleya govindia (Buch.- Ham. ex D. Don) Nair

MOLLUGINACEAE

Glinus lotoides L.

ALANGIACEAE

Alangium salvifolium (L. f.) Wang.

RUBIACEAE

Haldina cordifolia (Willd. ex Roxb.) Ridsd.
Hedyotis corymbosa L.
Mitragyna parvifolia (Roxb.) Korth.
Spermacoce pusilla Wall.
Xeromphis spinosa (Thunb.) Keay

ASTERACEAE

Acanthospermum hispidum DC.
Ageratum conyzoides L.
Bidens biternata (Lour.) Merr. & Sherff.
Blainvillea acmella (L.) Philip.
Blumea membranacea DC.
B. mollis (D. Don) Merr.
B. lacera (Brum. f.) DC.
B. sinuata (Lour.) Merr.
Carthamus oxycantha Bieb.
Cotula hemispherica Wall.
Cyathocline purpurea (D. Don) Kuntze
Echinops echinatus Roxb.
Eclipta prostrata (L.) L.
Emilia sonchifolia (L.) DC.
Gnaphalium polycaulon Pers.
Lactuca intybacea (Jacq.) Beauv.
Launaea procumbens (Roxb.) Ramayya & Rajgopal
Sonchus asper (L.) Hill
Tridax procumbens L.
Vernonia anthelmintica (L.) Willd.
V. cinerea (L.) Less.
Vicoa indica (L.) DC.
Xanthium streimariuas L.

CAMPANULACEAE

Campanula dimorpha Schweinf.

PLUMBAGINACEAE

Dyerophytum indicum (Gibs. ex Wight) Kuntze
Plumbago zeylanica L.

SAPOTACEAE

Mimusops elengi L.

EBENACEAE

Diospyros melanoxylon Roxb.

OLEACEAE

Nyctanthus arbotristis L.
Schrebera sweitenioides Roxb.

APOCYNACEAE

Carissa congesta Wight
Holarrhena pubescens (Buch.- Ham.) Wall. ex G. Don
Ichnocarpus frutescens (L.) R. Br.
Nerium indicum Mill.
Thevetia peruviana (Pers.) K. Schum.
Wrightia tinctoria R. Br.
W. arborea (Denst.) Mabb.

ASCLEPIADACEAE

Calotropis procera (Ait.) R. Br.
subsp. **hamiltonii** (Wight.) Ali
Leptadenia pyrotechnica (Forssk.) Decne.
Pergularia daemia (Forssk.) Chiov.
Wattakaka volubilis (L. f.) Stapf

GENTIANACEAE

Nymphoides hydrophylla (Lour.) Kuntze

BORAGINACEAE

Heliotropium ellipticum Ledeb.
H. strigosum Willd.
Trichodesma sedgwickianum Banerjee

EHRETIACEAE

Cordia dichotoma Forst. f.
Ehretia aspera Roxb.
E. laevis Roxb.

CONVOLVULACEAE

Convolvulus prostratus Forssk.
Ipomoea carnea Jacq.
subsp. **fistulosa** (Mart. ex Choisy) Austin
I. nil (L.) Roth
I. marginata (Desr.) H. Manitz
I. pes-tigridis L.
I. sindica Stapf
I. turbinata Lag.
Rivea hypocrateriformis Choisy
R. ornata Choisy

Forest view of SariskaTiger Reserve, dense Population of *Phoenix sylvestris* at foot of hills
(Courtesy: Sanjeev Kumar, ZSI, Jodhpur)

CUSCUTACEAE

Cuscuta hyalina Roth
C. reflexa Roxb.

SOLANACEAE

Capsicum annum L.
Datura fastuosa L.
D. innoxia Mill.
Nicotiana plumbaginifolia Viv.
Physalis divaricata D. Don
Solanum anguini Lam.
S. incanum L.
S. nigrum L.
S. virginianum L.
Withania somnifera (L.) Dunal

SCROPHULARIACEAE

Bacopa monnieri (L.) Pennell
Kickxia ramosissima (Wall.) Janch.
Limnophila indica (L.) Druce
L. rugosa (Roth.) Merr.
Lindenbergia indica (L.) Vatke
L. muraria (Roxb. ex D. Don) Bruehl
Lindernia ciliata (Colsm.) Pennell
L. crustacea (L.) F. Muell.
L. multiflora (Roxb.) Mukherjee
Mimulus strictus Benth.
Verbascum chinense (L.) Santapau
Veronica anagallis- aquatica L.

BIGNONIACEAE

Kigelia africana (Lam.) Benth.
Tecomella undulata (Seem) Sm.

PEDALIACEAE

Sesamum mulayanum Nair

MARTYNIACEAE

Martynia annua L.

ACANTHACEAE

Barleria cristata L.
B. prionitis L.
B. prionitis L.
var **dicantha** Blatt. & Hallb.
Blepharis integrifolia (L. f.) E. Meyer ex Krauss.
B. maderaspatensis (L.) Roth
Dicliptera verticillata (Forssk.) Chirst
Dipteracanthus patulus (Jacq.) Nees
Elytaria acaulis (L. f.) Linden
Eranthemum purpurascens Nees
Hemiadelphis polyspermus (Roxb.) Nees
Justicia adhatoda L.
Lepidagathis cristata Willd.
Peristrophe paniculata (Forssk.) Brummitt
Rostellularia procumbens (L.) Nees
R. quinqueangularis Koen. ex Roxb.
var. **peploides** (Nees) Raizada
Rungia parviflora Nees

VERBENACEAE

Clerodendrum multiflorum (Burm.) Kuntz
Gmelina arborea Roxb.
Lantana camara L.
var. **aculeata** (L.) Mold.
L. salvifolia Jacq.
Phyla nodiflora (L.) Greene
Vitex negundo L.

LAMIACEAE

Anisochilus carnosus Wall. ex Benth.
Anisomeles indica (L.) Kuntze
Leucas cephalotes (Roth) Spreng.
L. flaccida R. Br.
L. montana Spreng.
L. pilose Benth.
Ocimum americanum L.
O. basilicum L.
O. tenuiflorum L.

NYCTAGINACEAE

Boerhavia diffusa L.
B. chinensis (L.) Heimerl
Commicarpus boissieri (Heimerl) Cufod.

AMARANTHACEAE

Achyranthes aspera L.
A. aspera L.
var. **porphyristachya** Hook. f.
Aerva sanguinolenta (L.) Blume
Alternanthera pungens Kunth
A. sessilis (L.) DC.
Amaranthus graecizans L.
A. hybridus L.
A. lividus L.
A. spinosus L.
A. tricolor L.
A. virdis L.
Celosia argentia L.
Digera muricata (L.) Mart..
Gomphrena celosioides Mart.
Pupalia lappacea (L.) Juss.

CHENOPODIACEAE

Chenopodium album L.
C. murale L.

BASELLACEAE

Basella rubra L.

POLYGONACEAE

Persicaria barbata (L.) Hara
P. glabra (Willd.) Gomez
Polygonum plebeium R. Br.
Rumex dentatus L.

PROTEACEAE

Grevillea robusta Cunn. ex R. Br.

LORANTHACEAE

Dendrophthoe falcate (L. f.) Etting.

EUPHORBIACEAE

Acalypha ciliata Forssk.
A. indica L.
Bridelia crenulata Roxb.
Emblica officinalis Gaertn.
Euphorbia caducifolia Haines

Nyctanthus arbor-tristis

E. chamaesyce L.
E. hirta L.
E. indica Lam.
E. nivulia Buch.- Ham.
E. thymifolia L.
Mallotus philippensis (Lam.) Muell. Arg.
Phyllanthus amarus Schum. & Thonn.
P. virgatus Forst. f.
Ricinus communis L.

ULMACEAE

Holoptelea integrifolia (Roxb.) Planch.

MORACEAE

Ficus benghalensis L.
F. infectoria Roxb.
F. infectoria Roxb.
var. **wightiana** King
F. mollis Vahl
F. palmata Forssk.
F. racemosa L.
F. religiosa L.
F. rumphii Blume
Morus alba L.

CERATOPHYLLACEAE

Ceratophyllum demersum L.

HYDROCHARITACEAE

Hydrilla verticillata (L. f.) Royle
Vallisneria spiralis L.
var. **denseserrulata** Makino

LILIACEAE

Drimia indica (Roxb.) Jessop

COMMELINACEAE

Commelina benghalensis L.
C. erecta L.
Cyanotis cristata (L.) D. Don
Murdania nudiflora (L.) Brenan

PANDANACEAE

Pandanus fascicularis Lam.

ARECACEAE

Phoenix sylvestris (L.) Roxb.

TYPHACEAE

Typha angustata Bory & Chaub.

ARACEAE

Cryptocoryne retrospiralis Fisch. ex Wydler

LEMNACEAE

Spirodela polyrrhiza (L.) Schleid.

POTAMOGETONACEAE

Potamogeton crispus L.
P. pectinatus L.
P. perfoliatus L.

ZANNICHELLIACEAE

Zannichellia palustris L.

CYPERACEAE

Bulbostylis maritimus (L.) Palla
var. **affinis** (Roth) Parmar

Cyperus alopecuroides Rottb.
C. alulatus Kern.
C. benghalensis Spr.
C. compressus L.
C. flavescens L.
C. laevigatus L.
C. nutans Vahl
var. **elusinoides** (Kunth) Haines
C. pangorei Rottb.
C. pygmaeus Rottb.
C. rotundus L.
Eleocharis dulcis (Burm. f.) Trin. ex Henschel
Eriophorum comosum (Wall.) Wall. ex Nees
Fimbristylis bisumbellata (Forssk.) Bub.
F. miliacea (L.) Vahl
Kyllinga nemoralis (Forst. f.) Dandy ex Hutchinson & Dalz.
Schoenoplectus littoralis (Schard.) Palla
subsp. **subulatus** (Vahl) Koyama

POACEAE

Allotropsis cimicina (L.) Stapf
Apluda mutica L.
Aristida adscensionis L.
Arthraxon lancifolius (Trin.) Hochst.
Brachiaria distachya (L.) Stapf
B. ramosa (L.) Stapf
Cenchrus setigerus Vahl
Chloris dolichostachya Lagasca
C. virgata Sw.
Cymbopogon martinii (Roxb.) Wats.
Cynodon dactylon (L.) Pers.
Dactyloctenium aegyptium (L.) Willd.
D. scindicum Boiss.
Dendrocalamus strictus (Roxb.) Nees
Dichanthium annulatum (Forssk.) Stapf
D. pertusum (L.) Clayton
Digitaria abludens (Roem. & Schult.) Veldk.
D. ciliaris (Retz.) Koeler
Echinochloa colona (L.) Link
Eleusine indica (L.) Gaertn.
Elionurus royleanus Nees ex A. Rich.
Eragrostis amabilis (L.) Wight & Arn.
E. ciliaris (L.) R. Br.
E. japonica (Thunb.) Trin.
Hemarthria compressa (L. f.) R. Br.
Heteropogon contortus (L.) P. Beauv. ex Roem. & Schult.
Imperata cylindrica (L.) Raeuschel.
Oplismenus burmanii (Retz.) P. Beauv.
Oropetium thomaeum (L. f.) Trin.
Panicum antidotale Retz.
P. maximum Jacq.
P. trypheron Schult.
Paspalum distichum L.
Paspalidium flavidum (Retz.) A. Camus
Pennisetum orientale L.C. Rich.
P. pedicellatum Trin.
Perotis indica (L.) Kuntze
Phragmites vallatoria (Pulk. ex L.) Veldk.
Polypogon monspeliensis (L.) Desf.
Rottboellia exaltata L. f.
Saccharum benghalense Retz.
S. spontaneum L.
Schoenefeldia gracilis Kunth
Setaria intermedia Roem. & Schult.
S. pumila (Poir.) Roem. & Schult.
S. verticillata (L.) P. Beauv.
Sorghum halepense (L.) Pers.
Sporobolus coromandelianus (Retz.) Kunth
S. indicus (L.) R. Br.
var. **major** (Buse) Baaijens
S. tenuissimus (Sch.) Kuntze
Tetrapogon tenellus (Koen. ex Roxb.) Chiov.
Themeda quadrivalvis (L.) Kuntze
Urochloa panicoides P. Beauv.
Vetiveria zizanioides (L.) Nash

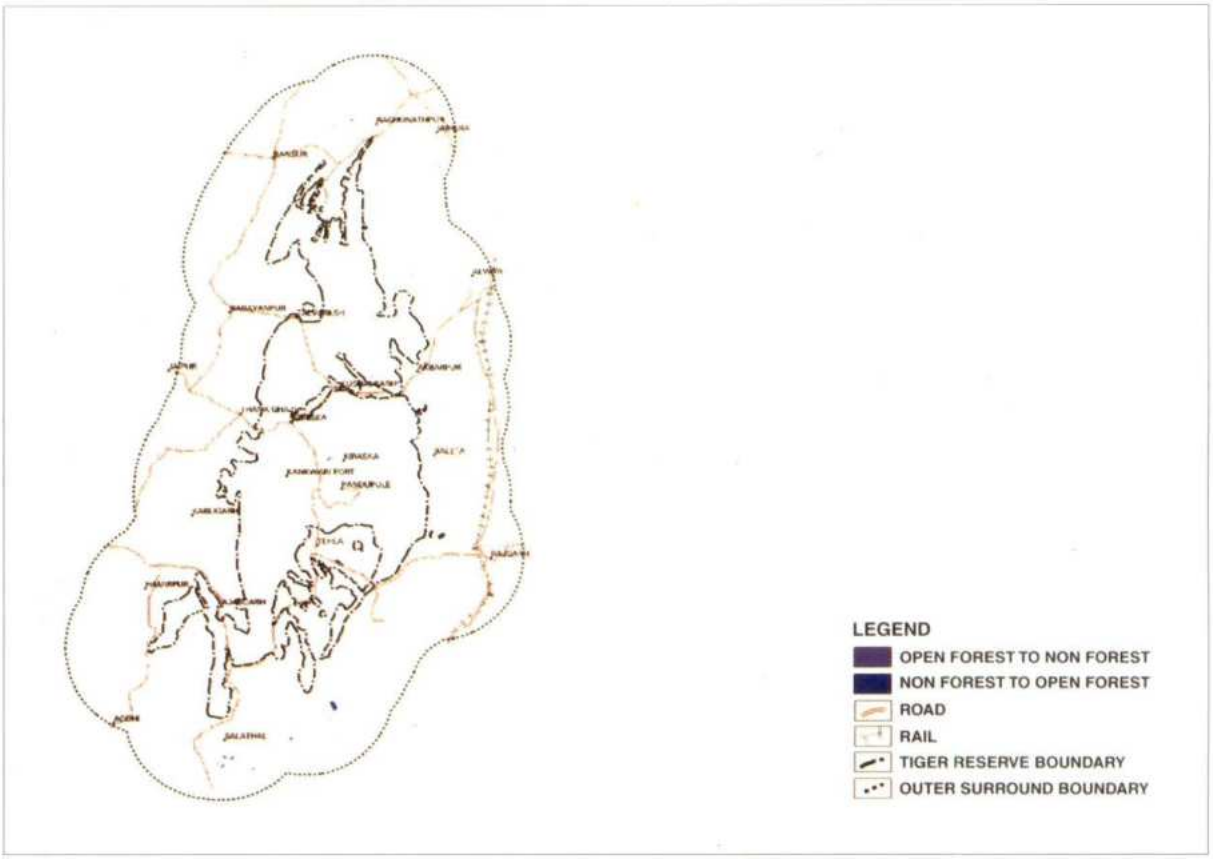
SYNOPSIS OF THE FLORA

In this work, a total number of 414 indigenous and naturalized plant species belonging to 273 genera under 86 families are enumerated. This includes 4 species of Pteridophytes belonging to 3 genera and 3 families, and a species of Gymnosperm.

Except for Poaceae (56 species) and Cyperaceae (17 species) the Monocotyledons are poorly represented. The remaining 16 species of Monocotyledons belong to 10 different families.

Population of *Boswellia serrata* at top of hills at Kankwari
(Courtesy: Sanjeev Kumar, ZSI, Jodhpur)

Ludwigia perennis



Map of Sariska Tiger Reserve

Among the Dicotyledons, Fabaceae is the largest family with 30 species and Asteraceae occupy second place with 23 species, the other families having more than ten species are: Acanthaceae (17 species), Amaranthaceae (16 species), Malvaceae (15 species), Euphorbiaceae (14 species), Mimosaceae (13 species) and Scrophulariaceae (12 species).

It is interesting to note that out of the 69 families of Dicotyledons, 50 families are represented by less than 5 species and more than 50 of that i.e. 27 families are represented by only a single species.

Fauna

The fauna of this tract is typical of dry deciduous forest type. Stoppage of exploitations of forest and control, of over grazing have proved beneficial to the animals, particularly the tigers whose numbers have increase in the last few years.

Besides the Tiger *(Panthera tigris)* the other carnivors found are: Jungle cat *(Felis chaus)*, Caracal *(Felis caracal)*, Leopard *(Felis bengalensis)*, Palm civet *(Paradoxurus hermaphorditus)*, Indian fox *(Vulpes bengalensis)*, Striped hyaena *(Hyaena hyaena)*, Jackal *(Canis aureus)*, Panther *(Panthera pardus)* etc. Among herbivora there are Nilgai *(Boselaphus tragocamelus)*, Wild boar *(Susscrofa cristatus)*, Chousinga *(Tetracerus quadricornis)*, Chinkara *(Gazella gazella)*, Hare *(Lepus rigricollis)*, Sambhar *(Cervus unicolar)*, Chital *(Axix axis)*, Porcupine *(Hystrix indica)*, Muskart *(Suneus murinus)* etc. Primates are represented by the common Langur and Macaque. About 94 species of bird are found in the reserve.

FOREST COVER

The assessment of 2002 data reveals that area under forest cover is 674 km^2 which is about 77% of the geographic area of the Reserve. Of this, very dense forest is 13 km^2, moderately dense forest covers 284 km^2 and open forest covers 377 km^2. The scrub constitutes 12 km^2 and the remaining area is non-forest. The density-wise forest cover for the assessment years 1997, 2000 and 2002 along with the changes during 1997-2002 as assessed in this study is given in the table. It is seen that during the period from 1997 to 2002, there is no change in the forest cover.

Forest cover maps of Sariska Tiger Reserve along with its Outer Surround for the periods 1997 and 2002 are shown in under.

The Outer Surround of 10 km radius from the periphery of the Tiger Reserve has a geographic area of 2,491 km^2 which completely falls in Rajasthan. The forest cover in the Outer Surround for the three assessments is given in the table.

Forest Cover in the Outer Surround of Sariska Tiger Reserve (1997-2002)

(Area in km^2)

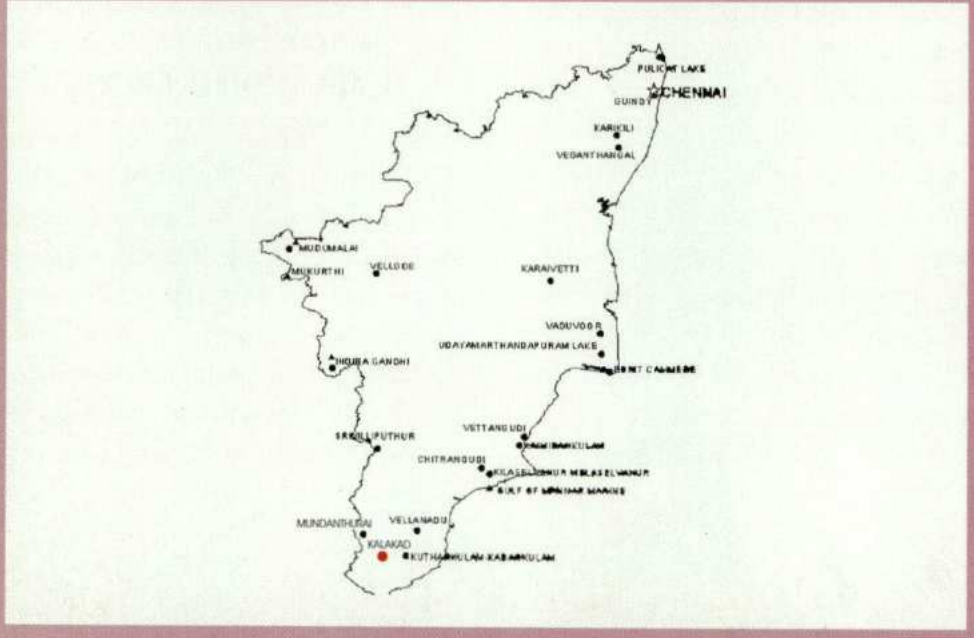
Category	Assessment year			Net Change (1997-2002)
	1997	2000	2002	
(A) Very dense Forest	1	1	1	-
(B) Moderately Dense Forest	95	95	95	-
(C) Open Forest	368	367	367	-1
Total Forest (A+B+C)	**464**	**463**	**463**	**-1**
Scrub	88	88	88	-
Non-Forest	1,939	1,940	1,940	1
Total Area	**2,491**	**2,491**	**2,491**	

The table shows a decrease of 1 km^2 in the open forest during the period 1997-2000. The likely reason for the change in forest cover is the pressure of population residing in the area.

Agasthiyamalai (Pothigai) Peak - R. Gopalan

TAMIL NADU

Kalakad-Mundanthurai Tiger Reserve



Kalakad-Mundanthurai Tiger Reserve

R Gopalan
Botanical Survey India, Southern Circle, Coimbatore - 641 003

1.1. ORIGIN

The Mundanthurai Wildlife Sancturay was constituted in the year 1962 consisting of the Papanasam reserve forests and Singampatti ex Zamin forest primarily for the preservation of the tiger (*Panthera tigiris* L.). The very concept of a sanctuary for tigers and attempts at providing a preferential treatment for a carnivore are pioneering actions taken by the State Government of Tamil Nadu (Madras state) towards wildlife management in India, much ahead of the officially launched "Project Tiger" in 1973 with the joint efforts of IUCN, WWF and the Indian Board for Wildlife. The Mundanthurai plateau was one of the richest regions in all forms of wildlife and the area was subjected to licensed hunting by the then European community and local Zamindars, resulting in the drastic decline of tigers. Also many tigers were killed by follidol poisoning by the local communes. In 1977 the Mundanthurai sanctuary area was extended to 550 sq km. The adjoining Kalakad reserve forest with an area of about 250 sq km. was given the status of sanctuary in 1976. Later both these sanctuaries were combined under "Project Tiger" and was declared as Kalakad-Mundanthurai Tiger reserve in the year 1988 with a total area of 800 sq km (MoEF Annual Report 2001 - 2002). This premier conservation project nutures, *inter alia*, a large number of species of rare and threatened flora and fauna in which tiger is at the apex of the complex biotype pyramid. As envisaged this Tiger Reserve is not only to save the 'key stone' species 'Tiger' but essentially to conserve its habitat the biodiversity and to conserve water, soil and replenish clear air for the of survival of man and his future generations by ensuring the life support.

1.2. Geography

The Kalakad-Mundanthurai Tiger reserve is situated in the southern end of the Western Ghats, in Tirunelveli district of Tamil Nadu, lying between 8°21' & 8° 83' N and 77° 12' & 78° 2' E. According to Henry & al. (1984), and Vajravelu & al. (1987), the forest tracts of Kalakad-Mundanthurai Tiger reserve including Kannikatti R.F., Papanasam R.F., Agasthiyamalai, Aninthalaipothigai, Nagapothigai, Kalkachi, Manjolai, Mahendragiri, Natterikkal, Sengaltheri, Singampatti R.F., having an undulating topography, with inhospitable terrains and still retain their substantial natural vegetational cover comprising a rich flora and fauna between 40 to 1868 m altitudes. The climate is dry humid and hot in plains and pleasantly cold in the higher elevations and the annual rainfall varies from 750 to 3500 mm.

1.3. TIGER POPULATIONS AND ITS HABITAT REQUIREMENTS

Kalakad-Mundanthurai area is a suitable habitat for Tigers as it naturally composed of moist and dry deciduous forests and grassland at lower altitudes, provide food and shelter to several herbaceous animals which form tigers' prey. Tamil Nadu forest department has done considerable work in developing habitat management for Food, Shelter and Water. The Kalakad-Mundanthurai plateau is a richest region in flora representing various types of

Peaks of Agasthiyamalai : Naga Pothigai, Ainthalai Pothigai, Pothigai (Agasthiyamalai) - *R. Gopalan*

forests which includes a significant forest 'the Tirunelveli semi-evergreen forest'. The gradual transition of forest types plays an important role in wildlife and gives food and shelter for living and breeding.

FLORISTIC COMPOSITION

2.1. Past botanical studies

Among the earlier botanists who explored this district, mention may be made of Beddome (1877), Ramaswami (1914), Ranga Acharya (1919), Mudaliar & Sundararaj (1954), Govindarajalu & Swamy (1958) and Shankaranarayan (1960).

The progress of botanical exploration in this area for floristic studies was speeded up by the establishment of the southern circle, Botanical Survey of India at Coimbatore in 1955. Several floristic accounts of this region were published, which include Sebastine & Henry (1960), Sebastine & Saroja (1962), Sharma & al. (1973), Henry & al. (1984), Henry & Subramanyam (1981) and Vajravelu *et al.* (1987). Many new plant taxa have been described and several plants of geographical interest including threatened and endangered taxa rediscovered from this area after a lapse of several decades. Parthasarathy & Mahadevan (1987) gave an account of the forest types in Kalakad R.F., A.N. Henry & Gopalan, R. (1998) published a floristic assessment of the area, Gopalan, R. & A.N. Henry (2000) attempted Conservation Assessment and Management Plans (CAMP) which includes systematic studies and status survey; assigning taxa to new IUCN categories of threat; and making recommendations for research management activities for over 100 threatened strict endemics of this area.

2.2. Vegetation

This area has a unique flora of biogeographical interest with high diversity and endemism. Out of almost 5000 vascular plant species occurring in southern Peninsular India, this region harbours over

2000 of them. About 100 local endemics and 50 rare and endangered species occur here (Henry al. 1984; Nair & Daniel 1986; Subramanyam & Nair 1974; Henry & Gopalan (1998); Gopalan & Henry, 2000). Since the ecosystem diversity is quite high almost all vegetation types known from the Western Ghats are found in this reserve: **1.** Southern tropical thorn forests, **2.** Southern tropical dry deciduous forests, **3.** Grasslands at lower altitudes, **4.** Southern tropical dry deciduous forests, **5.** Tropical semi-evergreen forests, **6.** Southern tropical wet evergreen (rain) forests, **7.** Subtropical montane forests and **8.** Grassy swards at high altitudes. The occurrence of the tropical rain forests a precious world natural resources must be regarded as a prime example of this ecosystem in southern India.

Southern tropical thorn forests: This type of forest occurs in the foothills up to an altitude of about 200 m in and around Papanasam, Singampatti, Kalakad, Thirukuranudi etc. In these scrub jungles, the most common shrubs and trees are *Acacia chundra, A. horrida, A. planifrons, Alangium salvifolium, Albizia amara, A. lebbeck, Atalantia racemosa, Bauhinia tomentosa, Euphorbia antiquorum, Ziziphus oenoplia* and *Z. xylopyra*. Amidst these trees *Canthium angustifolium, C. dicoccum, Capparis grandis, C. sepiaria, C. zeylanica, Carissa carandas, Dischrostachys cinerea, Dodonaea viscosa, Securinnega leucopyrus* and *S. virosa* are frequently met with. The climbers are represented by *Abrus precatorius, Cissus quadrangualris, Jasminum calophyllum, Tylophora indica* and others.

Southern tropical dry deciduous Forests: These forests occur at an altitude of about 350 m and are located in Kalakad R.F., Papanasam R.F., Singampatti R.F. The dominant trees are *Adina cordifolia, Anogeissus latifolia, Dillenia pentagyna, Peterocarpus marsupium, Semecarpus anacardium* and *Terminalia chebula*. Shrubs and undershrubs like *Acacia pennata, Chassalia ophioxyloides, Desmodium triangulare* var. *congestum* and *Phyllanthus polyphyllus* are found frequently. Herbaceous species like *Desmodium triflorum, Indigofera prostrata, Oryza granulata* and *Rostellularia procumbens* are common.

Grassland at lower altitudes: This type of grassland occurs beyond scrub jungle and deciduous forest, but below 500 m. Trees like *Anogeissus latifolia, Buchanania lanzan, Givotia rottleriformis, Grewia tiliaefolia, Mundelia sericea, Phyllanthus emblica, Pterocarpus marsupium, Terminalia chebula* and *Ziziphus xylocarpus* grow intermixed sporadically with grasses like *Cymbopogon coloratus, C. flexuosus, Themeda cymbaria* and *T. triandra. Desmodium triquetrum, D. velutinum, Indigofera wightii, Rhynchosia cana* are frequently found as undergrowth. Amidst these, *Euphorbia cristata* and *Rhynchosia rufescens* are noticeable in the dry season.

Southern tropical moist deciduous forest: This type of vegetation occurs at an altitude of about 500 m and covers an extensive area in this Tiger reserve. The forests are thick and the topography is much undulating with varied composition of flora. The forest is densely populated with *Calamus* spp. The major trees are *Acronychia pedunculata, Dalbergia coromandeliana, D. latifolia, Pterocarpus marsupium, Scleropyrum wallichianum, Terminalia chebula, T. paniculata* and *Vateria indica*. The common shrubs and undershubs are *Baleria courtalica, Blachia calycina, Helicteres isora, Ixora brachiata, Mallotus stenanthus, Mussaenda laxa,* and *Psychotria connata. Spatholobus parviflora* and *Anamirta cocculus* are huge lianas. Other climbers are *Calycopteris floribunda, Cynanchum tunicatum, Dioscorea oppositifolia, Jasminum rottlerianum, Maerua oblongifolia, Morinda umbellata* and *Sarcostigma kleinii*. The herbaceous flora is composed of common herbs like *Alysicarpus rugosus, Justicia betonica* and *Waltheria indica*.

Tropical semi-evergreen forests: This type corresponding to "Tirunelveli semi-evergreen forests" of (Champion & Seth, 1968) occurs at an altitude of

Paphiopedilium druryi - R. Gopalan

about 700 m. Both evergreen and deciduous elements are intermixed and the former ones dominating the latter in their frequency of distribution. These forests are distributed in patches and belts wherever the moisture availability is adequate to support a semi-evergreen forest but at the same time inadequate for an evergreen climax formation. The dominant species are *Antidesma menasu, Filicium decipiens* and *Gordonia obtusa*. *Careya arborea* and *Terminalia chebula* are some of the deciduous elements. Small trees and shrubs like *Mallotus philippensis, Gomphia serrata, Clausena heptaphylla* and *Psychotria nigra* are frequent. *Ancistrocladus heyneanus, Entada pursaetha* and *Gnetum ula* are the huge climbers/lianas commonly twine around branches of trees. It is difficult to demarcate this type of forest due to its patchy occurrence and the transitional formation of its components from deciduous to evergreen.

Southern tropical wet evergreen (rain) forests: This climax type of rain forest occur between 800 m and 1500 m altitudes through a transition from moist deciduous to evergreen forms and are located around Agasthiyamalai (Pothigai), Kannikatti R.F., Kakachi, Mahendragiri and from Sengaltheri to Naterikkal. Though some areas are cleared for roads and hydro-electric projects, most of the area around Agasthiyamalai (Pothigaimalai), Ainthalaipothigai, Nagapothigai (Nagamalai) and Mahendragiri are still undisturbed with impenetrable forest on inaccessible slopes. The top canopy or the first layer is extremely dense and represented by gigantic trees like *Artocarpus hirsutus, Canarium strictum, Cullenia exarillata, Diospyros ebenum, Elaeocarpus tuberculatus, Gluta travancorica, Hopea parviflora, H. utilis, Palaquium ellipticum* and *Poeciloneuron pauciflorum*.

The second layer or storey is composed of trees such as *Cinnamomum iners, Decussocarpus wallichianus, Eugenia mundogam, Garcinia echinocarpa* var. *monticola, Homalium jainii, Kingiodendrom pinnatum* and *Xanthophyllum flavescens*.

Below the second layer, innumerable shrubs and small trees such as *Agrostistchys borneensis, A. indica, Antidesma menasu, Callicarpa tomentosa, Elaeocarpus munronii, Eugenia singampattiana, Eurya nitida, Litsea deccanensis, Mallotus distans* and *Tabernaemontana gamblei* are found. Huge liana like *Gnetum ula, Millettia rubiginosa* and climbers like *Ancistrocladus heyneanus, Aristolochia indica, Dioscorea oppositifolia, Piper barberi, P. nigrum, Pothos scandens* and *Senecio walkeri* clothe the trunks of trees and shrubs.

The ground layer in disturbed areas consists of herbs and undershubs such as *Acranthera grandiflora, Begonia malabarica, Carex filicina, Neurocalyx*

Southern tropical wet evergreen (rain) forests - R. Gopalan

calycinus, Ophiorrhiza mungos, O. eriantha, Chassalia curviflora, Saprosma corymbosum, Sarcandra chloranthoides and *Thottea* spp. Wild variety of *Elettaria cardamomum, Ochlandra travancorica, Psychotria connata, Schumannianthus virgatus* and *Strobilanthes* spp. occur in dense patches in the forests. Epiphytic orchids like *Aerides crispum, A. ringens, Bulbophyllum tremulum, Coelogyne nervosa, Cymbidium aloifolium, Dendrobium nanum, D. nutans, D. wightii* and *Sirhookera latifolia* are commonly seen on tree trunks and rocks on the banks of rivers. The common ferns met with are *Angiopteris evecta, Arachnoides aristata, Asplenium caudatum, A. tenuifolium* and *Cyathea gigantea.*

Subtropical montane forests: This type occurs as a continuous expanse of evergreen forest, generally above 1500 m around Agasthiyamalai (Pothigai) peak, Nagapothigai peak (Nagamalai), Mahendragiri peak and Kakachi peak. In these exposed areas, due to the high wind velocity, the trees are of stunted nature, hardly reaching up to 4 m height and are clothed with lichens, mosses, ferns and orchids. Some of the common species are *Aglaia elaegnoidea* var. *bourdillonii, Brysophyllum tetrandrum, Canthium neilgherrense, Eugenia mabaeoides, Euphorbia santapaui, Hedyotis purpurascens, Impatiens leschenaultii, I. travancorica, I. uncinata, I. verticillata, Lasianthus blumeanus, L. cinereus, Ligustrum deaisnei,*

Euphorbia santapaui - Population and a portion of stem with flowers and fruits - R. Gopalan

Moonia heterophylla, Polyscias acuminata and *Vernonia travancorica*. Populations of *Bentinckia condapanna*, an endemic palm, are seen in inaccessibly steep slopes.

Grassy swards at high altitudes: Grassy swards or savannahs are seen in smaller dimensions on exposed rocky surfaces, especially around Agasthiyamalai (Pogthigai), Ainthalaipothigai, Nagapothigai, Mahendragiri and Kakachi. Some of the common grasses met with are *Arundinella purpurea* var. *laxa, Chrysopogon orientalis, C. aciculatus, Eulalia phaeothrix, Isachne walkeri, Themeda tremula* and *Zenkaria sebastinei*. An interesting herbaceous Dilleniaceae member, *Acrotrema arnottianum* and other herbs like *Centratherum rangacharii, Crotalaria albida, Exacum travancoricum, Heracleum candolleanum, Leucas vestita, Osbeckia aspera* and *Smithia blanda* are commonly seen. A check-list of vascular flora of this region was published by Manickam & al. (2003).

2.3. Endemic Flora

The unique feature of this area is the occurrence of more than 100 localised endemic plant species and directly acting as sites for their *in situ* conservation. As stated, Gopalan & Henry (2000) surveyed systematically all these endemics and results obtained on the two major CAMP process viz. systematic study and the status survey, and assigning

taxa to New IUCN category of threat are summarized below:

2.3.1. Systematic study and status survey

2.3.1.1. **Species new to science:** In recent years about 50 new plant taxa have been discovered from the area and some of them are *Aenhenrya agastyamalayana* Gopalan, *Dendrobium diodon* Reichb. f. ssp. *kodayarensis* Gopalan & A.N. Henry, *D. panduratum* Lindl. ssp. *villosum* Gopalan & A.N. Henry, *Euphorbia santapaui* A.N. Henry, *Exacum klackenbergi* Gopalan, *Homalium jainii* A.N. Henry & Swamin., *Indotristicha tirunelveliana* Sharma & al., *Isachne jayachandranii* Gopalan & V. Chandras. *Marsdenia tirunelvelica* A.N. Henry & Subr., *Memecylon subramanii* A.N. Henry, *Reidia singampattiana* Sebastine & A.N. Henry, *Rhynchosia jacobii* Chandrab. & B.V. Shetty, *Sonerila kanniyakumariana* Gopalan & A.N. Henry, *Symplocos pulchera* Wight ssp. *coriacea* Gopalan & A.N. Henry, *Tylophora subramanii* A.N. Henry, *Vernonia peninsularis* C.B. Clarke ex Hook. f. var. *kodayarensis* A.N. Henry & Gopalan, *Vernonia pothigaiana* V. Chelladurai & Gopalan and *Janakia* Joseph & V. Chandras and *Aenhenrya* Gopalan are two new genera described from this area.

2.3.1.2. **Species of phytogeographical interest:**

Ampelocissus wightiana B.V. Shetty & P. Singh [Vitaceae]

Antidesma walkeri (Tul.) Pax. & Hoffm. [Stilaginaceae]

Cassipourea zeylanica (Baill.) Alston [Rhizophoraceae]

Cymbidium ensiformis (L.) Sw. var. *haemotodes* (Lindl.) Trimen [Orchidaceae]

Diospyros affinis Thwaites [Ebenaceae]

Eugenia mabaeoides Wight (Myrtaceae]

E. zeylanica (L.) Wight var. *lineare* (Duthie) Alston [Myrtaceae]

Garcinia gummi-gutta - R. Gopalan

Faberenhetia zeylanica (Thwaites) Airy Shaw [Euphorbiaceae]

Filicium decipiens (Wight & Arn.) Thwaites [Sapindaceae]

Gastrochilus acaulis (Lindl.) Kuntze [Orchidaceae]

Ixora thwaitesii Hook.f. [Rubiaceae]

Laurenbergia coccinea (Blume) Kan. var. *zeylanica* (Arn. ex C.B. Clarke) Meyden [Holoragaceae]

Medinella fuschioides Gardn. [Melastomataceae]

Schoenorchis nivea (Lindl.) Schltr. [Orchidaceae]

Trigonostemon memoralis Thwaites [Euphorbiaceae]

Vitis gardneri Thwaites [Vitaceae]

V. grandis Thwaites [Vitaceae]

2.3.1.2. **Species rediscovered:**

Aphyllorchis montana (Thwaites) Reichb.f. [Orchidaceae]

Belosynopsis kewensis Hassk. [Commelinaceae]

Bulbophyllum fusco-purpureum Wight [Orchidaceae]

Cheionanthus linocieroides (Wight) Bennet

Diospyros barberi Ramasw.

Drypetes malabaricus (Bedd.) Airy Shaw

Eugenia rotteleriana Wall. ex Wight & Arn.

E. singampattiana Bedd.

Grewia pandaica Drumn.

Hedyotis barberi (Gamble) A.N. Henry & Subram.

H. ramarowii (Gamble) R.S. Rao & Hemadri

Palaquium bourdillonii Brandis

Paphiopedilum druryi (Bedd.) Pfitzer

Piper barberi Gamble

**Poeciloneuron pauciflorum* Bedd.

Sciaphila janthiana (Champ.) Thwaites

Schizaea dichotoma (L.) Sm.

Symplocos oligandra Bedd.

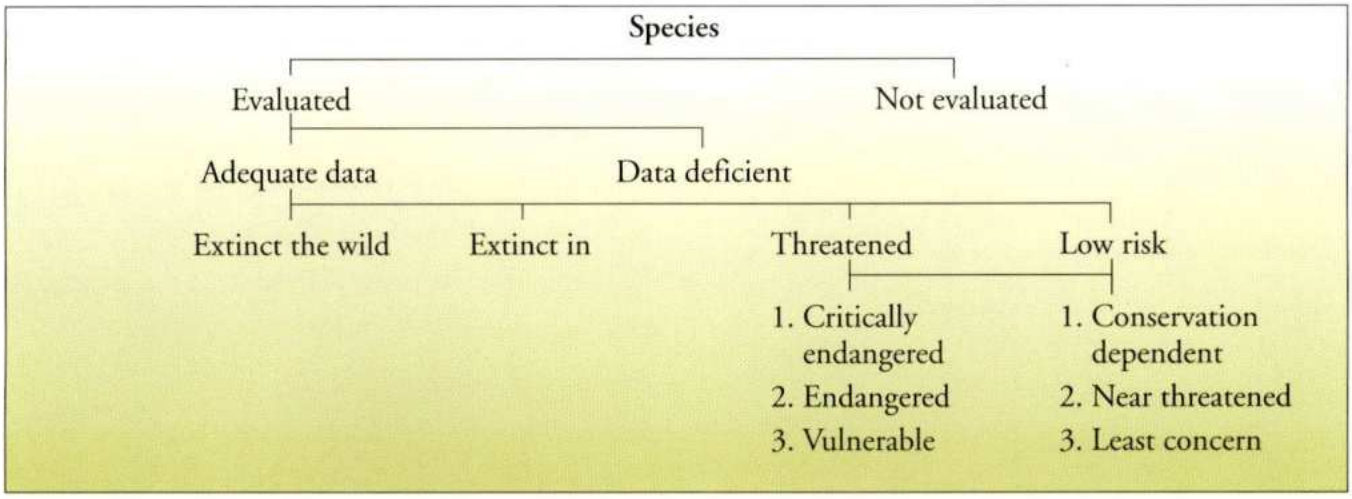
Thottea barberi (Gamble) Ding Hou

The following taxa known only through the type collection have since been rediscovered:

Biophytum insignis Gamble

Claoxylon wightii Hook.f. var. *hirsutum* (Hook.f.) Susila et Balakr. (= *Micrococa wightii* var. *hirsutum* sensu Gamble)

Didymocarpus missionis Wall. ex R.Br.



Drypetes porteri (Gamble) Pax & Hoffm.

Eugenia discifera Gamble

Helicia robusta (Roxb.) R.Br. ex Blume

Rostellularia simplex Wight

Schefflera bourdillonii Gamble

Syzigium beddomei (Duthei) Chithra

Vernonia heynei Bedd. ex Gamble

2.3.2. **Assigning species to the current IUCN Red List Categories of threat**

2.3.2.1. **Critically endangered**

Trees :

Actinodaphne campanulata Hook.f. var. *obtusa* Gamble

Cinnamomum travancoricum Gamble

C. walaiwarense Kosterm.

Poeciloneuron pauciflorum* has been recently placed under a new monotypic genus **Agasthiyamalaia (S. Rajkumar & M.K. Janarthanam in *J. Bot. Res. Inst. Texas* 1 : 129-133. 2007)

Claoxylon wightii Hook.f. var. *hirsutum* (Hook.f.) Susila et Balakr.

Diospyros barberi Ramasw.

D. humilis Bourd.

Drypetes malabaricus (Bedd.) Airy Shaw

Eugenia calcadensis Bedd.

E. discifera Gamble

E. floccosa Bedd.

Goniothalamus rhyncantherus Dunn

Grewia pandaica Drumm.

Humboldtia unijuga Bedd.

Helicia robusta (Roxb.) R.Br. ex Blume

Homalium jainii A.N. Henry & Swamin.

Palaquium bourdillonii Brandis

Symplocos oligandra Bedd.

Syzygium beddomei (Duthei) Chithra

S. rama-vermae (Bourd.) Chithra

Small trees/shrubs:

Cinnamomum travancoricum Gamble

Claoxylon wightii Hook.f. var. *hirsutum* (Hook.f.) Susila et Balakr.

Dimorphocalyx Beddi (Benth.) Airy Shaw

Drypetes porteri (Gamble) Pax. & Hoffm.

Euodia lunu-ankenda (Gaertner) Merr. var. *tirunelvelica* A.N. Henry & Chandrab.

Euphorbia santapaui A.N. Henry

E. vajravelui Binoj. & Balakr.

Schefflera bourdillonii Gamble

Symplocos nairii A.N. Henry, Gopalan & Swamin.

S. pulchra Wight subsp. *coriacea* Gopalan & A.N. Henry

Shrubs:

Anisochilus robustus Hook.f.

Hedyotis travancorica Bedd.

Lasianthes oblongifolius Bedd.

Phyllanthus singampattianus (Sebastine & A.N. Henry) Kumari & Chandrab.

Pogostemon travancoricus Bedd.

Teucrium plectranthoides Gamble

Subshrubs/undershrubs/herbs:

Hybanthus travancoricus (Bedd.) Melchoir

Janakia aryalpathra Joseph & V. Chandras.

Vernonia gossipyana Gamble

Herbs:

Aenhenrya agastyamalayana Gopalan

Belosynopsis kewensis Hassk.

Biophytum insignis Gamble

Bulbostylis puberula (Poir.) Kunth ex C.B. Clarke var. *garcilis* C.E.C. Fisch.

Didymocarpus missionis Wallich ex R. Br.

Eriocaulon ensiforme C.E.C. Fisch.

E. panagudianum Ansari & Balakr.

Exacum travancoricum Bedd.

Impatiens travancorica Bedd.

Indotristica tirunelveliana B. Sharma & al.

Ophiorrhiza tirunelvelica A.N. Henry & Swamin.

Paphiopedilum druryi (Bedd.) Pfitzer

Phyllocephalum sengaltherianum (Narayana) Narayana

Peucedanum josephianum Wadhwa & H.J. Chowdhery

Rhynchosia jacobii Chandrab.

Rostellularia simplex Wight

Zenkeria sebastenei A.N. Henry & Chandrab.

Cycas circinalis - R. Gopalan

Epiphytic herbs:

Bulbophyllum agastyamalayanum Gopalan & A.N. Henry

Dendrobium dioidon Reichb.f. subsp. *kodayarensis* Gopalan & A.N. Henry

D. panduratum Lindl. subsp. *villosus* Gopalan & A.N. Henry

Impatiens auriculata Wight

Climbers:

Cissampelopsis ansteadii (Tad. & Jacob) C. Jeffrey & Y.L. Chen

Dioscorea wightii Hook.f.

Piper barberi Gamble

Toxocarpus beddomei Gamble

2.3.2.2. **Endangered:**

Trees

Actinodaphne campanulata Hook.f. var. *campanulata*

Aglaia elaeagnoidea (Juss.) Benth. var. *bourdillonii* (Gamble) K.K.N. Nair

Brysophyllum tetrandrum (Bedd.) Hook.f. ex Bedd.

Elaeocarpus venustus Bedd.

Eugenia rottleriana Wight & Arn.

E. singampattiana Bedd.

Hopea utilis (Bedd.) Bole

**Poeciloneuron pauciflorum* Bedd.

Poeciloneuron pauciflorum* has been recently placed under a new monotypic genus **Agasthiyamalaia (S. Rajkumar & M.K. Janarthanam in *J. Bot. Res. Inst. Texas* 1 : 129-133. 2007)

Popowia beddomeana Hook.f. & Thomson

Symplocos sessilis C.B. Clarke

Small trees/shrubs:

Cinnamomum chemungianum Mohanan & A.N. Henry

Diotacanthus albiflorus (Bedd.) Benth. ex C.B. Clarke

Hedyotis barberi (Gamble) A.N. Henry & Subram.

H. evalata (Gamble) A.N. Henry & Subram. var. *agastyamalayana* A.N. Henry & Subram.

H. gamblei A.N. Henry & Subram.

H. ramarowii (Gamble) R. Rao & Hemadri

H. villosostipulata (Gamble) R.S. Rao

Memecylon subramanii Henry

Syzygium zeylanicum (L.) DC. var. *ellipticum* A.N. Henry, Chandrab. & Nair

Wendlandia bicuspidata Wight & Arn.

Undershrubs/herbs:

Amorphophallus smithsonianus Sivadasan

Biophytum longibracteatum Tad. & Jacob

Didymocarpus ovalifolius Wight

D. repens Bedd.

Elatostema lineolatum Wight var. *setosum* A.N. Henry

Neanotis monosperma (Wall. ex Wight & Arn.) W. Lewis var. *tirunelvelica* A.N. Henry & Chandrab.

Sonerila kanniyakumariana Gopalan & A.N. Henry

Thottea barberi (Gamble) Ding Hou

Vernonia bourdillonii Gamble

V. peninsularis (C.B. Clarke) C.B. Clarke ex Hook.f. var. *kodayarensis* A.N. Henry & R. Gopalan

V. ramaswamii Hutch.

Climbers:

Premna mundanthuraiensis Rajendran & P. Daniel

Pothos crassipedunculatus Sivadasan, N. Mohanan & Sathishk.

Vulnerable:

Trees:

Garcinia travancorica Bedd.

Shrubs:

Hedyotis albo-nervia Bedd.

H. viscida Bedd.

Lasianthus cinereus Gamble

Herbs:

Exacum atropurpureum Bedd.

Fuirena ponmudiensis Ravi & Anilkumar

Sonerila sadasivanii Nayar

2.4. Wild genetic resources

This Tiger reserve and its environs which are floristically rich with genetically diverse population of species, abound in economically and medicinally important plants as well. Some of the primitive cultivars, land races and wild relatives of cultivated speceis are as follows:

Amorphophallus dubius Blume, *Cinnamomum sulphuratum* Wallich ex Wight & Arn., *Curcuma aromatica* Salisb., *C. zedoaria* (Christm.) Roscoe, *Dioscorea bulbifera* L., *D. oppositifolia* L., *Elletaria cardamomum* (L.) Maton, *Elusine indica* Gaertner, *Knema attenuata* (Wallich ex Hook.f. & Thoms.) Warb., *Murraya koenigii* (L.) Spreng., *Musa kattuvazhana* Jacob, *Myristica malabarica* Gaertner, *Pinanga dicksonii* Blume, *Piper nigrum* L., *P. barberi* Gamble, *P. longum* L., *Solanum nigrum* L., *Sorghum halepense* Pers., *Zingiber casumanar* Roxb. and *Z. wightiana* Thwaites.

Amomum, Atylosia, Canavalia, Coffea, Garcinia, Mangifera, Musa, Oryza, Rauvolfia - the presence of such gene pools makes this area

Evergreen and Rain Forests

a potentially very valuable source of genetic material.

2.5. Economics and Ethnobotany

Economic evaluation has always played an important role in studies of how plants are used by local people. A concerted effort should be made to assess the value of non-cultivated resources that are harvested from forests and fields. This forms part of an effort to demonstrate the economic benefits of conserving forests and documenting traditional ecological knowledge (Martin, 1995).

2.5.1. **Hill tribe:** Settlements of the Kanis (or Kanikkkarans) occur around Inchikuzhi, Kanthaparai, Karaiyar, Mylar, Servalar, Lower Kodayar and Anchunariyathod. The Kanis live partly on leaves, tubers and fruits of forest plants and by hunting wild animals. They offer much scope for ethnobiological studies.

2.5.2. Plants of local use and commercial potential

Vegetables: *Acacia pinnata* (L.) Willd., *Achyranthes aspera* L., *Breynia retusa* (Dennst.) Alston, *Cassia laevigata* Willd., *Ficus amplissima* W. Smith, *Givotia rottleriformis* Griffith, *Justicia betonica* L., *Premna latifolia* Roxb. and *Pouzolzia zeylanica* (L.) Bennett.

Flowers: *Cullinia exarillata* Robyns and *Indigofera wightii* J. Graham ex Wight & Arn..

Fruits: *Aglaia elaeaganoidea* (Juss.) Benth. var. *courtallensis* (Gamble) K.K.N. Nair, *Allophyllus serratus* (Roxb.) Kurz, *Bridelia crenulata* Roxb., *Canthium travancoricum* (Bedd.) Hook.f., *Cansjera rheedii* Gmel., *Diospyros ovalifolia* Wight, *Grewia obtusa* Wall. ex Gamble, *Solanum melongena* L. var. *insanum* (L.) Prain and *Syzygium cumini* (L.) Skeels.

Tubers: *Dioscorea pentaphylla* L., *D. oppositifolia* L. and *Pouzolzia wightii* Bennett var. *lawsoniana* C.E.C. Fisch.

Substitute for coir: *Aganosma cymosa* (Roxb.) G. Don, *Dalbergia acaciaefolia* Dalz., *Eriolaena hookeriana* Wight & Arn. and *Grewia abutilifolia* A.L. Juss.

Substitute for tamarind: *Garcinia gummi-gutta* (L.) Robyns

Medicinal plants:

Timber species: *Canarium strictum* Roxb., *Cullenia exarillata* Robyns , *Elaeocarpus* spp., *Gluta travancorica* Bedd., *Hopea* spp., *Litsea* spp., *Mesua* spp., *Myristica* spp. and *Pterocarpus marsupium* Roxb.

Oil & resin: *Boswellia serrata* Roxb., *Canarium strictum* Roxb., *Dipterocarpus* spp., *Elaeocarpus* spp. etc.

Bamboos & rattans: *Indocalamus wightianus* (Nees) Nakai, *Ochlandra travancorica* Benth. ex Gamble, *O. wightii* C.E.C. Fisch., *Callamus gamblei* Becc. *C. rottang* L. and *C. travancoricus* Bedd.

2.6. SOCIAL AND ENVIRONMENTAL VALUE

The Tiger reserve attracts tourists not only to witness the wildlife but also to experience the feeling of wilderness. The tourists are also enchanted by the scenic beauty provided by several water courses, viz., Banathirtham, Agastiyar falls, Tiger falls, Kalikesan, and Meemutti falls. Another fascination is boating in the lakes of Upper Thambraprani, Neyyar, Peppara and Chenduruny. The 'Pothigaimudi' or Agastyarkudam, the highest peak in the range, not only offers a spectacular scenery to scale the summit trail, but also a place of pilgrimage to the numerous devotees of the sage 'Agasthiya Maharishi'. The number of tourists who visit the area and the amount of income this generates for the local economy are yet to be assessed.

The forests protect important water catchment areas. There are five reservoirs in the region, which are used to produce hydroelectricity and supply water for irrigation.

2.7. Economic Assessment

The current value of natural resources and ecological services which the area provides to the national economy on a sustainable basis has yet to be fully assessed. Besides valuable timber trees, revenue is collected from the sale of minor forest products, such as bamboos (e.g. *Bambusa arundinacea* (Retz.) Willd., *Dendrocalamus strictus* (Roxb.) Nees and *Ochlandra travancorica* (Bedd.) Benth. ex Gamble and rattans (*Calamus rotang* L.). Ilavangam (*Cinnamomum verum* Presl and other species) leaves, young buds and barks are collected for crude drugs. Trees yielding gums, resins, and dyes are also common in these forests; *Canarium strictum* Roxb. yields the Alsiba resin. The hill tribe - Kanis mainly collect honey, cinnamomum bark, and resins especially black dammar. Hill slopes are used to grow commercial crops such as coffee, tea, rubber, pepper, clove and cardamom.

2. 8. Threats

Habitation, clearance for plantation crops, over exploitation of plants of medicinal and horticultural value, hydroelectric power schemes, visitor pressure, fire, cattle gazing and fuel wood cutting are the remain threat factors affecting loss of biodiversity of this area (Davis & al., 1995).

Large number of species having medicinal and horticultural value are unfortunately threatened by over-exploitation. *Paphiopedilum druryi*, the lady's slipper orchid, endemic to this region, is critically endangered; only three scattered populations exist in Agasthiyamalai and Kalakkad hills. Also medicinal plants like *Janakia aryalpathra, Trichopus zeylanicus* and *Piper barberi* are severely threatened.

Another major threat is increasing tourism, and particularly the increasing number of tourists and pilgrims who visit 'Pothikaimudi' or 'Agastyakudam' the highest peak in the range, has resulted in increased trampling and local modification and clearance of vegetation, for example by the widening of footpaths and bridle paths. Intentional and accidental fire to seasonally dry forests by the visitors has disastrous effects on the rare and endangered plant species. Most localities of *Euphorbia santapaui* A.N. Henry, and *Paphiopedilum druryi* (Beddome) Pfitzer have already been destroyed. Cattle grazing and fuel woodcutting are also the other major threats.

Trichopus zeylanicus subsp. *travancoricus* - R. Gopalan

Several settlements in the existing hydel and irrigation projects (Upper Thambraprani, Servalar, Papanasam Lower, Manimuthar, Upper and Lower Kodayar) have caused much ecological disturbances. These hydel projects have been instrumental for changes in forest type, especially on the Mundanthurai Plateau and upper Kodayar regions - indicating a shift in soil hydrology. Singampatti R.F. and certain pockets of Papanasam R.F. (Katalamalai, Valayar, Kanthaparai) have been considerably disturbed due to the cultivation of tea, cardamom, clove and other cultivation crops.

3. CONCLUSION

It is gratifying to note that the Agasthiyamalai (Pothigai) Hills (including the Tiger Reserve) in the S.W. Ghats with their unique flora of biogeographical interest, the high diversity and endemism have been selected as one of the plant diversity centers within India for conserving global biological diversity (Davis & al. 1995; Henry & Gopalan, 1998). As early as in 1984, the Agasthiyamalai Hills, as a phytogeographical region (both eastern and western slopes) were proposed for a biosphere reserve (Henry & al. 1984). It is unfortunate that the western slopes of Agasthiyamalai Hills in Kerala comprising Neyyar, Peppara and Shenduruney Wildlife Sancturaries and their adjoining areas totalling 1701 sq km only were designated as the Agasthiyamalai Biosphere Reserve in MoEF Annual Report 2001 - 2002. It is ardently hoped that Govt. of Tamil Nadu should take speedy steps to include the biodiversity - rich eastern slopes of Agasthiyamalai comprising Kalakad-Mundanthurai Tiger Reserve, Gothayar R.F., Muthukuzhivayal, Mahendragiri R.F. and surrounding regions in Tirunelveli and Kanniyakumari districts of Tamil Nadu in this newly designated Biosphere Reserve, so that the area in its totality will serve as an "**ecological protectorate**" for the effective functioning of the biosphere reserve.(included in Agasthiyamalai BR on 30 March, 2005-Annual Report of MoEF-2005-2006).

Summary of the Status of the Endemic Flora

Species	Habit	Proposed IUCN Red List categories
Actinodaphne campanulata var. *campanulata*	Tree	En
A. campanulata var. *obtusa*	Tree	CR
Aenhenrya agastyamalayana	Herb	CR
Aglaia elaeagnoidea var. *bourdillonii*	Tree	En
Amorphophallus smithsonianus	Herb	En
Anisochilus robustus	Shrub	CR
Belosynopsis kewensis	Herb	CR
Biophytum insignis	Herb	CR
B. longibracteatum	Herb	En
Brysophyllum tetrandrum	Tree	En
Bulbophyllum agastyamalayanum	Epiphytic herb	CR
Bulbostylis puberula var. *gracilis*	Herb	CR
Cinnamomum chemungianum	Small tree/shrub	En
C. travancoricum	Small tree	CR
C. walaivarense	Tree	CR
Cissampelopsis ansteadii	Climber	CR
Claoxylon wightii var. *angustatum*	Shrub	Ex
C. wightii var. *hirsutum*	Small tree/shrub	CR
Dalbergia travancorica	Scandent shrub	Ex
Dendrobium diodon subsp. *kodayarensis*	Epiphyte	CR
D. panduratum subsp. *villosum*	Epiphyte	CR
Derris brevipes var. *travancorensis*	Shrub	Ex
Didymocarpus missionis	Herb	CR
D. ovalifolia	Herb	En
D. repens	Herb	En
Dimorphocalyx beddomei	Tree/shrub	CR
Dioscorea wightii	Climber	CR
Diospyros barberi	Tree	CR

Species	Habit	Proposed IUCN Red List categories
D. humilis	Tree	CR
Diotacanthus albiflorus	Shrub	En
Drypetes malabaricus	Tree	CR
D. porteri	Tree/shrub	CR
Elaeocarpus venustus	Tree	En
Elatostemma lineolatum var. *setosum*	Undershrub/herb	En
Eria muscicola var. *ponmudica*	Epiphyte	CR
Eriocaulon ensiforme	Herb	CR
E. panagudianum	Herb	CR
Eugenia calcadensis	Tree	CR
E. discifera	Tree	CR
E. floccosa	Tree	CR
E. rottleriana	Tree	En
E. singampattiana	Tree	En
Euodia lunu-ankenda var. *tirunelvelica*	Shrub/small tree	CR
Euphorbia santapaui	Shrub/tree	CR
E. vajravelui	Shrub/tree	CR
Exacum atropurpureum	Herb	Vu
E. courtallense var. *boneccordensis*	Undershrub	En
E. travancoricum	Woody herb	CR
E. wightianum var. *uniflorum*	Herb	CR
Fuirena ponmudiensis	Herb	Vu
Garcinia travancorica	Tree	Vu
Goniothalamus rhyncantherus	Tree	CR
Grewia pandaica	Tree	CR
Hedyotis albonervia	Shrub	Vu
H. barberi	Shrub	En
H. eualata var. *agastyamalayana*	Shrub	En
H. gamblei	Shrub	En
H. ramarowii	Shrub	En

Species	Habit	Proposed IUCN Red List categories
Hedyotis travancorica	Shrub	CR
H. villosostipulata	Shrub	En
H. viscida	Shrub	Vu
Helicia robusta	Tree	CR
Homalium jainii	Tree	CR
Hopea utilis	Tree	En
Hoya kanyakumariana	Epiphyte	CR
Humboldtia trijuga	Tree	CR
H. unijuga	Tree	CR
Hybanthus travancoricus	Undershrub/herb	CR
Impatiens auriculata	Epiphyte	CR
I. travancorica	Herb	CR
Indotristica tirunelveliana	Herb	CR
Ixora agastyamalayana	Small tree	En
Janakia aryalpathra	Undershrub	CR
Knoxia sumatrensis var. *linearis*	Herb	CR
Lasianthus cinereus	Shrub	Vu
L. oblongifolius	Shrub	CR
L. obovatus	Shrub	Ex
Marsdenia tirunelvelica	Climbing undershrub	Ex
Memecylon subramanii	Shrub	En
Morinda reticulata	Climber	En
Neanotis monosperma var. *tirunelvelica*	Herb	En
Ophiorrhiza tirunelvelica	Herb	CR
Palaquium bourdillonii	Tree	CR
Paphiopedilum druryi	Herb	CR
Peucedanum josephianum	Herb	CR
Phyllanthus singampattianus	Shrub	CR
Phyllocephalum sengaltherianum	Herb	CR
Piper barberi	Climber	CR

Species	Habit	Proposed IUCN Red List categories
Poeciloneuron pauciflorum	Tree	En
Pogostemon hedgi	Shrub	CR
P. travancoricum	Shrub	CR
Popowia beddomeana	Tree	En
Pothos crassipedunculatus	Climber	En
Premna mundanthuraiensis	Straggling shrub	En
Rhyncosia jacobii	Herb	CR
Rostellularia simplex	Herb	CR
Schefflera bourdillonii	Tree (epiphytic/lithophytic)	CR
Sonerila kanniyakumariana	Herb	En
S.sadasivanii	Herb	Vu
Symplocos macrophylla ssp. *rosea*	Shrub/small tree	Ex
S. nairii	Shrub/small tree	CR
S. oligandra	Tree	CR
S. pulchra ssp. *coriacea*	Shrub/small tree	CR
S. sessilis	Tree	En
Syzygium beddomei	Tree	CR
S. gambelianum	Tree	Ex
S. myhandrae	Tree	Ex
S. parameshwaranii	Tree	CR
S. rama-varmae	Tree	CR
S. zeylanicum var. *ellipticum*	Shrub	En
Teucrium plectranthoides	Shrub	CR
Thottea barberi	Undershrub	En
Toxocarpus beddomei	Climber	CR
Trias bonaccordensis	Epiphyte	CR
Vernonia boudillonii	Herb	En
V. gossypiana	Undershrub	CR

Species	Habit	Proposed IUCN Red List categories
V. heynei	Undershrub	CR
V. meeboldii	Undershrub	Ex
V. peninsularensis var. *kodayarensis*	Undershrub/Herb	En
V. ramaswamii	Undershrub	En
Wendlandia bicuspidata	Undershrub	En
Zenkeria sebastinei	Herb	CR

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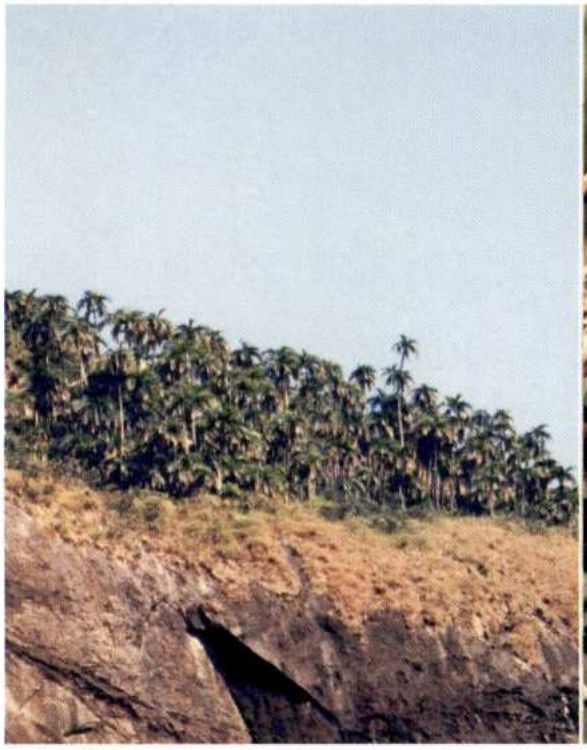
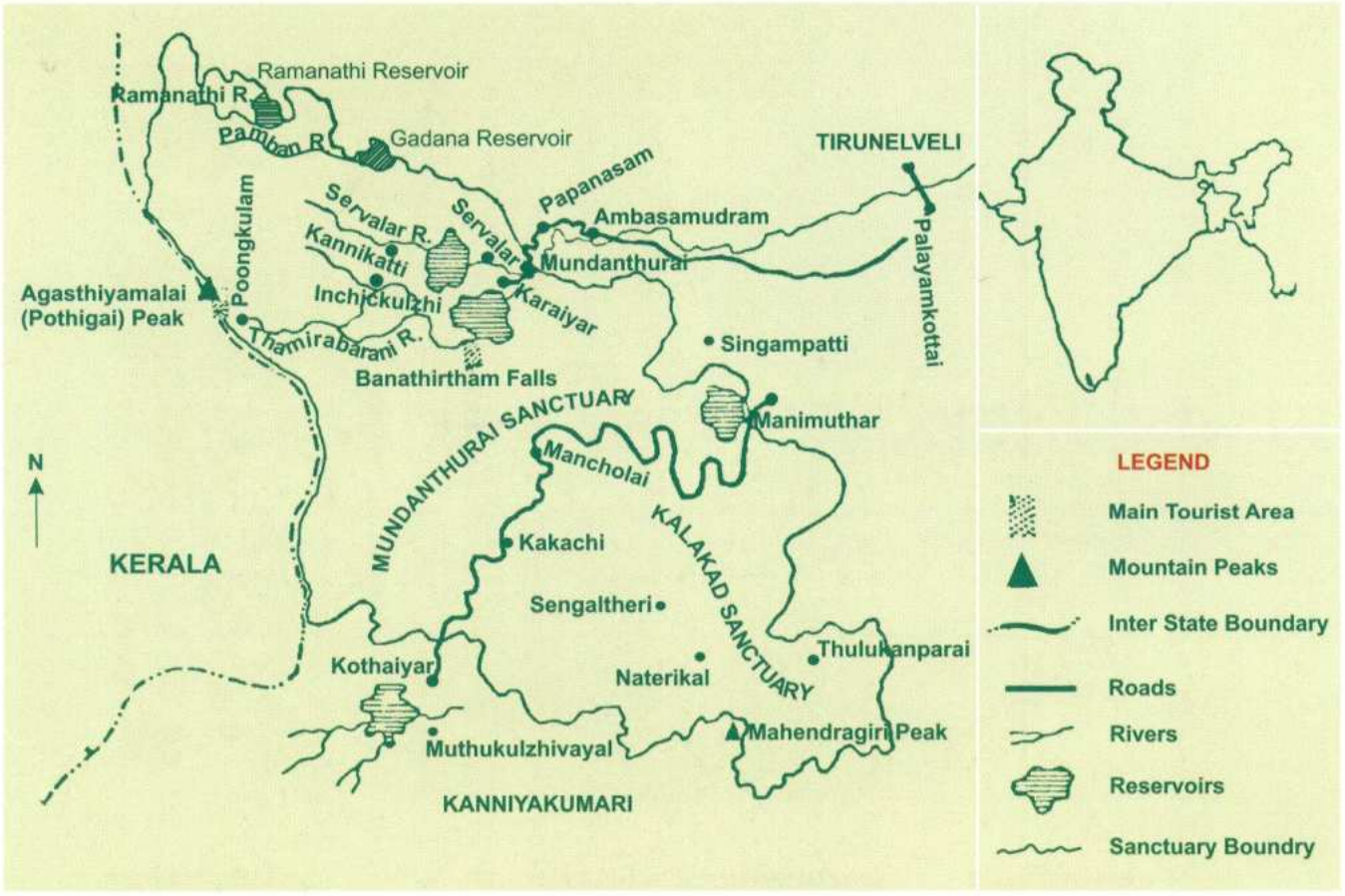


(a) Bentinckia condapanna - Population

(b) immature and mature fruits

(c & d) Beccaurea courtallensis - immature and mature fruits on trunks. R. Gopalan



Map of Kalakad-Mundanthurai Tiger Reserve

Nageia wallichiana

R. Gopalan

Sarcandra chloranthoides

R. Gopalan

FOREST COVER

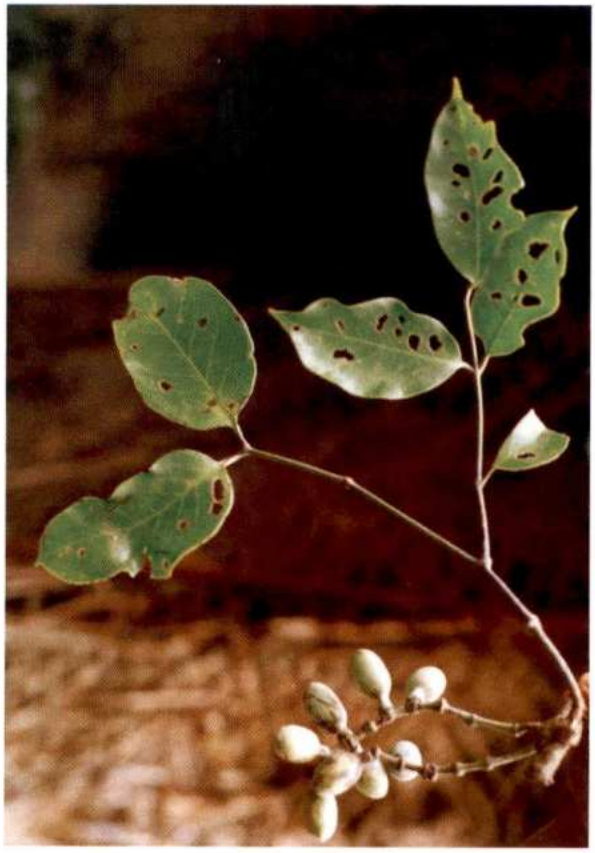
The results of the study taken up in 1993 showing density-wise forest cover in the Tiger Reserve for the assessment years 1983 and 1989 and the net changes between the two years are given in table. It shows a net decrease of 61.16 km^2 in forest cover.

Forest Cover in Kalakad-Mundanthurai Tiger Reserve (1983-1989)

(Area in km^2)

Category	Assessment year		Net Change
	1983	1989	(1983-1989)
Dense Forest	596.01	554.02	-41.99
Open Forest	95.15	75.98	-19.17
Total Forest	**691.16**	**630.00**	**-61.16**
Scrub	-	78.72	78.72
Non-Forest	108.84	84.43	-24.41
Un-interpreted	-	6.85	6.85
Total Atea	**800.00**	**800.00**	-

Gnetum ula R. Gopalan



Kigelia africana - courtesy P. Singh

UTTAR PRADESH

Dudhwa Tiger Reserve

Dudhwa Tiger Reserve

S Kumar
Botanical Survey of India Northern Circle Dehradun-248 195, Uttarakhand

Dudhwa Tiger Reserve in the North Kheri Forest division with an area of about 490 sq. km was first declared as a National Park by the Government of Uttar Pradesh in February, 1977. The "Project Tiger" was introduced in Dudhwa National Park in the year 1987-88 and large part of the park was declared as "Tiger Reserve" to provide an undisturbed habitat for tigers.

The reserve is a centre of great attraction to visitors, foreign tourists, botanists, naturalists and wildlife experts. The area has historical significance as the famous Khairagarh fort and the fort of Ghorishah are located in its close vicinity. The other important historical monument is the ruined Nawalkhar fort near Sathiana forest Rest House. The habitation of "Tharu Tribe" in the bordering forest add cultural dimensions to Dudhwa National Park.

Location and Topography

Dudhwa Tiger Reserve was initially declared with an area of ca 490 km^2. In 1999-2000, Govt. of India extended this Reserve by including Katarniaghat WLS having an area of 400 km^2 thereby making the total area of Dudhwa-Katarniaghat Tiger Reserve equal to 1,284 km^2. Katarniaghat lies in the South-East of Dudhwa National Park separated by the town of Singhai Kalan in the Bahraich district of Uttar Pradesh and entire reserve lies between 28°02' - 28°42' N and 80°19' - 81°20'E and is bounded in the north by Nepal whereas remaining sides are contiguous with the Kheri district of Uttar Pradesh. The adjoining area of 123 sq km is also under the administrative control of the Reserve thus making it a complete block of 613 sq km. The elevation ranges between 150-182 m in the south-east to extreme north.

Dudhwa Tiger Reserve, occupies large stretches of alluvial plain covered in the northern half with forests and intersected in between by many rivers and water courses. There is absence of prominent ridges and the only irregularities of surface are formed by low river beds and high river banks which flank them on either sides. This results in a series of fairly elevated plateaus, separated by streams and rivers flowing from the north-west to the south-west and bordered by low alluvial belts of varying width. The important river forming an international boundary is Mohan river whereas Suheli river forms southern boundary of the park.

Dudhwa Tiger Reserve is mainly composed of gangetic alluvium showing a succession of beds of sand and loam, varying in depth according to the configuration of the ground. The surface soil in the low alluvium is of recent origin, but in the high alluvium is mostly a loamy sand varying in depth and composition. The underlying soil of the forest area also consists of gangetic alluvium with a succession of beds of sand and loam of varying depth. In areas where clay has been deposited on the surface as in depressions, the ground becomes swampy during the rainy season.

The climate of the Reserve is of monsoon type. The winter season extends from the last week of October to the middle of March. The coldest months of the season being December and January. The mean temperature vary between 8.0°C - 22°C, the relative humidity being 74.2 per cent. The summer season starts from the middle of March and extends up to the break of monsoon. The mean relative humidity being

Grassland in Dudhwa Tiger Reserve

63.5% and the mean temperatures ranging between 23.5° - 36.9°C. The rainy season starts from the first week of July extending up to the first week of October. July and August are the wettest months of the year. The average total annual rainfall is about 1159.79 mm, the mean relative humidity being ca 78.8 per cent.

Phytodiversity of Dudhwa Tiger Reserve

The vegetation of Dudhwa Tiger Reserve is of tropical moist deciduous type. It is one of the best natural Sal forests, forming a climatic climax in Uttar Pradesh. Champion and Seth (1968) classified this Sal forest into Moist Bhabar Sal and Moist Plains Sal, the sub-types being Damar Sal forest and Western light alluvium plain Sal. These are found at Dudhwa, Bellraien, Bankati and several other places with in the area. Sal is the dominant constitutent of these forests both by way of natural growth and by plantation. Grasslands are also seen within the reserve area along with riparian fringe forest, Sal forest, mixed Sal and teak, and semievergreen forests. The major vegetation types in Dudhwa Tiger Reserve, based on structure and composition can be classified as follows :

1. Northern tropical semi-evergreen forests
2. North Indian moist deciduous forests
3. Alluvial plain sal forests
4. Western light alluvium forests
5. Riparian forests
6. Moist Sal savanna
7. Moist savanna
8. Tall wet grasslands
9. Intermediate level grasslands
10. Short grasslands
11. Marshes
12. Plantations.

The composition of vegetation in various forest types are as follows :

The various types of forests throughout the reserve are interrupted by wide streches of grasslands locally called as 'phantas'. The common perennial grasses are *Themeda arundinacea* (Roxb.) Ridley, *Saccharum spontaneum* L., *Saccharum benghalense* Retz., *Narenga porphyrocorma* (Hance) Bor, *Vetiveria zizanioides* (L.) Nash., *Cymbopogon flexuosus* (Nees) Wats., *Desmostachya bipinnata* (L.) Stapf, *Apluda mutica* L., *Dichanthium annulatum* (Forssk.) Stapf., *Dichathium glabrum* (Roxb.) Jain Deshpande, *Pseudosorghum fasciculare* (Roxb.) A. Camus, etc. *Hygroryza aristata* (Retz.) Nees is the common aquatic grass whereas on the margins of ditches *Panicum paludosum* Roxb. and *Echinochloa* spp. are frequent. Occasionally scattered trees or shrubs of *Syzygium cumini* (L.) Skeels, *Lannea coromandelica* (Houtt.) Merr., *Mallotus philippensis* Muell.-Arg. and climbers like *Ventilago denticulata* Willd., *Dioscorea belophylla* Voigt, *Dioscorea bulbifera* L., and *Trichosanthes cucumerina* L., are also seen.

Riparian fringe forests are found on the bank of Suheli river near Dudhwa and elsewhere. *Acacia catechu* Willd. and *Dalbergia sissoo* Roxb. are found associated with *Trewia nudiflora* L., *Mallotus philippensis* Muell.-Arg. and occasionally with *Syzygium cumini* (L.) Skeels and *Barringtonia acutangula* Gaertn.

Thick Sal forests are met with in Dudhwa, Bankati, Bellraien and several other places and occupy a fairly large area in the Tiger reserve. The common associates of *Shorea robusta* Gaertn.f. are *Mallotus philippenisis* Muell.-Arg., *Ardisia solanacea* (Poir.) Roxb., *Callicarpa macrophylla* Vahl., *Murraya koenigii* (L.) Spreng., *Clerodendrum viscosum* Vent., *Mitragyna parvifolia* (Roxb.) Korth, *Flemingia macrophylla* (Willd.) Prain ex Merr., *Grewia elastica* Royle, *Ziziphus mauritiana* Lamk., *Ziziphus oenoplia* (L.) Mill., *Ziziphus xylopyrus* (Retz.) Willd., *Carissa spinarum* L., *Aegle marmelos* Corr. The common grass in undergrowth is *Desmostachya bipinnata* (L.) Stapf.

The other type of forests found in Dudhwa Tiger Reserve are mixed Sal and Teak forests. The characteristic species found in these forests are *Mitragyna parvifolia* Korth. *Adina cordifolia* (Roxb.) Hook.f. ex Brandis, *Dalbergia sissoo* Roxb., *Kydia calycina* Roxb., *Emblica offlcinalis* Gaertn., *Ziziphus mauritiana*Lamk., *Ehretia laevis* Roxb., *Ficus semicordata* Buch.-Ham., *Desmodium triangulare* (Retz.) Merr., *Desmodium pulchellum* (L.) Benth., etc.

Semievergreen forests occupy a small portion of land in Gauriphanta, Bankati and Bellraien. The forests of these areas have no uniformity in composition of vegetation and with no apparent dominant species. The important constituents in this type are *Cassia fistula* L., *Kydia calycina* Roxb., *Adina cordifolia* Benth., *Terminalia bellirica* Roxb., *Mallotus philippensis* Muell.-Arg., *Acacia catechu* Willd., *Casearia elliptica* Willd., *Tectona grandis* L., *Emblica officinalis* Gaertn. *Phyllanthus reticulatus* Poir., *Holarrhena antidysenterica* (Roxb.) Wall. ex A. DC., *Milletia auriculata* Baker, *Helicteres isora* L. and *Xeromphis spinosa* (Thunb.) Keay.

The straggling shrubs and climbers frequently met with in the reserve are *Dioscorea belophylla* Voigt, *Dioscorea bulbifera* L., *Phanera vahlii* (Wight & Arn.) Benth,, *Porana paniculata* Roxb., *Ipomoea cairica* (L.) Sweet, *Cryptolepis buchanani* Roem. et Schult., *Ichnocarpus frutescens* (L.) R. Br., *Thunbergia grandiflora* Roxb., *Abrus precatorius* L., etc. Occasional occurence of *Naravelia zeylanica* (L.) DC., a climber and *Olax nana* Wall. a small woody herb at Bellraien is also noteworthy.

The herbaceous undergrowth often encountered in these forests consists of *Ajuga macrophylla* Wall. ex Benth., *Alternanthera sessilis* (L.) DC., *Borreria brachystema* (R. Br. ex Benth.) Valet, *Mazus pumilus* (Burm.f.) Steen., *Hemigraphis hirta* T. Anders., *Uraria picta* Desv. and sedges like *Cyperus rotundus* L., *Cyperus exaltatus* Retz., *Carex fedia* Nees, *Fimbristylis dichotoma* (L.) Vahl, *Fimbristylis ovata* (Burm.f.) Kern. etc.

The frequent surveys of these forests revealed five dominant types of plant communities, viz. *Shorea - Mallotus - Adina* community, *Bridelia* community, *Shorea - Terminalia* community, *Dalbergia - Acacia* community, *Syzygium -Barringtonia - Kirganelia - Trewia* community.The weed flora is found along roadsides, railway lines and in cultivated fields etc.

The common weeds of wastelands are *Xanthium strumarium* L., *Cassia tora* L., *Cassia occidentalis* L., *Croton bonplandianum* Baill., *Cleome viscosa* L., *Cleome gynandra* L., *Solanum surattense* Burm.f., *Cannabis sativa* L., *Amaranthus spinosus* L., *Adhatoda zeylanica* Medik., *Scoparia dulcis* L., *Argemone mexicana* L., *Tephrosia purpurea* (L.) Pers., *Tribulus terrestris* L., *Urena lobata* L., etc. There is quite a notable presence of exotic weeds introduced in the reserve, common among these are *Ageratum conyzoides* L., *Alternanthera paronychioides* St. Hil., *Alternanthera pungens* Kunth *Anagallis arvensis* L., *Hyptis suaveolens* (L.) Poit., *Lantana camara* L., *Oxalis corniculata* L., etc. Beside these state forest department has introduced many ornamental and economic trees and shrubs which include *Ailanthus excelsa* Roxb., *Morus alba* L., *Averrhoa carambola* L., *Cassia siamea* Lam., *Delonix regia* (Boj. ex Hook.f.) Rafin., *Ficus pumila* L., *Grevillea robusta* A. Cunn., *Kigelia pinnata* DC., *Pinus roxburghii* Sarg., *Prunus domestica* L., *Prunus persica* (L.) Stokes, *Terminalia arjuna* Wight & Arn., *Populus* sp., *Eucalyptus citriodora* Hook.f., etc.

Vanda tessellata (Roxb.) Hook, ex G. Don is usually found on the tree trunks of *Madhuca longifolia* var. *latifolia*. *Dendrophthoe falcata* (L.f.) Ettings. and *Cuscuta reflexa* Roxb. are the most common parasitic species found in the tiger reserve.

There are a number of rivulets, temporary water pools and permanent tals in the Dudhwa Tiger Reserve which support a variety of aquatic plants. The common free-floating hydrophytes are *Trapa natans* L. var. *bispinosa* (Roxb.) Makino, *Utricularia flexuosa* Vahl, *Hygroryza aristata* (Retz.) Nees, *Lemna perpusilla* Torrey, *Spirodela polyrhiza* (L.) Schleid., etc. *Aponogeton crispum* Thunb., *Hydrilla verticillata* (L.f.) Royle, *Potamogeton pectinatus* L., *Ottelia alismoides* (L.) Pers., *Nelumbo nucifera* Gaertn., *Nymphaea nouchali* Burm.f., *Nymphoides cristata* (Roxb.) Kuntze, *Monocharia vaginalis* (Burm.f.) Presl, *Echinochloa vaginalis* (Burm.f.) Presl, *Sagittaria guayanensis* Kunth are most common species among anchored submerged hydrophytes. *Echinochloa colonum*(L.) Link, *Echinochloa stagnina* (Retz.) P. Beauv., *Panicum paludosum* Roxb. are few amphibious hydrophytes found in the reserve area.

STATISTICAL ANALYSIS OF THE FLORA

An analysis of the floristic diversity of Dudhwa Tiger Reserve revealed the presence of about 821 species of angiosperms falling under 489 genera representing 120 families. The composition of dicot and monocot families is shown in Table 1.

Table 1 : Statistical analysis of Families, Genera and Species of Dicotyledons and Monocotyledons

	Group	Families		Genera		Species	
1.	Dicotyledons	99	(82.50)*	386	(78.93)	635	(77.46)
2.	Monocotyledons	21	(17.50)	103	(21.07)	186	(22.54)
	Total	**120**		**489**		**821**	

*The figures in parantheses show percentage in each category.

It is obvious from the table that the ratio of families belonging to Monocotyledons and Dicotyledons is 1: 4.76, of genera 1: 3.75 and of species 1: 3.41. The monocotyledons are rather poorly represented except those belonging to Poaceae, Cyperaceae, Orchidaceae and Commelinaceae. A comparison of ten dominant families of Dudhwa Tiger Reserve in terms of species richness is provided in Table 2 which indicates that Fabaceae with 106 species is the most dominant family followed by Poaceae (76), Asteraceae (56), Cyperaceae (46) and Euphorbiaceae (35).

Table 2 : Dominant plant families of Dudhwa Tiger Reserve

Family	Genera	Species
Fabaceae	41	106
Poaceae	54	76
Asteraceae	35	56
Cyperaceae	7	46
Euphorbiaceae	19	35
Convolvulaceae	8	23
Lamiaceae	7	22
Acanthaceae	16	20
Scrophulariaceae	11	19
Rubiaceae	12	17
Malvaceae	9	17

The dominant plant genera of the Tiger Reserve are listed in Table 3 which indicates that *Cyperus* L. (24), *Ipomoea* L. (14), *Ficus* L. (11), *Desmodium* Desv. (11), *Cassia* L. (9) and *Fimbristylis* Vahl (9) are among the most diverse genera of flowering plants in Dudhwa Tiger Reserve.

Table 3 : Dominant plant genera in Dudhwa Tiger Reserve

Genus	No. of species
Cyperus L.	24
Ipomoea L.	14
Ficus L.	11
Desmodium Desv.	11
Cassia L.	09
Fimbristylis Vahl	09
Grewia L.	08
Crotolaria L.	08
Blumea DC.	07
Euphorbia L.	07

Cymbopogon osmastonii Parker is an endemic species reported from the reserve area only. Dudhwa Tiger reserve is rich in medicinal and other economically important plants. The important medicinal plants reported from the Tiger reserve included *Dioscorea pentaphylla* L., *D. bulbifera* L., *Rauvolfia serpentina* (L.) Benth. ex Kurz, *Emblica officinalis* Gaertn., *Acorus calamus* L., *Costus speciosus* Sm., *Andrographis paniculata* (Burm.f.) Nees, *Bacopa monnieri* (L.) Wettst., *Centella asiatica* (L.) Urban, *Curculigo orchioides* Gaertn., *Terminalia arjuna* Retz., *T. bellirica* Gaertn., etc. The other economically important plants included *Eulaliopsis binata* (Retz.) Hubb., *Celastrus paniculatus* Willd., *Madhuca longifolia* (Koen.) Macb. var. *latifolia* Chev., *Ventilago denticulata* Willd., *Gmelina arborea* Roxb., *Mallotus philippensis* (Lam.) Muell. Arg., *Tectona grandis* L., *Shorea robusta* Gaertn.f., species of *Acacia* etc. to name a few.There are only two RET species as per IUCN red list (1997) in the Tiger reserve area which included *Cymbopogon flexuosus* (Nees ex Steud.) Watson var. *microstachys* (Hook.f.) Bor and *Cymbopogon osmastonii* Parker. The later is also an endemic species reported from the reserve.

It is obvious from the above, that Dudhwa Tiger Reserve is one of the most floristically rich areas of Uttar Pradesh. The immense floristic diversity is reflected by the presence of more than 75 species of trees, ca 25 species of shrubs, ca 20 species of climbers and ca 180 species of aquatic plants. Besides these, more than 50 species of medicinal and other economically important plant species are also reported from the region. It is therefore not only significant but also should be of prime concern to save the rich floristic wealth of this "Reserve".

Acknowledgements

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Tiliacora acuminata - a liana

ENUMERATION

RANUNCULACEAE
Clematis gourlana Roxb. ex DC.
Naravelia zeylanica DC.
Ranunculus cantoniensis DC.
R. sceleratus L.

DILLENIACEAE
Dillenia pentagyna Roxb.

ANNONACEAE
Annona squmosa L.
Milusa tomentosa Finet & Gagnep.
M. velutina Hook. f. & Thomson
Polyalthia suberosa Thw.

MENISPERMACEAE
Cissampelos pareria L.
Cocculus hirsutus Diels
Tilacora acuminata Miers
Tinospora cordifolia Miers
T. sinensis Merr.

NYMPHAECEAE
Nymphaea nouchali Burm. f.
N. stellata Willd.

NELUMBONACEAE
Nelumbo nucifera Gaetrn.

PAPAVERACEAE
Argemone mexicana L.
A. ochroleuca Sweet

FUMARIACEAE
Fumaria indica Pugsley

BRASSICACEAE
Cornopus didymus Sm.
Eruca sativa Mill.
Rorippa indica Hiern.
R. montana Small

CAPPARACEAE
Capparis zeylanica L.

Cleome gynandra L.
C. viscosa L.

VIOLACEAE
Hybanthus ennaspermus Muell. Arg.

FLACOURTIACEAE
Casearia elliptica Willd.
C. graveolens Dalz.
Flacourtia indica Merr.
F. jangomas Raeusch.
Xylosma longifolia Clos.

POLYGALACEAE
Polygala arvensis Willd.
P. crotalarioides Buch.-Ham. ex DC.
P. erioptera DC.

CARYOPHYLLACEAE
Polycarpaea corymbosa Lak.
Polycarpon prostratum Pax.
Stellaria media Vill.

PORTULACACEAE
Portulaca oleracea L.
P. quadrifida L.

TAMARICACEAE
Tamarix dioica Roxb.

ELATINACEAE
Bergia ammoniodes Roxb. ex Roth

MALVACEAE
Ablemoschus crinitus Wall.
Abutilon indicum (L.) Sweet
Hibiscus lobatus Kuntze
H. rosa-sinensis L.
H. vitifolius L.
Kydia calycina Roxb.
Malva sylvestris L.
M. verticilata L.
Malvastrum coromandelianum Garcke
Sida acuta Burm. f.'
S. alba L.
S. cordata (Burm f.) Borss. Waalk.
S. cordifolia L.
S. rhombifolia L.
Urena lobata L.
U. palmata Roxb.

BOMBACACEAE
Bombax ceiba L.

STERCULIACEAE
Helicteres isora L.
Melochia corchorifolia L.
Pentapetes phoeniceae L.
Pterospermum acerifolium Willd.
Sterculia villosa Roxb.

TILIACEAE
Corchorus aestuans L.
C. capsularis L.
C. trilocularis L.
Grewia disperma Rottl. ex Spreng.
G. elastica Royle
G. hainesiana Hole
G. hirusta Vahl
G. polygama Roxb.
G. sapida Roxb.
G. sclerophylia Roxb. ex G .Don
G. tilaefolia Vahl
Trimphetta pentandra A. Rich.
T. pilosa Roth
T. rhomboidea Jacq.

ZYGOPHYLLACEAE
Tribulus terrestris L.

AVERRHOACEAE
Averrhoa carambola L.

OXALIDACEAE
Biophytum sensitivum DC.
Oxalis corniculata L.

RUTACEAE
Aegle marmelos Carr.
'Citrus medica L.
Clausena pentaphylla DC.
Glycosmis arborea DC.
G. mauritiana Tanaka
Muraya koenigi Spreng.

SIMAROUBACEAE
Ailanthus excelsa Roxb.

OCHANACEAE
Ochna pumila Buch.-Ham. ex D.Don.

BURSERACEA
Garuga pinnata Roxb.

MELIACEA
Azadlarachta indica Juss.
Melia hamitoniana Pennell
Toona ciliata Roem.
Trichilla connaroides Benth.

OLACACEA
Olax nana Wall. ex Benth.

CELASTRACEAE
Celastrus paniculatus Willd.
RHAMNACEAE
Gouania leptostachya DC.
Ventilago denticulata Willd.
Ziziphus mauritiana Lam.
Z. mauritiana var. Seb. & Balak.
Z. nummalaria Wight & Arn.
Z. oenoplia Mill.
Z. rugosa Lam.
Z. xylophyrus Willd.
VITACEAE
Ampelocissus latifolia Planch.
Cayaratia trifolia Domin.
Cissus repanda Vahl
LEECEAE
Leea alata Edgew.
L. asiatica Ridsdale
L. macrophylla Roxb.
SAPINDACEAE
Cardiospermum halicacabum L.
Dodonaea viscosa Jacq.
Eriglossum rubiginosum Blume
Schleichera oleosa Oken.
ANACARDIACEAE
Buchanania lanzan Spreng.
Lannea coromandelica Merr.
Mangifera indica L.
Semecarpus anacardium L. f.
Spondia pinnata Kurz
MORINGACEAE
Moringa oleifera Lam.
FABACEAE
Abrus precatorius L.
Aeschynomene aspera L.
A. indica L.
Alysicarpus bupleurifolius DC.
A. longifolius Wight & Arn.
A. vaglanlis DC.
Atylosia scarabaeoides Benth.
A. volubilis Gamble
Butea monosperma Taub.
B. parviflora Roxb.
Crotalaria albida Heyne ex Roth
C. bialata Schrank
C. calycina Schrank
C. mysorensis Roth
C. sessiliflora L.
C. spectabilis L.
Desmodium brachystachyum Grah. ex Benth.
D. gangeticum DC.
D. heterocarpon DC.
D. laxiflorum DC.
D. microphyllum DC.
D. motorium Merr.
D. oojeinense Ohashi
D. pulchellum Benth.
D. triangulare Merr.
D. triflorum DC.
D. triquetrum DC. subsp. **pseudotriquetrum**
D. velutinum DC.
Dunbaria glandulosa Prain
Erythrina resupinata Roxb.
Flemingia chapper Buch.-Ham.
F. congesta Roxb.
F. congesta Roxb. var. **nana** Baker
F. paniculata Wall. ex Benth.
F. procumbens Roxb.
F. strobilifera R. Br. ex Aiton
Galactia tenuiflora Wight & Arm.
Indigofera cassiodes Rotll. ex DC.
I. glabara L.
I. hamiltoni R. Grah, ex Duthie & Prain
I. hirsuta L.
I. linifolia Retz.
I. trifoliata L.
Lens culinaris Medik.
Lespedeza cuneata G. Don
Medicago lupulina L.
M. polymorpha L.
Melilotus alba Desr.
M. indica All.
Millettia extensa Baker
M. peguensis Ali
Mucuna prurita Hook. f.
Outeinia oojeinensis Hochr.
Pterocarpus marsupium Roxb.
Pueraria phaseoloides Benth.
P. tuberosa DC.
Rhynchosia minima DC.
R. rothii Benth. ex Ait.
Sesbania blespinosa Faweett & Randle
S. sesban Merr.
Tephrosia candida DC.

T. pumila Pers.
T. purpurea Pers.
Trifolium alexandirinum L.
Uraria alopecuroids Wight
U. neglecta Prain
U. picta Desv. ex DC.
U. rufescens Schind.
Vicia hirsuta S.F Gray
V. sativa L.
Vigna aconitifolia Marechal
V. vexillata A. Rich.
Zornia gibbosa Span.

CAESALPINIACEAE
Bauhinia linnaei Ali
B. malabarica Roxb.
B. racemosa Lam.
B. vahlii Wight & Arn.
B. variegata L.
Casalpinia bonduc Roxb.
C. descapetala Alston
Cassia absus L.
C. fistula L.
C. occidentalls L.
C. siamea Lam.
C. sophera L.
C. surattensis Burm. f.
C. surattensis var. **suffrutiosa** Chatt.
C. tara L.
Cassine glacua Kuntze
Dallbergia lanceolaria L. f.
D. sissoo Roxb.
D. volubilis Roxb.
Tamaridnus indica L.

MIMOSACEAE
Acacia auriculoformis A. Cunn.
A. catechu Willd.
A. farnesiana Willd.
A. nilotica Willd. ex Delile subsp. indica Brenan.
A. sinuata Merr.
Albizia chinesis Merr.
A. lebbeck Benth.
A. procera Benth.
Mimosa pudica L.
M. rubicaulis Lam. subsp. **himalayana** Ohasi.
Pithecellobium dulce Benth.

ROSACEAE
Potentilla indica Wolf.
P. suplna L.
Prunus persica Stokes
Pyrus pashia Buch.-Ham.
Rubus niveus Thunb.

COMBRETACEAE
Combretum manum Buch.-Ham. ex D. Don
Terminalia alata Heyne ex Roth
T. arjuna Wight & Arn.
T. bellirica Roxb.
T. chebula Retz.

MYRTACEAE
Eucalyptus citriodora Hook. f.
Syzygium cerasoides Chat. & Kanjilal. f.
S. cumini Skeels
S. heyneanum Wall. ex Duthie

LECYTHIDACEAE
Barringtonia acutangula Gaertn.
Careya arobrea Roxb.
C. herbacea Roxb.

LYTHRACEAE
Ammania bacciifera L.
A. multiflora Roxb.
Lagerstoemia parviflora Roxb.
L. speciosa Pers.
Lawonia inermis L.
Rotala indica Koehne
R. mexicana Chamb. & Schlect
Woodfordia fruticosa Kurz

ONAGRACEAE
Ludwigia adscendens Hara
L. octovalvis Raven subsp. sessiliflora Raven
L. perennis L.
L. prostrata Roxb.

CUCURBITACEAE
Actinostemma tenerum Griff.
Coccinia grandis Voigt
Diplocyclos palmatus Jeffery
Gymnopetalum cochinchinesis Kurz
Luffa echinata Roxb.
L. graveolens Roxb.
Momordica charantia L.
M. dioca Roxb. ex Willd.
Mukia maderaspatana M. Roem.
Solena heterophylla Lour.
Trichosanthes bracteata Voigt
T. cordata Roxb.

T. cucumerina L.
T. dioica Roxb.
T. himalensis C.B. Clarke

CACTACEAE
Opuntia stricta var. **dilleni** Benson

AIZOACEAE
Trianthema portulacastrum L.

MOLLUGINACEAE
Gilnus lotoides L.
G. oppositifolius DC.
Mollugo pentaphylla L.

APIACEAE
Centella asiatica Urban
Cnidum monnieri Cusson
Hydrocotyle sibthorpoldes Lam.
Peucedanum dhana Buch.-Ham. ex C.B. Clarke
Seseli diffusum Santapu & Wagh.

ALANGIACEAE
Alangium salvifolium Wang.
subsp. **salvifolium** Mukerjee

RUBIACEAE
Adina cordifolia Hook f. ex Brandis
Borreria articularis F.N. Wills.
B. pusilla (Wall.) DC.
Gardenia turgida Roxb.
Hymenodictyon orixensis Mabb.
Hyptianthera sticta Wight & Arn.
Knoxia sumatrensis DC.
Mitragyna pavifolia Korth.
O. mudicaulis Roth
O. paniculata L.
Wendandia heynei Santapau & Merchant
Xeromphis spinosa Keay
X. uliginos Mahesh

ASTERACEA
Adenostemma lavenia Kuntze
Agerantum conzyoides L.
Amberboa ramosa Jafri.
Bidens biternata Merr. & Scherff.
Blumea eriantha DC.
B. hieracifolia DC. var. **hamiltonii** Hook. f.
B. lacera DC.
B. laciniata DC.
B. membranacea DC.
B. mollis Merr.
B. oxyodonia DC.
Caesulia axiallaris Roxb.
O. nudicaulis Roth
O. paniculata L.
Wendlandia heynei Santapau & Merchant
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B. lacera DC.
B. laciniata DC
B. membranacea DC.
B. mollis Merr.
B. oxydonta DC.
Caesulia axiallaris Roxb.
Centipeda minima Aesch.
Chrysanthellum americanum (L.) Vatke
Cichorlum intybus L.
Clrsium avense Cop.
Conzya bonarlensls Cronq.
C. canadensis Cronq.
Cotula anthemoides L.
C. hemisphaerica Wall. ex C.B.
Cyathoeline purpurea Kuntze
Dichrocephaia integrifolia Kuntze
Eclipta alba Hassk.
Elephantopus scaber L.
Emilia sonchifolia DC.
Erigeron asteroides Roxb.
Gnaphalium indicum L.
G. lluteoalbum L. subsp. **affine** Koster.
G. peregrinum Fernald
G. pulvinatum Del.
Grangea maderaspatana Poir.
Lactura dolichophylla Kitamura
L. polycephala C.B. Clarke
Laggera aurita Sch.-Bip.
L. falcata Kurnze
Launaea aculis Bubc. ex Kerr.
L. asplenifoia Hook f.
L. procumbens Ramayya & Rajgopal
Parthenium hysterophorus L.
Pentanema indicum Ling.

P. vestitum Ling.
Pluchea tomentosa DC.
Policaria crispa Sch.-Bip.
Saussurea heteromalla Hand. Mazz.
Sigesbeckia orientalis L.
Sonchus oleraceus L.
Saphaeranthus indicus L.
Tridax procumbens L.
Veronia anthelmintica Willd.
V. cineria Less
V. revoluta Buch.-Ham.
V. squarrosa Less
Xanthium strumarium L.
Yougnia japonica DC.

CAMPANULACEAE
Campanula benthamii Wall. ex Kitamura
Lobelia alsinoides Lam.
Wahlenbergia marginata DC.

PLUMBAGINACEA
Plumbago zeylanica L.

PRIMULACEAE
Anagalis arvensis L.
Androasac umbel latga (Lour.) Merr.
Lysimachia candida Lindl.
subsp. **obovata** Kunth
Primula umbellata Benth.

MYRSINACEA
Ardisia solanacea Roxb.
Embelia villosa Wall. ex. Roxb.

SAPOTACEA
Madhuca longifolia Macb.
var. **latifolia** Chev.
Manilkara hexandra Dub.

EBENACEA
Diospyros exscuipta Buch.-Ham.
D. peregrina Gurke

OLEACEAE
Jasminum arborescens Roxb.
J. brevipetiolatum Duthie
J. grandiflorum L.
J. multiforum Andrews
J. roxburghianum Wall. ex DC.
Linociera intermedia Wight
var. **roxburghi** C.B. Clarke

SALVADORACEAE
Salvadora oleoides Decne.

APOCYNACEAE
Alsonia scholaris R. Br.
Carissa opaca Stapf ex Haines
Holarrhena pubescens Wall. ex G. Don
H. antidysentrica A. DC.
Ichnocarpus frutescens R. Br.
Nerium indlucm Mill.
Rauvolfa serpentina Benth. ex Kurz
Tabernamontana divaricata R.Br.
Vallaris solanacea Kuntze
Wrightia tomentosa Roem & Schult

ASCLEPIADACEA
Calotropic acia Buch.-Ham.
C. gigantea R.Br.
C. procera R.Br.
Cryptolepis buchanani Roem & Schult
Dregia volubilis Benth. ex Hook. f.
Gongronema nepalense Decne.
Hemidesmus indicus R. Br.
Leptadenia pyrotechnia Decne.
L. reticulata Wight & Arn.
Oxystelma secamone K. Schum.
Tylophora indica Merr.
T. rotundifolia Buch.-Ham.

LOGANIACEAE
Buddleja asiatica Lour.
Cynoctonum mitreola Britton.

GENTIANCEAE
Canscora decussata Roem & Schult. Chatt.
Centrauium centauriodes Rolla Rao & Hemadri
C. ramosissimum Druce
Exacum tetragonum Roxb.
Swertia angustifolia Buch.-Ham. ex D.Don

MENIANTHACEAE
Nymphoides indicum Kuntze

HYDROPHYLLACEAE
Hydrolea zeylanica Vahl

BORAGINACEAE
Arnebia hispidissima DC.
A. nilagirica Pamp.
Cordia dichotoma Forst.f.
Cynoglossum lanceolatum Forssk.

C. zeylanicum Thunb. ex Lehm.
Ehretia acuminata R. Br. var. serrata Johns.
E. laevis Roxb.
Heliotropium strigosum Willd.
Trichodesma sedgwickianum Banerjee

CONVOLVULACEAE

Convolulus microphyllus Sieb. ex Spreng.
Cuscuta reflexa Roxb.
Evolvulus alsinoids L.
E. nummularius L.
Ipomoea aquatica Forst.
I. barleriodes Benth. ex C.B. Clarke
I. cairica Sweet
I. carnes Jacq.
subsp. **fistulosa** Austin
I. ericarpa R. Br.
I. hederifolia L.
I. muricata Jacq.
I. obscura Ker-Gawl.
I. pentaphylla Jacq.
I. pestigridis L.
I. quanoclit L.
I.quinata R. Br.
I. rumicifolia Choisy
I. sepiraia Roxb.
Merremia hederacea Hamer. f.
M. dissecta Hamer. f.
Operculina petaloidea van. Ooststr.
O. turpenthum Silva Manso
Parana paniculata Roxb.
Rivea ornata Choisy
Volvulopsis nummularia Robert.

SOLANACEAE

Datura innoxia Mill.
D. metel L.
Nicotiana plumbaginifolia Viv.
Physalis minima L.
Solanum erianthum D. Don
S. incanum L.
S. indicum L.
S. nigrum L.
S. surrattense Burm. f.
S. viarum Dunal.
Vithania somnifera Dunal.

SCROPHULARIACEAE

Bacopa monneri Wettst.
Limpnophilia indica Druce
Lindenbergia indica Vatke
L. macrostachya Benth.
Lindernia anaglis Pennell
L. ciliata Pennell
L. crustacea F. Muell.
L. parviflora Haines
L. viscosa Boldingh
Mazus delavayi Bonati
M. pumilus van Steenis
Scoparia dulcis L.
Striga angustifolia Saldahana
S. asiatica Kuntze
Torenia cordifolia Roxb.
Verbascum chinesis Santpau
V. thapsus L.
Veronica anagaliis-aquatici L.

LENTIBULARIACEAE

Utricularia aurea Lour.

BIGNONIACEAE

Kigelia africana Benth.
Spathodea campanulata Beauv.
Stereospermum suaveolens DC.

PEDILIACEAE

Pedaiium murex L.

MARTYNIACEAE

Martynia annua L.

ACANTHACEAE

Adhatoda zeylanica Medik.
Andrographis paniculata Wall. ex Nees
Barleria cristata L.
B. prlonitls L.
B. prlonitls L.
Cephalanthus occidentalis L.
Dicliptera roxburghiana Nees
Dipteracanthus prostatus Nees
D. suffruticosus Voigt
Eranthemum purpurascens Wight ex Nees
Hemiadelphis polyspermus Nees
Hemigraphis hirta T. Anders.
Hygrophila auriculata Heine
H. salicifolia Nees
Justica quinqueangularis Koen. ex Roxb.
Lepidagathis incurva D. Don
Nelsonia canescens Spreng.

Peristrophe bicalyculata Nees
Rungia pectinata Nees
Thunbergia grandiflora Roxb.

VERBENACEAE
Callicarpa longifolia Lam. var.
lanceolaria C.B. Clarke
C. macrophylla Vahl
Clerodendrum indicum Kuntze
C. serratum Moon
C. viscosum Vent.
Gmelina arborea Roxb.
Lantana camara L. var. **aculeata** Mold.
Phyla nodiflora Greene
Premna latifolla Roxb.
var. mucronata C.B. Clarke
Pygmaeopremna herbacea Mold.
Tectona grandis L. f.
Verbena offlclnalls L.
Vitex negundo L.

LAMIACEAE
Acrocephalus hispidus (L.)
Nicol. & Sivadasan
Ajuga bracteosa Wall. ex Benth.
Anisomeles indica Kuntze
Colebrookea oppositifolia Sm.
Eusteralis stellata Panigarhi
Hyptis suaveolens Poit.
Leonotis nepetifolia R. Br.
Leucas aspera Spreng.
L. biflora R. Br.
var. **procumbens** Gamble
L. cephalotes Spreng.
L. hyssopifolia Benth.
L. moliissima Wall.
L. mollissima Wall.
var. **scaberula** Hook. f.
L. nutans Spreng.
Nepeta hindostana Haines
Ocimum americantum L.
O. basilcum L.
O. sanctum L.
Perilla frutescens Britt.
Plectranthus ternifolius D. Don
Pogostemon benghalensis Kuntze
Salvia plebia R. Br.

NYCTAGINACEAE
Boerhavia diffusa L.
Bougainvillea spectabilis Willd.

AMARANTHACEAE
Achyranthes aspera L.
var. **aspera**
var. **porphyristachya** Hook. f.
Aerva lanata Juss.
A. sanguinolenta Blume
Alternathera paronychioides (Hort. ex Regd.)
St. Hill
A. pungens Kunth
A. sessills DC.
Amaranthus spinosus L.
Celosia argentea L.
Centrostachys aquatica Wall. ex. Miq.
Deeringia amaranthodes Merr.
Digera muricata Mart.
Gomphena celosioldes Mart.
Psilotrichum ferrugineum Miq.

CHENOPODIACEAE
Chenopodium album L.
C. ambrosiodes L.
C. murale L.

BASELLACEAE
Basella alba L.

POLYGONACEAE
Polygonum barbatum L. subsp. **gracile** Danser
P. glabrum Willd.
P. hydropiper L.
subsp. **microcarpum**
var. **lenticularis** Danser
P. lanigerum R. Br.
P. limbatum Meissn.
P. plebium R.Br.
Rumex dentaus L.

PIPERACEAE
Peperomia pellucida Kunth
Piper longum L.

LAURACEAE
Litsea glutinosa C.B. Robins.
L. monopetala Pers.

PROTEACEA
Grevillea robusta A. Cunn.

LORANTHACEAE
Dendrophthoe falcata Ettings.
EUPHORBIACEA
Antidesma acidum Retz.
A. ghaesembilla Gaertn. f.
Baliospermum montanum Muell. Arg.
Bischofia javanica Blume
Breynia javanica Blume
Breynia rhamnoides Muell. Arg.
Bridella squamosa Gehrm.
B. stipularis Blume
Chrozophora parvifolia Klotz. ex Schw.
C. rottleri Juss. ex Spreng.
Croton bonplandianum Baill.
C. roxburghii Balak.
Drypetes roxburghii Hurusawa
Emblica officianlis Gaertn f.
Euphorbia chamaesyce L.
E. dracunculoides Lam.
E. fusiformis Buch.-Ham.
E. him L.
Ehypericifoila L.
E. thymifolia L.
Glochidion assamicum Hook. f.
G. lanceolarium Voigt
G. multioculare Voigt
Jatropha curcas L.
J. gossypifolia L.
Mallotus philippensis Muell. Arg.
Ricinus communis L.
Securinega leucopyrus Muell. Arg.
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Securinega leucopyrus Muell. Arg.
S. virosa Baill.
Tragia involucrata L.
Trewia nudiflora L.
ULMACEAE
Holoptelea infegrifolia Planch.
Cannabis sativa L.
MORACEAE
Artocarpus heterophyllus Lam.
A. gomezianus ssp. zelynacius Jarret.
Broussonetia papyrlfera Vent.
Ficus benghalensis L.
F. heterophylla L. f.
F. hispida L.
F. oligodon Miq.
F. palmata Forssk.
F. pumila L.
F. racemosa L.
F. religiosa L.
F. rumphii Blime
F. semicordata Buch.-Ham ex Smith
F. virens Ait. var. **virens**
Morus alba L.
Streblus asper Lour.
URTICACEAE
Debregesia longifolia Wedd.
Pilea peploides Hook. & Arn.
Pouzolzia hirda Hassk.
P. pentandra Benn.
P. zeylanica Benn.
SALICACEAE
Sallix tetrasperma Roxb.
CERATOPHYLLACEAE
Ceratophyllum demursum L.
HYDROCHARITACEAE
Hydrilla verticillata Royle
Ottelia olismoides Pers.
Vallisneria spiralis L.
ORCHIDACEAE
Eulophia bicarnata Hook. f.
E. explanta Lindl.
E. flays Hook. f.
E. graminea Lindl.
E. hormusji Duthie
E. nuda Lindl.
Vanda tessellata Hook. ex G. Don
Zeuxine strateumatica Scht.
ZINGIBERACEA
Costus speciosus Sm.
Curcuma amada Roxb.
C. angustifolia Roxb.
Globba sessiliflora Sims
Zingiber capitatum Roxb.
Z. roseum Rose
HYPOXIDACEAE
Curculigo orchioides Gaertn.

DIOSCORIACEAE
Dioscorea bellophyulla Voigt
D. bulbifera L.
D. glabra Roxb.
D. pentaphylla L.

LILIACEAE
Asparagus adscendens Roxb.
A. racemosus Willd.
Asphodelus tenuifolius Cav.
Gloriosa superba L.

SMILACEAE
Smilax ocreata A. DC.
S. ovalifolia Roxb.
S. perfoliata Lour.

PONTEDERIACEAE
F. hispida L.
F. oligodon Miq.
F. palmata Forssk.
F. pumlia L.
F. racemosa L.
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Pilea peploides Hook. & Arn.
Pouzolzia hirta Hassk
P. pentanda Benn.
P. zeylanica Ben.

SALICEAE
Salix tetrasperma Roxb.

CERATOPHYLLACEAE
Certanophyllum demursum L.

HYDROCHARITACEAE
Hydrilla verticilata Royle
Ottelia alimoides Pers.
Vallisneria spiralis L.

ORCHIDACEAE
Eulophia bicarnata Hook. f.
E. explanata Lindl.
E. flays Hook. f.
E. graminea Lindl.
E. hormusji Duthie
E. nuda Lindl.
Vanda tessellata Hook. ex G. Don
Zeuxine strateumatica Scht.

ZINGIBERACEAE
Costus speciosus Sm.
Curcuma amada Roxb.
C. angustifolia Roxb.
C. angustifolia Roxb.
Globba sessiliflora Sims
Zingiber capitatum Roxb.
Z. roseum Rose

HYPOXIDACEAE
Curculigo orchiodes Gaertn.

DIOSCORIACEAE
Dioscorea bellophylla Voigt
D. bublifera L.
D. glabra Roxb.
D. pentaphylla L.

LILIACEAE
Asparagus adscendens Roxb.
A. racemosus Willd.
Asphodelus tenuifolius Cav.
Gloriosa superba L.

SMILACACEAE
Smilax ocreta A. DC.
S. ovalifolia Roxb.
S. perfoliata Lour.

PONTEDERIACEAE
Eichhornia crassipes Solms.
Monochoria vaginalis Pres.

COMMELINACEAE
Amischophacelus axillaris Rao & U. Kamm.
Commelina attenuta Koen. ex Vahl
C. benghalensis L.
C. hasskarlii L.
C. paludosa Blume
Cyanotis cristata D. Don
Murdania nudiflora Brenan
M. scapiflora Roxb.

JUNCACEAE
Juncus bufonius L.
J. prismatocarpus R. Br.

ARACEAE
Acorus calamus L.
Arisaema tortuosum Schott.
Pistia stratiotes L.
Plesmonium margaritiferum Schott
Rhaphidophora glauca Schott
Scindapsus officianlis Schott

LEMNACEAE
Lemnapaucicostata Hegelm.
Spirodela polyrhiza Schleid.
Wolffia arhiza Horket ex Wimmer

ALISMATACEAE
Butomopsis latifolia Kunth
Caldesia parnassifolia Pari.
Sagittaria guayanensis Kunth
subsp. **lappula** Bogin.
S. trifolia L.

APONOGETONACEAE
Aponogeton undulatus Roxb.

POTAMOGETONACEAE
Potamogeton crispus L.
P. nodosus Poir.
P. pectinatus L.

ERIOCAULACEAE
Eriocaulon cinereum R. Br.

CYPERACEAE
Bulbostylis barbata C.B. Clarke
Carex cernua Booll.
C. fedia Nees
Cyperus alulatus Kern
C. brevifolius Hassk.
C. compactus Retz.
C. compressus L.
C. corymbosus Roxb.
C. cuspidatus Kunth
C. cyperoides Kuntze
C. difformis L.
C. distans L.f.
C. digitatus Roxb.
C. exaltatus Retz.
C. exaltatus Retz.
C. haspan L.
C. iria L.
C. kylingia Endl.
C. michelianus L.
subsp. **pygmaeus** Aschers & Gaertn.
C. niveus Retz.
C. pangorei Roxb.
C. pilosus Vahl
C. platystylis R. Br.
C. pumlius Link.
C. rotundus L.
C. silletenss Nees
C. tenuispica Steud.
C. triceps Endl.
Elaecoaris atropurpurea Kunth
E. dulcis Hensch.
E. palutis R.Br.
Fimbristylis bisumbellata Bub.
F. dulcis Hensch.
E. palustris R. Br.
Fimbristylis bosumbellata Bub.
F. dichotoma Vahl
F. falcata Kunth
F. littoralis Gaud.
F. ovata Kern.
F. podocarpa Nees
F. rigidula Nees
F. schoenoides Vahl
F. tenri Roem & Schult var. **oxylepis** C.B. Clarke
Scirpus affinis Roth
S. articulatus L.
S. grossus L. f.
S. michelianus L.
S. mucronatus L.
S. tuberosus Desf.
Scleria laevis Retz.

POACEAE
Apluda mutica L.
Arthraxon prionodes Dandy
Arundlnella bengalensis Druce
Avena fatua L.
Bothriochloa intermedia A. Camus
B. kuntzeana Henr.
B. pertusa A. Camus
Brachiaria distachya Stapf
B. kurzil A. Camus
Brachiaria distachya Stapf
B. kurzil A. Camus
B. reptans Gard. & Jabb.
B. ramosa Stapf
Capllipedium assimile A. Camus
Chloachne koenigii Thw.
Chloris barbata Sw.

C. dolichostachya Lagasca
Chrysopogon aciculatus Trin.
Coix lacryma-jobi L.
Cyanodon dactylon Pers.
Cymbopogon flexuosus Wats. var. microstachys
C. jwarancusa Schult.
C. osmatonii Parker
Cyrtococcum patens A. Camus
Desmotachya bipinnata Stapf
Dichanthuiam annuiatum Stapf
D. kuntzena Jain et Deshpande
Digitaria adscendens Henr.
Echinochloa colonum Link.
E. crusgalli Beauv.
E. stagnina Beauv.
Elusine indica Gaertn. f.
Eragrostis atrovirens Trin. ex Steud.
E. japonica Trin.
E. tenella Beauv. ex Roem & Schult.
E. unioloides Nees ex Steud.
Eulalia leschenaultiana Ohwi.
Eulaliopsis binata Hubb.
Hackelochloa granularis Kuntze
Hemarthria compressa R. Br.
Heteropogon contortus Beauv. ex Roem & Schult.
Hygroyza aristata Nees ex. Wight & Arn.
Hymenachne pseudointerrupta Muell.
Imperata cylindrica Beauv.
Mnesithea leavis Kunth
Narenga porphyrocoma Bor
Oplismenus burmannii Beauv.
O. compositus Beauv.
Oryza rufipogon Griff.
O. sativa L.
Panicum austo-asiaticum Ohwi
P. paludosum Roxb.
P. trypheron Schult.
Paspalidium flavidum A. Camus
P. punctatum A. Camus
Paspalum commersonii Lam.
P. distichum L.
Pennisetum polystachyon Schult.
Perotis indica Kuntze
Phalaris minor Retz.
Phragmites karka Trin. ex Steud.
Poa annua L.
Polypogon monspeliensis Desf.
Pseudopogonatherum contortum A. Camus
Pseudosorghum fasciculare A. Camus
Rottboellia exaltat L. f.
Saccharum bengalensis Retz.
S. spontaneum L.
Schizachryum brevifolium Nees
Setaria glauca Beauv.
S. tomentosa Kunth
S. verticillata Beauv.
Sorghum halepense Pers.
S. nitidum Pers.
Themeda arundinacea Ridley
Urochloa panicoides Beauv.
Vetieria zizanioides Nash

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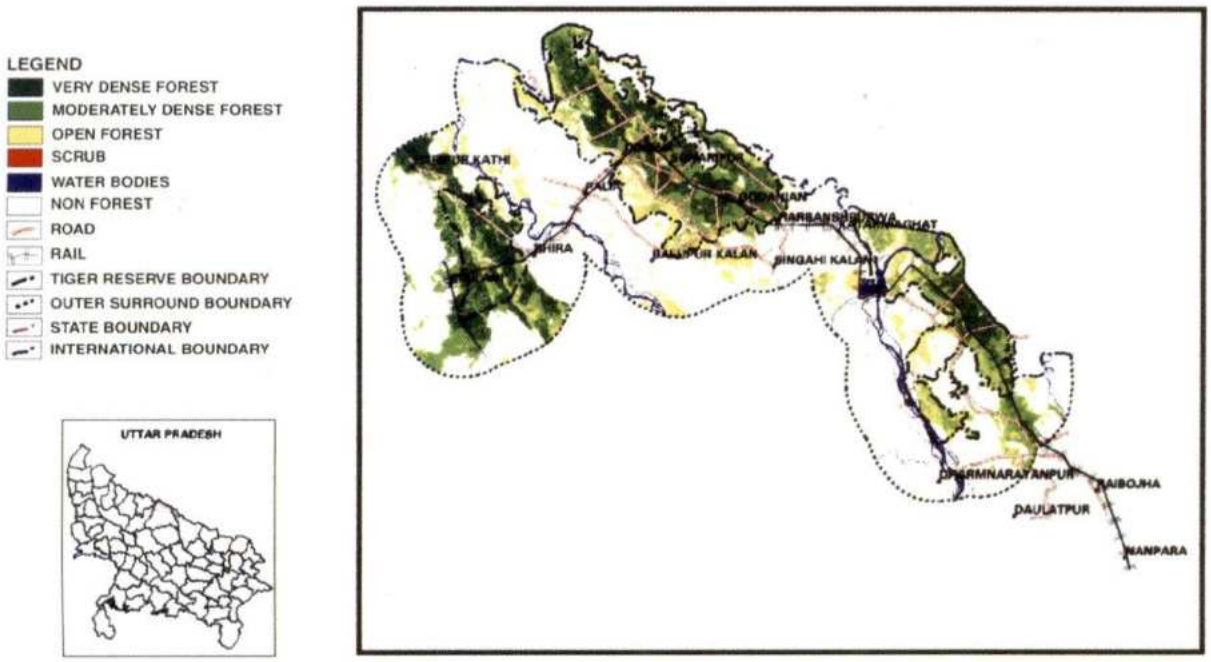

Map of Dudhwa Tiger Reserve

SALIENT FEATURES

Area

Core	:	490.2919 sq km
Total	:	884 sq km
Longitude	:	80°19' E and 81° 20' E
Latitude	:	28°02' N and 28°42'N
Altitude	:	150-182 m
Rainfall	:	1500 mm

Temperature

Minimum	:	2.8°C
Maximum	:	45°C

Seasons

Winter	-	Mid-October to mid-March
Summer	-	Mid- March to mid- June
Monsoon	-	Mid-June to mid-October

HIGHWAYS

Two P.W.D. roads namely Dudhwa-Gauriphanta and Dudhwa-Candan Chauki pass through the National Parks.

RAILWAYS

The Palia-Dudhwa-Belreyien section of Gonda-Bareilly railway line passes through the National Park. It also passes through the Sanctuary between Bhira and Mailani.

By Air

The nearest airport is Lucknow, connected to many places in India including Delhi and Mumbai by regular flights.

By Rail

The nearest railway stations are Dudhwa 4 km, Palia 10 km, and Mailani 37 km. Dudhwa, on North-Eastern Railway meter gauge section is connected via Mailani to Lucknow & Nainital.

By Road

Important road distances are Lucknow - 238 km, Bareilly - 260 km, Delhi - 430 km, Palia - 5 km.

Palia is the nearest place where Post and Telegraph offices are situated.

UTTARAKHAND

Corbett Tiger Reserve

Corbett Tiger Reserve

S Kumar
Botanical Survey of India, Dehradun-248 195, Uttarakhand

Corbett Tiger Reserve, is one of the richest wilderness areas of India. It comprises an area of *ca.* 1288.34 sq km which included two protected areas viz. Corbett National Park (520.82 sq km) and Sonanadi Wildlife Sanctuary 301.18 sq km). Corbett Tiger Reserve lies in the Shivalik-terai biotic province on the foothills of the Himalayas. It probably holds the second largest population of tigers in the world. In addition, nearly 600 Asian elephants and several endangered species of animals like Mugger, Goral, Mahasheer, Ghariyal, Serow etc. have a significant presence in the reserve. CTR is also rich in avian diversity with more than 600 species of resident and migratory birds and 49 species of diurnal raptors found at its maximum during winter season. Alongwith this, a rich floristic diversity with more than 900 species of plants make it one of the richest biological resource zones of the country.

The "Project Tiger" was launched at the Corbett National Park on 1st April 1973 to save the dwindling population of tiger as nine Tiger Reserves were declared during 1973-74 with financial and material support from the then World Wildlife Fund. The Corbett National Park with its remarkably beautiful landscapes, variety of habtiats and a rich and diverse wildlife is one of the famous National Park of India, well known for its roaring of tiger and trimping of elephants. Situated in the foot hills of Uttarakhand Himalayas, mainly in Pauri Garhwal and Nainital district, Corbett National Park was established on 8th August 1936, occupying an area of 323.75 sq km, thus being the oldest park of Indian sub-continent. Initially it was known by the name of Hailey National Park named in honour of the then Governor of United Provinces of Agra and Avadh. However, after independence, the name was changed to Ramganga National Park.Later on, after the death of Jim Edward Corbett in Kenya, the National Park was renamed as Corbett National Park in 1957. In 1966, the Corbett National Park was enlarged so as to provide more area for the wild animals for conservation and the total area of Corbett National Park increased to 520.82 sq km.

In 1987, about 301.18 sq km of the Kalagarh forest area lying to the west of Corbett National Park, was declared as "Sona Nadi Wildlife Sanctuary". This area being the natural habitat of the elephants of Corbett National Park, became very important keeping in view of their conservation. From 1973 to 1991, the Corbett Tiger Reserve and the Corbett National Park remained as synonyms to each other. In 1991, the area of Corbett Tiger Reserve got extended to 1318.54 sq km. From 1991 onwards, the Corbett National Park is considered to be an inclusion of Corbett Tiger Reserve and is included in core-zone area of the reserve. Legally, the reserve now possesses three entities, viz. 1. Nationa Park, 2. Wild life Sanctuary, 3. Reserve Forests. The main area of the Tiger Reserve lies in the Pauri Garhwal and Nainital district with a little of it extending to the Almora and Bijnore district as well.

LOCATION, TOPOGRAPHY

Located between 29°20' and 29°48' North latitude and 78°33' and 79°09' East longitude, Corbett Tiger Reserve has an area of varied topography from precipitous hills of Shivaliks formation with many interspersed seasonal streams and nallahs to valley of south Patli Dun patches of Savanna lands (CHAURS), north westerly flowing Ramganga river with its large basin and an appreciably large area of

Buttressed *Bombax ceiba (Salmalia malabarica)*

submerged zone of forested blocks from "Paterpani" "Dhikala" and "Gauj Pani".

In recent years consequent to the completion of Ramganga multipurpose hydel project dam at Kalagarh, there has been a considerable change in the westward boundary of the reserve area. Today, the reserve spreads in an area of ca 1288 sq kms with altitudinal range varying between 350 m to 1050 m above sea levels. One of the largest ridges of Shivalik hills runs through the reserve from Dhangadi (Ram Nagar) to the vicinity of Kalagarh, dividing the park area almost into two halves. The northern half is formed of south Patli-Dun, Savanna Land of Dhikala, Kanda the highest ridge of park, vast riparian tract of Ramganga river, Sarpaduli, Gairal and Dhulwa block. The southern half comprises of Bijrani, Mailani, Dhara, Dhela block, submerged zones of Boxar and Kalagarh area, situated in the foot hills of Western Himalayas. The Corbett Tiger Reserve partly forms the forest reserves of Ramganga and Kalagarh forest divisions with in the boundaries of Nainital and Pauri district of Uttarakhand.

CLIMATE

The climate of Corbett Tiger Reserve can be broadly distinguished as being cold from December - February with chilly and frosty nights at times with sufficient rains during this period to warm with sultry and high temperature during May - June with thunder storms and hail-stones not being unusual and warm and humid during July - September with plenty of monsoon rains. During October - November with south-west monsoon retreating autumn prevails with clear days and moderate temperature. Spring is ushered in March - April, the period being quite pleasent with moderate warmth and fast growing vegetation all round.

GEOLOGY

The area lies in the outer foot hill terrain of the Himalayas known as the Shivalik range which is composed of alluvial deteritus material derived mainly from the subaerial waste of the Himalayan mountain ranges and from the Shivalik system. Shivalik group has been divided into three recognisable lithounits viz., 1. Lower Shivaliks, 2. Middle Shivaliks, 3. Upper Shivaliks.

PHYTODIVERSITY OF CORBETT TIGER RESERVE

Owing to great variations in climate and topography, there is enormous diversity at species and ecosystem levels in Corbett Tiger Reserve. In general, the vegetation in the major biome of Corbett Tiger Reserve consists of mixed deciduous, tropical and subtropical forests which can be further grouped into the following sub-types :

1. Moist Shivalik Sal Forest
2. Dry Shivalik Sal Forest
3. Northern Tropical Mixed Dry Deciduous Forest
4. North Indian Dry Deciduous Forests
5. Moist Savanna Forest
6. Khair-Sisso Forest
7. Himalayan subtropical Forest
8. Bamboo Breaks.

The forest cover of Corbett Tiger Reserve comprises numerous species of trees, shrubs, climbers, interspread grasslands and herbaceous ground cover. *Shorea robusta* Roxb. ex Gaertn.f. (Sal) is the most dominant tree species gregariously growing in the area. Elegant patches of "Sal" could be seen in Dhikala, Khinawauli, Bijrani and Kanda environs. Some striking evergreen associates of "Sal" are *Mallotus philippensis* (Lam.) Muell. Arg., *Syzygium cumini* (L.) Skeels, *Phoebe lanceolata* (Nees) Nees, *Drypetes roxburghii* (Wall.) Hurusawa and *Boehmeria rugulosa* Wedd. etc.

The typical deciduous species like, *Lannea coromandelica* (Houtt.) Merr., *Haldina cordifolia* (Roxb.) Ridsdale, *Terminalia alata* Heyne ex Roth, *Terminalia bellirica* (Gaertn.) Roxb., *Lagerstroemia parviflora* Roxb., *Ehretia laevis* Roxb., *Sapium insigne* (Royle) Benth. ex Trimen, *Stereopermum chelonoides* (L.f.) DC. and *Semecarpus anacardium* L.f., could be seen throughout. At certain places like Dhela block, *Aegle marmelos* (L.) Correa forms dominant feature of the forest, while around Sultanand Ghilmodia forests, *Schleichera oleosa* (Lour.) Oken could be easily spotted during spring by its pink coloured new foliage. *Holarrhena pubescens* (Buch.-Ham.) Wall. ex G. Don, *Bombax ceiba* L. and *Caryea arborea* Roxb. also make their appearence at few places. At exposed faces of Dhangari, Patelichaur - Paterpani, *Acacia catechu* (L.f.) Willd. and in hilly tracts *Anogeissus latifolia* (Roxb. ex DC.) Wall. ex DC. could be seen gregariously growing. *Dalbergia sissoo* Roxb. is common at some places in Kanda, Paterpani and Dhikala. Some other scattered tree species in Corbett Tiger Reserve are *Ougenia oojeinensis* (Roxb.) Hochr., *Holoptelea integrifolia* (Roxb.) Planch., *Kydia calycina* Roxb., *Phyllanthus emblica* L., *Albizia odoratissima* (L.f.) Benth. and *Diospyros exsculpta* Buch.-Ham. which can be located inside the forest. On the other hand, species like *Alangium savifolium* (L.f.) Wang., *Firmiana fulgens* (Wall. ex Mast.) Corner, *Bischofia javanica* Bl., *Oroxylum indicum* (L.) Vent., *Clausena pentaphylla* DC., *Baliospermum montanum* (Willd.) Muell. Arg., *Ficus microcarpa* L.f., *F. sarmentosa* Buch.-Ham. ex Smith, *Maesa montana* A. DC. and *Miliusa velutina* (Dunal) Hook. f. & Thoms., are seen scarcely distributed.

During autumn, *Butea monosperma* (Lam.) Kuntze, *Bauhinia variegata* L. and *Erythrina suberosa* Roxb. could be easily spotted by their colourful blossoms. It is interesting to note that the genus *Ficus* L. exhibits a great diversity in the area. Some common species of *Ficus* L. are *Ficus benghalensis* L., *F. racemosa* L., *F. rumphii* Blume, *F. auriculata* Lour. and *F. virens* Ait. In addition to these, plantation of *Tectona grandis* L.f. and *Eucalyptus* spp. could be seen at some places.

The forest undergrowth is composed of *Clerodendrum viscosum* Vent., *Murraya koenigii* (L.) Spreng., *Pogostemon benghalense* (Burm.f.) Kuntze,

Adhatoda zeylanica Medik., *Woodfordia fruticosa* (L.) Kurz, *Ardisia solanacea* (Poir.) Roxb., *Colebrookia oppositifolia* Smith, *Baliospermum montanum* (Willd.) Muell. Arg., *Leea asiatica* (L.) Ridsdale, *Helicteres isora* L. and *Lantana camara* L., etc. Among the large number of climbers, mention may be made of *Millettia extensa* (Benth.) Baker, *Pueraria tuberosa* (Roxb. ex Willd.) DC., *Mucuna imbricata* DC. ex Baker, *Cryptolepis buchanani* Roem. & Schult., *Ichnocarpus frutescens* (L.) R. Br., *Bauhinia vahlii* Wight & Arn., *Ampelocissus divaricata* (Wall. ex Lawson) Planch, and *Dioscorea* spp. The two species of palms *Phoenix acaulis* Roxb., and *P. humilis* Royle, are found in grasslands.

A large number of epiphytic plants are also found growing on the trunks of trees. *Dendrophthoe falcata* (L.f.) Etting. and orchids such as *Vanda testacea* (Lindl.) Reichb.f., *Luisia trichorhiza* (Hook.) Blume and *Oberonia falconeri* Hook.f. along with some ferns and several lichens are conspicuous.

The ground flora consists of *Curculigo orchioides* Gaertn., *Elephantopus scaber* L., *Uraria* spp., *Cassia* spp., *Alysicarpus* spp., *Sida* spp., *Indigofera* spp., *Launaea procumbens* (Houtt.) Merr., *Anaphalis busua* (Buch.-Ham.) DC., *Tridax procumbens* L., *Pentanema indicum* (L.) Ling, *Siegesbeckia orientalis* L., *Artemisia capillaris* Thunb., *Zorina gibbosa* Spang., *Vernonia cinerea* (L.) Less. and *Ageratum conyzoides* L., etc.

The grasses are predominant in the herbacoeus flora. At places, luxuriant patches of grasslands (Chaurs) are seen, which are dominated by *Saccharum benghalense* Retz., *Themeda aurundinacea* (Roxb.) Ridley, *Eulaliopsis binata* (Retz.) Hubb., *Thysanolaena maxima* (Roxb.) Kuntze, *Apluda mutica* L., *Eragrostis atrovirens* (Desf.) Trin. ex Steud., *Eragrostis unioloides* (Retz.) Nees ex Steud., *Dichanthium annulatum* (Forssk.) Stapf, *Desmostachys bipinnata* (L.) Stapf, *Imperata cylindrica* (L.) P. Beauv. and *Heteropogon contortus* (L.) P. Beauv. ex Roem. & Schult., etc.

Sedges (Cyperaceae) are yet another widely distributed plants, usually growing in moist places with rhizomatous stem and triquetrous solid scape. Some frequently met Cyperaceous species are *Eriophorum comosum* (Wall.) Wall. ex Nees, *Fimbristylis bisumbellata* (Forssk.) Bub., *F. miliacea* (L.) Vahl, *Carex myosurus* Nees, *Cyperus brevifolius* (Rottb.) Hassk., *Cyperus pumilus* L., *Cyperus pilosus* Vahl, etc.

In cool, moist and shady habitats, luxuriant growth of ferns and fern-allies could be seen, the common among them are *Dryopteris cochleata* (Ham. ex D. Don) C. Chr., *Tectaria coadunata* (Smith) Chr., *Lygodium flexuosum* (L.) Sm., *Diplazium esculentum* (Retz.) Sw., *Pteris cretica* L., *Adiantum capilus-veneris* L., *Ophioglossum reticulatum* L. and *Selaginella chrysocaulos* (Hook. & Gerev.) Spreng. etc.

FLORISTIC ANALYSIS

An analysis of the flora of Corbett Tiger Reserve revealed the presence of about 912 species under 556 genera and 168 families of which 741 species belong to angiosperms, 2 to gymnosperms, 36 to pteridophytes, 25 to bryophytes and 108 to lichens which are shown in Table 1.

Table 1 : Statistical analysis of the Flora

Plant groups	No. of families	No. of genera	No. of species
Angiosperms	111	475	741
Gymnosperms	2	2	2
Pteridophytes	15	22	36
Bryophytes	19	22	25
Lichens	21	35	108
Total	168	556	912

Source : Dutt & al. 2003

Table 2 : Dominant plant families of Corbett Tiger Reserve

Family	No. of genera	No. of species
Poaceae	48	84
Fabaceae	28	70
Asteraceae	36	55
Cyperaceae	08	31
Euphorbiaceae	14	22
Scrophulariaceae	11	22
Lamiaceae	14	19
Acanthaceae	14	19
Moraceae	03	18
Rubiaceae	13	18

Most conspicuous genera which exhibit enormous phenetic diversity are shown in Table 3.

Table 3 : Dominant plant genera with maximum diversity in Corbett Tiger Reserve

Name of Genus	No. of species
Ficus L.	15
Cyperus L.	13
Desmodium Desv.	11
Crotalaria L.	10
Lindernia Allioni	09
Indigofera L.	07
Cassia L.	07

It is obvious from the table that *Ficus* L. (15 spp.), *Cyperus* L. (13 spp.), *Desmodium* Desv. (11 spp.), *Crotalaria* L. (10 spp.); *Lindernia* Allioni (9 spp.) are among the most diverse genera of flowering plants in Corbett Tiger Reserve. Similarly, fern-allies *Selaginella* P. Beauv. (4 spp.) and Lichen genera *Pyrenula* Ach. (13 spp.), *Pertusaria* DC. (12 spp.) and *Bacidia* De Not. (9 spp.) of non-flowering plants also show maximum diversity.

There is only one RET species viz. *Cymbopogon flexuous* (Nees ex Steud.) Watson, var. *microstachys* (Hook.f.) reported so far as per IUCN (1997) red list categorisation. However, Corbett Tiger Reserve is a repository of a number of important medicinal and economically important plant species which are being threatened and vulnerable for variety of reasons. The important medicinal plant species reported from this region included *Cassia fistula* L., *Costus speciosus* Sm., *Curculigo orchioides* Gaertn., *Centella asiatica* (L.) Urban, *Phyllanthus emblica* L., *Pueraria tuberosa* (Roxb. ex Willd.) DC., *Aegle marmelos* (L.) Correa, *Asparagus racemosus* Willd., *Dioscorea bulbifera* L., *Berberis lycium* Royle, *Boerhavia diffusa* L., *Adhatoda zeylanica* Medik. etc. to name a few.

The other economically important plant species like *Shorea robusta* (Roxb.) Gaertn. f., *Dalbergia sissoo* Roxb., *Terminalia arjuna* (Roxb. ex DC.) Wight & Arn., *Mallotus philippensis* (Lam.) Muell. Arg., *Pyrus pashia* Buch.-Ham. ex D. Don, *Rubus ellipticus* Smith, *Grewia optiva* J.R. Drumm., *Acacia catechu*

(L.f.) Willd., *Trema politoria* Blume, *Rhus parviflora* Roxb. etc. are found in the Tiger reserve.

The presence of rich floristic diversity alongwith a large faunal representation including quite a good tiger population emphasize on the need for extra efforts to protect this already conserved habitat which is being "disturbed" by vested interests frequently. The participation of local people can ensure better safety measures to protect this floristically and faunal rich natural resource.

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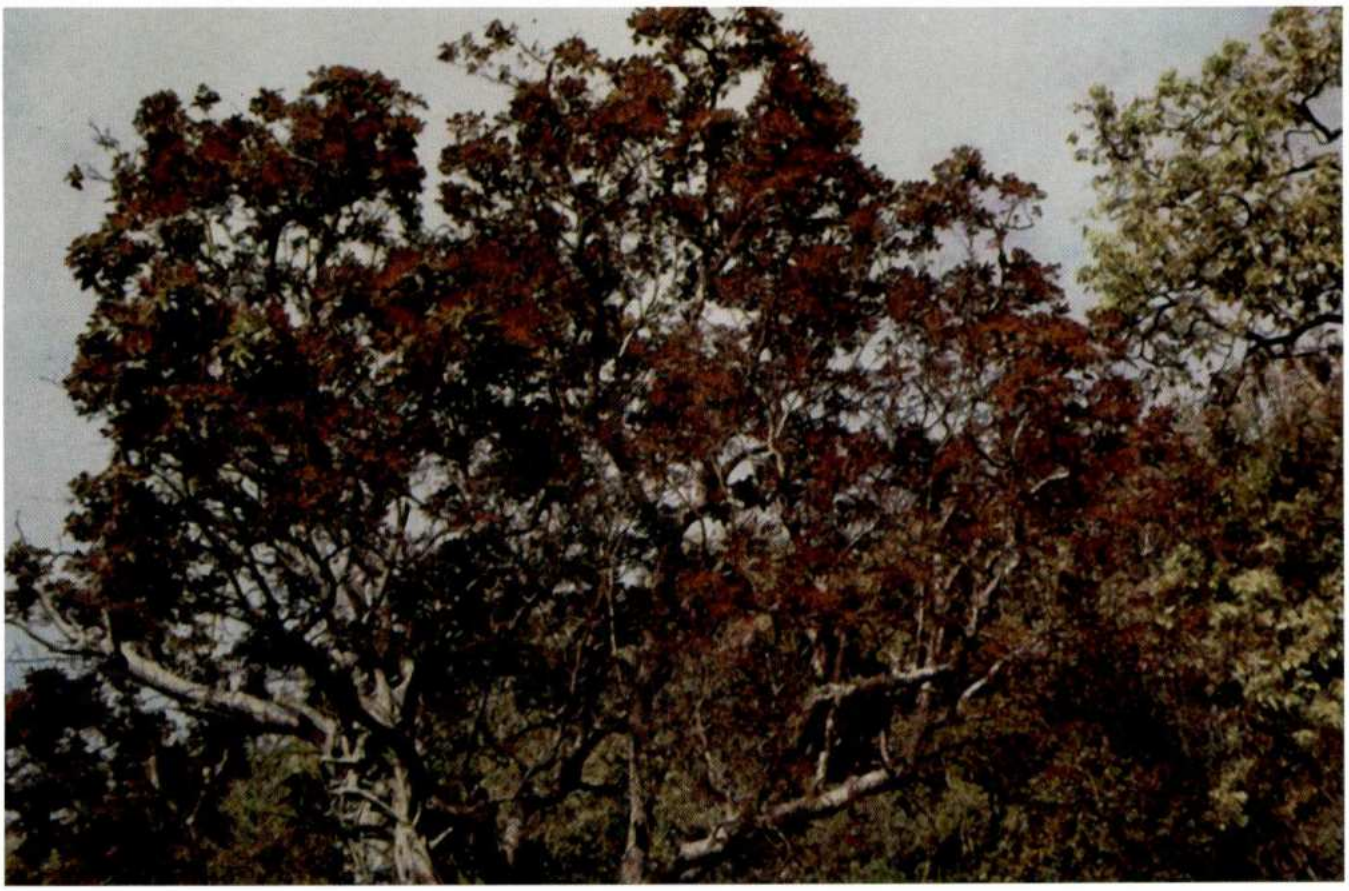
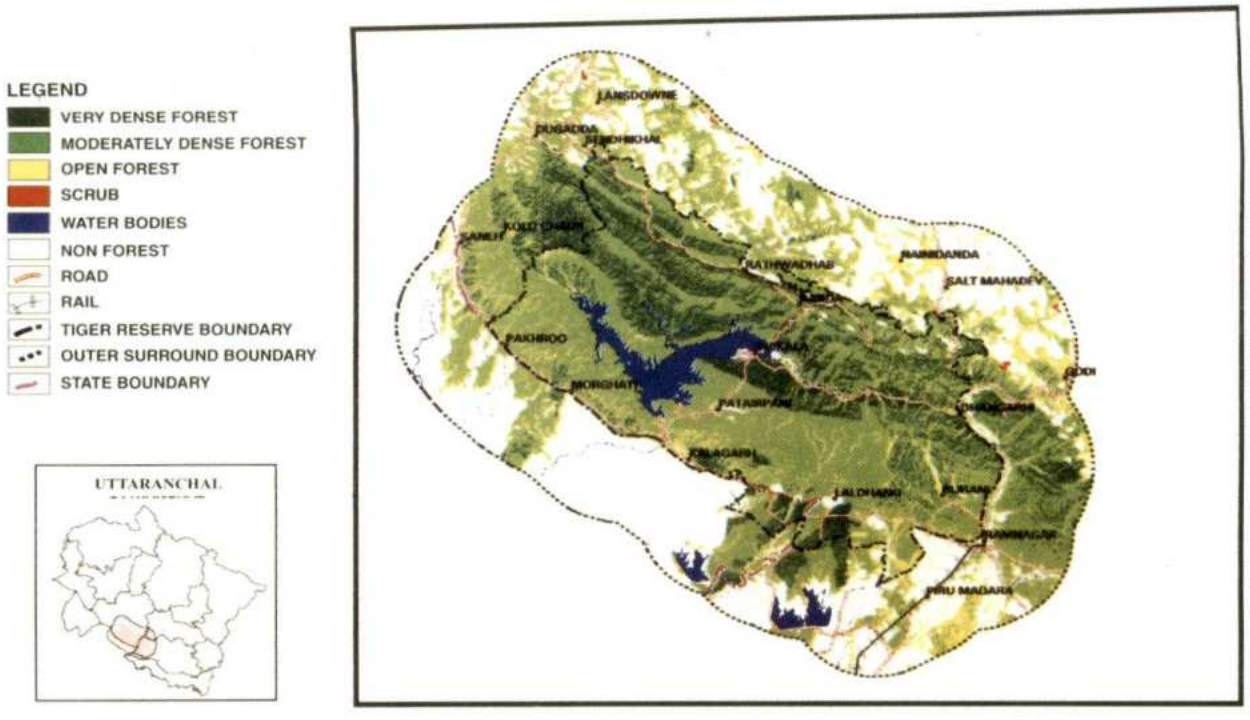
Pant, P.C. 1986. Flora of Corbett National Park, U.P. B.S.I., Howrah.

Schleichera oleosa





Map of Corbett Tiger Reserve

SALIENT FEATURES

Area

Core	:	520.82 sq km
Buffer	:	797.72 sq km
Total	:	1318.54 sq km
Longitude	:	78°33' to 79°09' E
Latitude	:	29°20' to 29°48' N
Altitude	:	365 m – 1100 m above MSL
Rainfall	:	1400 mm - 2800 mm

Temperature

Minimum	:	4°C
Maximum	:	42°C

Seasons

Winter - November to February
Summer -March to June
Monsoon- July to October

HIGHWAYS

There is a State Highway (*Moradabad-Tehri S.H.No.4*) lying on the Eastern boundary of Corbett Tiger Reserve from Ramnagar to Marchula for about 35 km.

TOURISM

New Tourism Zone - Dhikala represented the main area open to visitors. Day visit to Dhikala was banned in 1990 and only those visitors were permitted to enter from the National Park gate that had confirmed overnight accommodation. As the number of beds in different forest rest houses in Dhikala Zone is mere 113, this represented one of the strictest controls on the number of visitors entering the NP. The ban was enforced as per the recommendations of the committee constituted by Government of India. In order to cope up with the increasing demand of the tourists an alternate day visit zone was set up at Bijrani. In 1996 three more tourism zones were demarcated within the reorganized Corbett. These included the Sonanadi WLS and the Jhirna and Lohachaur zone located in the buffer.

At present, the area open to visitors in Corbett Tiger Reserve has been divided into five mutually exclusive tourism zone each having a separate gate/gates for entrance. A visitor wishing to go from one zone to another has to come out and re-enter through the gate for the other zone. This has been done to disperse visitor pressure all around the reserve and check excessive visitor numbers in more popular areas.

Conducted Day Visits - Conducted day visits were initiated in 1996 to motivate visitors to stay out of the NP and go inside only for wildlife viewing in small groups.

CORBETT NATIONAL PARK - REACHING THERE

By Air

Phoolbagh, Pantnagar at a distance of 50 km is the nearest airport. Delhi at a distance of 300 km is the nearest international airport.

By Rail

Ramnagar is on the broad gauge track from where the road transport options have to be availed to reach the park.

By Road

Dhikala is 300 km from Delhi, 145 km from Lucknow and 51 km from Ramnagar. The route from Delhi spans Hapur-Murababad-Ramnagar. The turn off is some 7 km beyond Muradabad to the left, marked by a small board. The route from Lucknow spans Bareilly–Kichha–Rudrapur–Doraha–Kashipur.

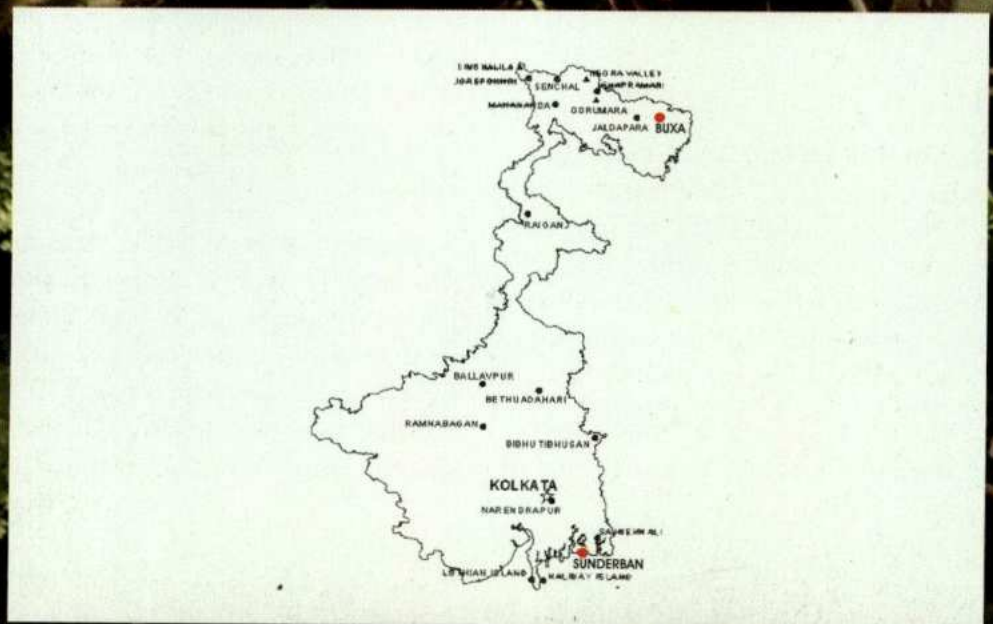
Accommodation is available at Dhikala (103 beds) and there are a number of forest rest houses elsewhere in the national park (48 beds). There is also provision for caravans and tents. Tourists also have a range of resorts to choose from, all located along the main Ramnagar-Ranikhet road bordering the eastern edge of the park. These are all high-end budget resorts but even for the budget tourists, there are adequate options available in Ramnagar, the nearest town.

Banking and other important tourist facilities are available at Ramnagar . The park is closed from mid June to mid October.

Dendrobium densiflorum

WEST BENGAL

- **Buxa Tiger Reserve**
- **Sunderban Tiger Reserve**



Buxa Tiger Reserve

PP Ghoshal
Botanical Survey of India, Howrah

Buxa Tiger Reserve (BTR) is situated in Alipurduar Subdivision of Jalpiguri District, West Bengal. It was constituted on 16th of February 1983 and became the 15th Tiger Reserve. The name of this Reserve is acquired from the historical Buxa fort that was used for detention during freedom movement of India as a most rigorous prison next to Cellular jail. The area of the Reserve encompasses 760.87 sq km, having a Sanctuary of 268 sq km and a National Park of 117.02 sq km (demarcated as core zone). The rest of about 375.85 sq km is treated as buffer zone. It comprises of the entire former Buxa Forest Division (702.44 sq km) and a part of Cooch Beher Forest Division (58.43 sq km) in Jalpaiguri district. The Reserve lies between latitudes 26°29□ and 26°51' N and longitudes 89°22□and 89° 53□ E. It stretches up to a length of 50 km from west to east and about 35 km from north to south. The reserve is bounded by the international boundary of Bhutan in the North, Coochbehar district in the south, with Assam on the eastern side by the river Sankosh and on western side by Coochbehar forest division (in Jalpaiguri district).

Geology & Soil

The area of Buxa Tiger Reserve lies at the foothills of Himalayan Ranges. It consists of the Himalayan formation of Darjeeling gneiss at an altitude of 1800 m., the great boundary fault (Gondwanas) lies just on south of it, followed by shiwalik hills and then followed by highly drained Bhabar tract and finally, south of 22nd mile, the ill-drained clayey Terai tract.

The soil of the Buxa Tiger Reserve is mainly composed of alluvium with deposit of coarse gravel near the hills, sandy clay and sand along the course of rivers and fine sand consolidating into clay in rest of the Reserve. The beds of the Buxa hills consist of variegated slates, quartzites and dolomites.

Climate

A damp warm climate is met within Jalpaiguri district, that usually favours the formation of wet evergreen forests. Which are found only in some patches, while tropical semi evergreen forests, moist sal forests, Riverine khair-sisoo forests and the Savannah forests are other types met within the reserve area.

Temperature

The area lies in the moist tropical zone. The average day temperature varies from 12°C to 21°C from November to February, between 27°C to 32°C from May to September, between 24°C to 27°C for the rest of the year. The highest recorded temperature was 39°C (102.5°F) in 1899 and lowest was 2°C (36°F) in 1887. A considerable variation in day and night temperature throughout the year. Sometimes winter nights are too severe. From July to September, the days and early evenings are moist and hot and indeed oppressive, however nights are always cooler.

Rainfall

Southwest monsoon is the main source of rainfall. The Reserve receives maximum rainfall from mid June to September. Very high rainfall is seen during the month of June, July and August. It usually subsides from early September and disappears during the first week of October. December is the driest month with minimum rainfall. While, March

Hill forest, Buxa Duar

receives maximum of winter rain. Pre-monsoon showers accompanied by hail and thunderstorm occur in the month of April to May.

The average annual rainfall in the Reserve is about 4100 mm, increasing a little towards north. Along the foothills the rainfall varies according to the configuration of the hills; on the outer ranges of the hills it reaches around 5000 mm per year. The average rainfall at Rajabhatkhawa is 3750 mm, while in Buxa duar (altitude 780 m) it is 5600 mm. Highest rainfall in a day in last 11 years was recorded as 992 mm, on 19th July 1993, which caused devastating flood in Alipur duar.

Humidity

Maximum relative humidity varies between 80% - 95%, rarely below 75% with a maximum in June to September and minimum in December to February. As the Reserve is located in the foothills of the outer Himalayas, it remain adequately humid throughout the year.

Wind

The Reserve does not experience any high windstorm possibly due to existence of large chunk of dense forest cover. However, severe storms sometimes accompanied by hail occur in the month of April & May and rarely in September and October.

Frost, Dew and Fog

During the month of November to February the nights are very cold with much frost and dew and in low lying areas a dense fog lingers often even beyond 9 am. From March to the onset of monsoon, fog and frost are absent but dew is common until April.

Local Tribes

Rava, Mech, Oraon, Rajbanshi, Garo, Bhutia, Bodo and Santhal are the main ethnic communities found in Buxa Tiger Reserve.

Important fauna

Buxa Tiger Reserve supports vital population of Tiger (*Panthera tigris*), the National animal and one of the world's most endangered carnivores. It also provides shelter to many wild species included in Red Data Book of the IUCN and the appendixes of CITES. There are many, but mention should be made of Leopard, Asian Elephant, Indian Bison, Sloth Bear, Himalayan Black Bear, Leopard cat, Chinese Pangolin, Fishing cat and wild dog among Mammals. Bengal Florican, Black necked Crane, Great pied Hornbill among Aves and Common Monitor lizard, Indian Python, Regal Python among Reptiles.

Botanical Exploration in the area

Floristic account and notes on Buxa Tiger Reserve in particular were limited till late seventy's. Gamble made a list with many tree species of undivided Jalpaiguri district. Prain's Bengal Plants (1903) from North Bengal in general without any mention of Jalpaiguri district. Cowan and Cowan (1929) made a list without precise localities. 'Notes on sedges and grasses' by Chaudhuri (1959). A brief sketch on the vegetation of Jalpaiguri district, based on limited collection during 1962 from Rajabhatkhawa forest Range of this Reserve and Apalchand forest Range of Baikunthpur Forest Division by Mukherjee (1965). In addition he also published accounts of some Orchids and Ferns from Buxa Division (1972a; 1972b). K.P. Biswas' book (upto Ericaceae 1966) with a few species from Rajabhatkhawa and Buxaduar, but without any precise localities and a list of 145 species (Sikdar, 1984) (collected by V. Narayanswamy and party in 1949 and mostly identified by them but not published). Ghosh and Ghosh (1978) have also made some addition to the Flora of Buxa Division. Subsequently Sikdar (1974-1977) carried out several explorations, covering all the Forest Divisions including Buxa Tiger Reserve as a Research Scholar of Botanical Survey of India and prepared a detailed flora of the district (Ph.D. thesis, 1980, unpublished), after which Ghosh (1999) and Ghoshal (2000-2003) of Botanical Survey of India have collected plants from BTR, specifically for revision of some families for West Bengal and Medicinal Plants of Buxa Tiger Reserve respectively.

Vegetation

The Buxa Tiger Reserve is a forest of multi-tier vegetational assemblage. The forest of the Reserve can broadly be classified as moist Tropical Forests of Champion and Seth's classification. As the extension of this forest ranges from plains up to 1750 m in the hills, variation in the floristic composition is clearly visible depending on altitude, soil moisture, topography, drainage and formations of soil.

The most common species found within the forest and most important from ecological and economic point of view is Sal (*Shorea robusta*). The lofty sal trees occur with its usual associates, viz., Champa (*Michelia champaca*), Chilaune (*Schima wallichii*), Chikrashi (*Chukrasia tabularis*), Bahera (*Terminalia belerica*), Sidha (*Lagerstroemia parviflora*), Toon (*Cedrela toona*), Lali (*Amoora wallichii*), Lasuni (*Amoora rohituka*), Lampati (*Duabanga sonneratioides*), Simul (*Bombax ceiba*), etc. In riverine areas Simul, Sirish (*Albizzia* spp.), Sisoo (*Dalbergia sissoo*) and Khair (*Acacia catechu*) are the most common.

Also, Katus (*Castanopsis indica*), Mandane (*Acrocarpus fraxinifolius*), Bhalukhath (*Talauma hodgsonii*), Palavi (*Walsura tabulata)* associated with Kimbu (*Morus laevigata)*, Panisaj (*Terminalia myriocarpa*), Gokul (*Ailanthus grandis*), etc. can be found in different areas.

The Savannahs are also characterized by tropical tree of Kumbhi *(Careya arborea)*, Aksi *(Dillenia pentagyna)*, Jamun (*Syzgium cumini*), Palas (*Butea monosperma*) and Kul (*Zizyphus* spp.).

No.	Types of Forest	Champion & Seth's Classification	Principal localities of occurrence
1.	Riparain forests	Northern Dry Deciduous Khair, Sisoo, Simul association ($5B/IS_2$).	Riverbanks of Jainti, Pana, Dhawla, Rydak, Bhutri.
2.	Sal forests	Eastern Bhabar and Terai Sal ($3C/C_{1b}$ & $3C/C_{1c}$)	Occurs mostly in Raimatang, Jainti and few compartments of North Rajabhatkhawa blocks and Terai Sal forest occurs in South Rydak, South Rajabhatkhawa and Damanpur blocks.
3.	Dry mixed forests	East Himalayan moist mixed deciduous forests ($3C/C_{3b}$)	Northern part of Reserve. More or less north of 25 mile.
4.	Wet mixed forests	Sub-Himalayan secondary wet mixed forests ($2B/2S_3$)	The forests South of 21 mile and some portion of south Rydak block.
5.	Semi-evergreen forests	Eastern submontane semi-evergreen forests ($2B/C_{1b}$).	Found in Raimatang-2, Santrabari – 3, 4, Tashigaon -1, Bhutanghat – 1 & 2 compartments.
6.	Evergreen forests	Northern tropical evergreen forests ($1B/C_{1a}$).	Near streams, occurs in a very small area in comparison with other types.
7.	Hill forests	East Himalayan subtropical wet hill forests ($8B/C_1$).	Found in Adma, Hatipota, Chunabhati, Tobgaon, Santrabari, Tashigaon and Pashkhawa blocks.
8.	Savannah forests	Moist Sal Savannah (3C/ DSI) and Low alluvium savannah woodland ($3C/3/IS_1$).	Riverine areas of North Rydak, South Rydak & Bholka blocks.

1. Riparain forests

This type is found in adjoining area of principal rivers like Rydak, Pana, Basra, Jainti, Dhawla and different stream. Champion & Seth recognised this type as Northern dry deciduous forests. The Seral type of Khair-Sisoo Association is seen on either banks of the river Rydak in North & South Rydak Ranges, Jayanti in Jyanti Range, Basra in Hemiltonganj Range, Pana in Pana Range. This type is restricted in some particular places of Bhutanghat, North Rydak, Central Rydak, Marakata, Naratholi & in some parts of Jainti, Pana, Bhutni, Dhawla and Gudamdabri blocks.

The vegetation occurs in recently formed unstable banks and islands varies from the vegetation found in older banks and islands.

Principal constituents are Khair (*Acacia catechu*) and Sisoo (*Dalbergia sisoo*) usually with Simul (*Bombax ceiba*), *Albizzia* spp. as secondary species. On older soils Khair and Sisoo form the secondary group of species, while *Albizzia* spp., *Bombax ceiba, Streblus* spp., *Lagerstroemia parviflora, Cassia fistula, Trewia nudiflora, Anthocephalus kadamba* etc. from the principal species.

Holmskioldia sanguinea

Pitali (*Trewia nudiflora*), Kainjal (*Bischofia javanica*), with a few number of Chalta (*Dillenia indica*) and Gamar (*Gmelina arborea*) appear to do well in this type, wherever the water table is not low. *Bauhinia purpurea* is the commonest in the neighborhood of riverbeds where permanent water table is fairly deep.

2. Sal forests

Champion & Seth recognised this forest type as Northern Tropical moist deciduous forests that contains both eastern Bhabar and Eastern Terai Sal. Sal forests of this area cover the maximum area of plains and foothills. Eastern Bhabar Sal forests occur in Raimatang and Jainti blocks and in a few compartments of North Rajabhatkhawa block. Eastern Terai Sal forests occur in Damanpur, South Rajabhatkhawa, Panabari, Poro, Nimati and South Rydak block. Here Sal (*Shorea robusta*) with an admixture of many deciduous species, viz., Bahera (*Terminalia belerica*), Chilauni (*Schima wallichii*), Kumbhi (*Careya arborea*), Odal (*Sterculia villosa*), Tantri (*Dillenia pentagyna*), *Lagerstoemia parviflora, Bridelia squamosa, Cassia fistula,* with some undergrowth of *Coffea bengalensis, Clerodendrum viscosum, Leea asiatica, Alpinia speciosa, Eupatorium odoratum, Mucuna pruriens, Saccharum arundinaceum* and sometimes *Dendrocalamus stictus.*

Eastern Terai Sal occurs mostly in the Southern parts of Buxa Tiger Reserve where soil is heavier and water table is higher. Though, Sal dominates this type, number of other species as Lali (*Amoora wallichii*), Champa (*Michelia champaca*), Chilauni (*Schima wallichii*), Bahera (*Terminalia belerica*), Paksaj (*Terminalia tomentosa*), Kawla (*Machillus villosa*), Angari (*Phoebe attenuata*) are also found.

3. Dry mixed forests

This type of vegetation corresponds to Champion & Seth's Moist tropical forests called East Himalayan moist mixed deciduous forests. This type of forest found in some part of Kumargram, Bhutanghat 1 & 2, Phaskhawa, Panbari, Jainti, Raimatang and South and North Rajabhatkhawa.

This type comprises of very diverse type of vegetation. No particular vegetation occurs continuously. Deciduous tree species of medium to good height are found here. They form an open canopy. In dry session grasses are generally absent. Considerable quantity of herbs, shrubs and grasses are available during the monsoon. In this type 'Sal' trees are met with very frequently.

The most common species in this type of forests are *Shorea robusta*, *Dalbergia sissoo*, *Lagerstroemia parviflora*, *Stereospermum personatum*, *Mallotus philippinensis*, *Wrightia tomentosa*, *Sterculia villosa*, *Erythrina stricta*, *Bridelia stipularis*, *Cryptocarya amygdalina*, *Celastrus paniculata*, *Zizyphus rugosa*, *Antidesma acidum*, *Holmskioldia sanguinea*, *Ficus hispida*, etc.

The common grasses in such forests are *Panicum sarmentosum*, *Eragrostis uniloides*, *Neyraudia borphyrocoma*, *Pogonatherum paniceum*, etc. Ferns like *Lygodium flexuosum*, *Asplenium crinicaule*, etc. are sometimes found in the forest as undergrowth.

4. Wet mixed forests

This type of forests mainly occurs in South Rydak, Panabari, South Rajabhatkhawa, Cheko, Gadadhar and Damanpur Range.

It has got a canopy of considerable height and fully shaded forest floor covered with leaf litter. Grasses and other herbs are usually very little and the top storey may be formed by some deciduous species. The canopy is open only in some degraded places.

The principal genera in such forests are *Eugenia*, *Machilus*, *Elaeocarpus*, *Schima*, *Dysoxylum*, *Litsea* covered with climbers of Vitaceae. Other common species are *Aphanamixis polystachya*, *Callicarpa arborea*, etc. Besides *Casearia vareca*, *Clerodendrum viscosum*, *Aporusa roxburghii*, *Maesa indica*, *Symplocos laurina*, *Phlogacanthus thyrsiflorus*, *Thunbergia coccinea*, *Lepidagathis incurva*, *Coffea bengalensis*, *Carallia brachiata*, *Duchesnea indica*, *Tricosanthes bracteata* are also distributed in such forests.

Also *Macaranga denticulate*, *Leea asiatica*, *Mallotus philippinensis*, *Litsea* spp., *Cinnamomum glaucescens*, *Ficus benghalensis*, etc. along with some common herbs like *Curcuma amada*, *Zingiber roseum*, *Dioscorea bulbifera*, *Asparagus racemosus*, *Colocasia esculenta* and others.

5. Semi evergreen forests

According to Champion & Seth, this type belongs to Eastern Submontane Semi-evergreen forests and found in the Subhimalayan tract and the lower slopes of the hills, namely Rangamati, Tashigaon, Hatipota block of this area.

The top storey is composed of Chilauni (*Schima wallichii*), Tanki (*Bauhinia purpurea*), Toon (*Toona ciliata*), Lampate (*Duabanga sonneratioides*), Maina (*Tetrameles nudiflora*), Champa (*Michelia champaca*), Gamar (*Gmelina arborea*), Chikrasi (*Chukrasia tabularis*) and Gokul (*Ailanthus grandis*). Lower storey is composed of Angara (*Litsea* spp.), *Dysoxylum* spp., *Mallotus* spp. and others. *Dendrocalamus hamiltonii* are also found in some places.

6. Evergreen forests

Champion & Seth recognised this type as Northern Tropical Evergreen forests. This type can be found mostly near to streams, that rises in the plains and covers a very small area in comparison with other types. The most typical trees are Satpate (*Aesculus punduana*), Amboke (*Eugenia formosa*), Chalta (*Dillenia indica*), Gobre (*Echinocarpus sterculiaceus*), Katus (*Castanopsis* sp.) and mention may be made of Bhalukat (*Talauma hodgsonii*), Latore (*Artocarpus chaplasha*), Gokuldhup (*Canarium sikkimense*), Lali (*Amoora wallichii*) and Malagiri (*Cinnamomum ceoidodaphne*).

7. Hill forests

This type of forests belong to East-Himalayan Submontane Wet Hill forest. Mainly occurs in Chunabhati, Adma, Hatipota, Phaskhawa, Tashigaon and Tobgaon blocks. Dry mixed type of forest occurs generally in the foothills along with some *Shorea robusta* and *Dendrocalamus hamiltonii*, *Acrocarpus fraxinifolius*, *Phoebe lanceolata*, *Pterocarpus acerifolium*, *Gynocardia odorata*. Most common large trees found upto 1000 m are *Castanopsis* spp., Mandane (*Acrocarpus fraxinifolius*), Bhalukat (*Talauma hodgsonii*), Lampate (*Duabanga sonneratioides*), *Terminalia myriocarpa*, Gokul (*Ailanthus grandis*), Champa (*Michelia champaca*) and Chikrasa (*Chukrasia tabularis*). The hill species found above 1000 m elevation are Oaks (*Quercus* spp.), *Michelia cathcartii*, *Alnus nepalensis*, *Phoebe attenuata*, *Betula cylindrostachys*, *Acer* spp. and many others.

8. Savannah

Champion & Seth classified two distinct type of Savannah forests in this area:

a. Moist Sal Savannah is actually characterized by the presence of scattered Sal along with Khumbhi (*Careya arborea*), Amloki (*Embelia ribes*), Sidha (*Lagerstroemia parviflora*), Tanki (*Bauhinia purpurea*), etc. *Saccharum* spp. shows the most significant power of colonize. It covers a huge area of Riverine forests, from the fresh sandy deposition to swamps. Grasses thrives in different type of location and conditions and successfully stabilizes in very loose soil. The most dominant grasses are *Arundo donax*, *Imperata cylindrica*, *Phragmites karka* and *Themeda arundinacea*.

b. Low Alluvium Savannah Woodland ($3C/IS_1$) is characterized by *Albizzia* and *Bombax* association. The area is dry throughout the winter but is inundated during the rains. The important tree species found in this type are Khair (*Acacia catechu*), Kainjal (*Bischofia javanica*), Pitali (*Trewia nudiflora*) and *Dillenia* spp., etc. Grasses are very dense and species generally found are *Saccharum procerum*, *S. spontaneum*, *Paspalidium punctatum*, *Arundo donax*, *Saccharum spontaneum*, *Phragmites karka*, *Themeda arundinacea*, *Cymbopogon nardus*, etc.

Climbers and twiners

Climbers and twiners play an important role in constituting a typical forest, with different structures like tendrils, prickles, hooks which are helpful for their climbing habit and growing over other plants. Climbers and twiners have representative species in all vegetational strata and some of the common species distributed in B.T.R. are :

Abrus pulchellus, A. precatorius, Acacia caesia, A. pennata, Aganosma cymosum Ampelocissus barbata, A. latifolia, A. sikkimensis, Argyreria argeantea, A. hookeri, A. nervosa, A. capitata, Aristolochia peltata, Artabotrys uncinatus, Asparagus racemosus, Aspidopterys elliptica, Bauhinia vahlii, Berchemia floribunda, Butea parviflora, Buttneria pilosa, Caesalpinia bonduc, Capparis acutifolia, multiflora, C. olacifolia, Cayratia pedata, monospermus, C. paniculatus, Ceropegia macrantha, Cissampelos parriera, Cissus adnata, C. assamica, C. quadrangularis, C. javanica, C. repanda, Clematis gouriana, Clitoria ternatea, Coccinia grandis, Cocculus hirsutus, Cryptolepis sinensis, Cyclea peltata, C. flagrocarpum, Dalbergia stipulacea, D. volubilis, Derris robusta, D. trifoliata, Desmos chinensis, D. dumosus, Dregia sanccolata, Entada phaseolodes, Erycibe pegnensis, Fissistigama palyanthum, F. verucosum, Gouania leptostachya, Hedyotis scandens, Hemidesmus indicus, Hiptage bengalensis, Hodgsonia macrocarpa, Hoya lanceolata, H. polyneura, Ipomea eriocarpa, Jasminum pubescens, Melothria heterophylla, M. maderaspatana, Mezoneurum cuculatum, Mikania cordata, Miliusa macrocarpa, M. roxburghiana, Millettia pachycarpa, M. auriculata, Mimosa himalayana, Mucuna pruriens, M. imbricata, Naravelia zeylanica, Paederia foetida, Parabaena sagittata, Passiflora foetida, P. edulis, Piper spp., *Porana paniculata, Pueraria tuberosa, Sabia lanceolata , Schefflera venulosa, Smilax zeylanica, Stephania peltata, Stephania glabra, Stephania hernandifolia, Tetracera asiatica, Tetrastima bracteolatum, T. lanceolarium,*

Glycirhiza glabra cultivated as medicinal plant

T. serrulatum, T. thomsonianum, Thunbergia grandiflora, Tinospora cordifolia, Tiliacora racemosa, Toddalia asiatica, Trichosanthes sp., *Tylophora hirsuta, U. scandens, Uncaria sessilifractus, Ventilago maderaspetana, Zizyphus oenoplia.*

Aquatic plants

Some of the common hydrophytes available from some plants of BTR are *Acorus calamus, Aeschynomene indica, Ammania baccifera, Bacopa monnieri, Cyperus haslpan, C. iria, Limnophila heterophylla, Ludwigia parviflora, Myriophyllum indicum, Nymphaea pubescens, N. nouchali, N. rubra, Nymphoides cristanum, N. hydrophylla, N. Indica, Trapa bispinosa, Rotala densiflora.*

Ferns & fern allies

Ecologically the fern inhabiting the area may be classified into following categories: (i) epiphytic, (ii) climbers, (iii) species inhabiting shady and bark forests, (iv) inhabiting forest floor and (v) lithophytes.

Many species may become extinct if the present form of the forest not being maintained. *Asplenium esculentum* is the predominant fern in BTR. Some other Pteridophytes reported from the area are:

Selaginella involvens (Sw.) Spring
S. monospora Spring
Helminthostachys zeylanica (L.) Hook.
Dcranopteris linearis (Burm. f.) Under W.
Loxogramme involuta (D. Don) C. Presl
Polypodium lineare Thumb.
Pyrrosia floculosa (D. Don) Ching
P. stigmosa (Sw.) Ching
Microsorum membranaceum (D. Don) Ching
M. punctatum (L.) Copel.
Drynaria quercifolia (L.) J. Sm.
Lygodium japonicum (Thunb.) Sw.
L. microphyllum (Cav.) R. Br.
Cheilanthus belangeri (Bory) C. Chr.
Onychium siliculosum (Desv.) C. Chr.
Pteris excelsa Gaud.
P. semipinnata L.
Adiantum philippense L.
Hemionitis arifolia (Burm. f.) Moore
Macrolepia speluncae (L.) Moore
Sphenomeris chinensis (L.) Maxon
Microthelypteris torresiana (Gaud.) Ching.
Christella dentata (Forssk.) Brownsey & Jerry
C. parasitica (L.) Lev.
Dryopleris gongylodes (Schkuhr) Kuntze
Asplenium finlaysonium Wall. ex Hook
A. laciniatum D. Don
A. nidus L.
Cystopteris tennuisecta (Bl.) Mett.
Diplaziam esculentum (Retz.) Schrad
Polystichum lentum (D. Don) Moore

Davallia trichomenoides Bl.

Blechnum orientalis L.

Tea gardens are also an important element of the vegetation of BTR. Around 25 tea plantations can be found in the Buffer area of the Reserve. The common tree species planted in the gardens to provide partial shade to the tea plants are *Albizia lebbeck, A. procera, A. chinen Dalbergia assamica, Tephrosia candida, Aleutis fordii* and *A. montana,* etc.

Weeds

Soil and moisture condition favours the weed formation in the Reserve and is a very serious problem in Buxa Tiger Reserve. In all new plantation area (except teak) are infested with prolific growth of weeds and grasses particularly during rainy season. The most dangerous weed to eradicate is *Eupatorium odoratum* (Assamilata). Other major weeds are *Leea* spp., *Lantana camara, Laportia crenulata* (Chotra), *Ageratum conizoides, Clerodendron* spp., *Cassia tora* and *Solanum nigrum.*

Dominant families/ genera

The analysis of the vegetation of BTR reveals that Dicots are dominant over Monocots.

Ten dominant families and ten dominant genera of BTR are :

Table II - Ten Dominant Families

Family	Species in BTR
Orchidaceae	144
Leguminosae(*s.l.*)	111
Euphorbiaceae	58
Rubiaceae	52
Poaceae	43
Cyperaceae	29
Lauraceae	27
Moraceae	27
Asteraceae	25
Meliaceae	24

Ten Dominant Genera

Name of the genera	Species in BTR
Dendrobium	25
Ficus	21
Bulbophyllum	16
Crotalaria	14
Desmodium	12
Elatostemma	8
Eria	8
Cymbidium	9
Glochidion	8
Grewia	8

Rare and Endangered plants

The following plants may be considered for conservation for their rarity of occurrence.

Aesculus punduana Wall. ex Hiern (Satpate)
Bulbophyllum leopardinum Lindl.
Canarium sikkimense King (Gokuldhup)
Cinnamomum ceidodaphne Meissn. (Malagiri)
Dalbergia latifolia Roxb. (Satisal)
Ehretia acuminata R. Br. (Putli)
Eleocarpus aristatus Roxb. (Dulchiuri)
E. varunua Buch.-Ham. (Bhadrasa)
Endospermum chinensis Benth. (Setikath)
Erythropsis colorata (Roxb.) Burkill (Seto Udal)
Hovenia dulcis Thunb. (Bengi)
Machilus gamblei King. ex Hook. f.(Kawla)
M. villosa Hook. f. (Kawla)
Morus laevigata Wall. (Kimbu)
Myristica longifolia Hook. f. & Thomson (Ramgua)
Pygeum acuminatum Colebr. (Dharani)
Sapindus detergens Roxb. (Ritha)
Celtis tetrandra Roxb. (Kari)
Spondias mangifera Willd. (Amaro)
Vanda pumila Hook. f.
Vitex heterophylla Blume ex Miq (Panchpate)

Endemic

Endemic plants of Gangetic region are very poorly represented. But numbers of new taxa have been described in the recent past (Sikdar, 1984). As par as the latest information on the Endemic plants of BTR is concerned, *Amblyanthopsis bhotanica* (C.B. Clarke)Mez., *Senecio bhot* C.B. Clarke and *Acanthus carduaceous* Griff., which were supposed to be endemic to small patches in Bhutan, with specific ecological habit, along with *Aganosma gracilis* Hook. f., an interesting rare species said to be confined to Sikkim, North Bengal (Possibly Darjeeling district) and Meghalaya (Khasi hills), have been reported from Buxa Division (Sikdar 1984). Besides these, two new species have been described from Buxa Tiger Reserve i.e., *Dalbergia duarensis* by K. Thothatri (1972) on the basis of Heawood's collection of 1891 from Alipurduar and *Ophiorrhiza seshagiriana* by Sikdar and Maiti (1981).

Medicinal plants

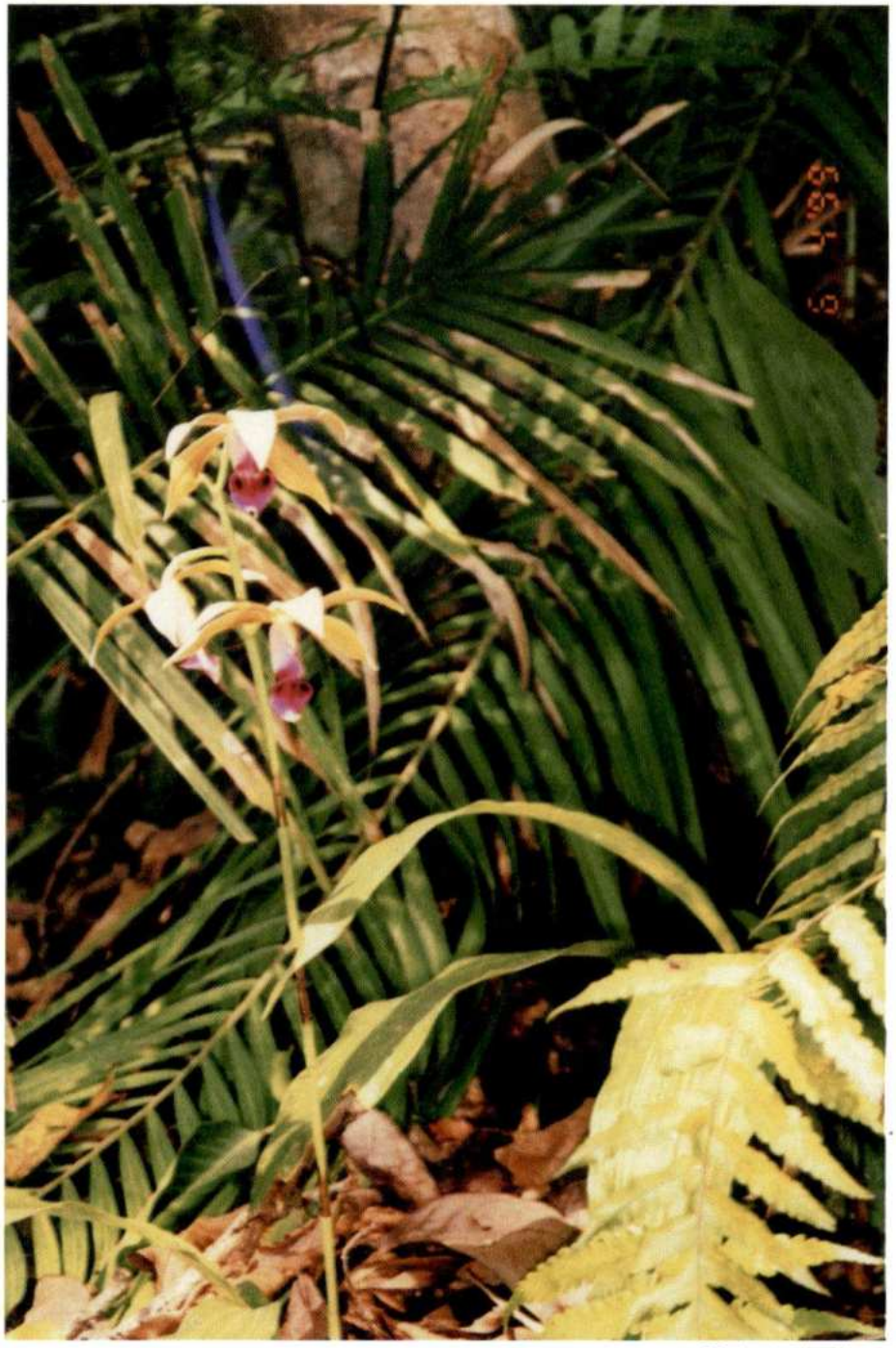
From ancient times the mountains of Himalayas and its surrounding are famous as the home of many medicinal plants. A number of primitive tribes inhabit the Buxa Tiger Reserve like Oraon, Rava, Mech, Garo, etc. are used to practice herbal medicines to cure various ailments.

Some of the plants are listed in the following Table, along with some information like uses, parts used, etc.

No.	Botanical Name	Family	Local Name	Parts Used	Use
1.	*Acampe papillosa* (Lindl.) Lindl.	Orchidaceae		Root	In rheumatism
2.	*Acacia pennata* (L.) Willd.	Mimosaceae	Bachi	Stem bark, fruits, seeds	The decoction of the stem bark is used in the infection.
3.	*Acorus calamus* L.	Araceae	Sothi	Rhizome	It is processed scalp and served as baby food.
4.	*Aerides odoratum* Lour.	Orchidaceae		Whole plant	Anti tuberculosis
5.	*Ageratum conyzoides* L.	Asteraceae	B.-Uchunti*,	Lvs.	Juice of the leaves is used to stop bleeding.

No.	Botanical Name	Family	Local Name	Parts Used	Use
6.	*Amaranthus spinosus* L.	Amaranthaceae	Parucha	Leaves, roots	The paste of the leaves or roots is used in constipation, decoction of the root used in skin irruption.
7	*Aphanamixis polystahya* (Wall.) Parker	Meliaceae	Akhawa	Stem bark, seeds	The paste of stem bark is used in hepatic disorder, seed oil is used in rheumatic pain.
8.	*Artemisia vulgaris* L.	Asteraceae	Titepate	Leaves	Leaves are used to check bleeding from nose.
9.	*Asparagus racemosus* Willd.	Liliaeae	Satamuli	Root	Root used in stomach trouble, white discharge in ladies, blood infection.
10.	*Astearcantha longifolia* Nees	Acanthaceae	Makhna	Whole plant, leaves	Very useful in anemic patient.
11.	*Baliospermum solanifolium* (Burm.) Suresh & al.	Euphorbiaceae	Jarinata	Root	The paste of fresh root is taken as an antidote to food poison.
12.	*Begonia barbata* Wall.	Begoniaceae	Jabjew	Leaves	Leaf juice is used on leech cut to stop bleeding from the wound.
13.	*Boerhaavia diffusa* L.	Nyctaginaceae		Root	Root extract is used in jaundice also used in stomach upset.
14.	*Buddleja asiatica* Lour.	Loganiaceae	Agia-chitya		used in skin complaints and as abortifacient.
15.	*Bulbophyllum careyanum* (Hook.) Spreng.	Orchidaceae		Pseudo bulbs and leaves	Used to increase lactation in cattle.
16.	*Capparis obasifolia* Hook. f. & Thomson	capparideaceae	Simbri	Leaves	Poultice made of leaves is used in gaut.
17.	*Capparis zeylanica* L.	Capparidaceae	Kalokesa	Root bark, lvs.	Root bark is sedative, stomachic, cholagauge and in cholera. leaves used as counter irritant and as cataplasm in boils, swelling and piles.
18.	*Croton caudatus* Geisel	Euphorbiaceae	Halongre	Leaves	Leaves applied as poultice.
19.	*Curculigo orchioides* Gaertn.	Amaryllidaceae	Talmuli	Rhizome	Used in jaundice, asthma, diarrhoea, impotency, nervous

No.	Botanical Name	Family	Local Name	Parts Used	Use
					debility, colic pain also used as demulcent and diuretic. When mixed with roots of *Asparagus racemosus*, *Tinospora cordifolia*, seeds of *Butea frondosa* and root of palmyra palm and taken with honey and cows milk – prevents weakness due to old age.
20.	*Dendrocnide sinuata* (Blume) Chew	Urticaceae	Pagsa	Root	Root juice is used in chronic fever, root paste is used in swelling.
21.	*Dioscorea deltoidea* Wall.	Dioscoriaceae	Pani do tarul	Rhizome	Rhizome is used for birth control.
22.	*Dregea volubilis* Benth. ex Hook. f.	Asclepiadaceae	Lorong	Root	Root is taken internally as paste for a easy child birth.
23.	*Drymaria cordata* Willd. on Roem. & Schult.	Caryophyllaceae	Nasya-pati, avijal	Lvs and whole plant	Used in diarrhoea and dysentery also to prevent vomiting.
24.	*Euphorbia neriifolia* L.	Euphorbiaeae	Manasa	Leaves & bark	Juice of leaves is good for bronchitis, bark is used in piles.
25.	*Gnetum scandens* Roxb.	Gnetaceae		Stem and root	Both stem and root is used as antiperiodic. Whole plant used as fish poison.
26.	*Echolium linneanum* Kurz	Acanthaceae	Jhati	Leaves	Juice of leaves is used in fever, cough & cold and also in weakness.
27.	*Ipomoea paniculata* R. Br.	Convolvulaceae	Bhuikumra		Used in accidental dislocation of bone.
28.	*Leonurus sibiricus* L.	Lamiaceae	Gumma	Root and leaves	Root and leaves are used as febrifuge.
29.	*Lepidagathis incurva Buch-Ham.* ex D. Don	Acanthaceae		Leaves	Leaves are chewed to get relieve from cough.
30.	*Litsea monopetala* (Roxb.) Pers.	Lauraceae	Chiru	Seed	Paste made up of seeds used as ointment in rheumatism.
31.	*Melastoma malabathricum* L.	Melastomataceae		Leaves	Leaves used in cough & cold.
32.	*Mimosa pudica* L.	Mimosaceae	Lajjabati, Garchang	Leaves, root	Juice of leaves used in iron deficiency, Paste of root is used in body ache and swellings.



Phaius tankervilleae

No.	Botanical Name	Family	Local Name	Parts Used	Use
33.	*Murraya koenigii* Spreng.	Rutaceae	Barsanga, karipata	Whole plant, bark and root	The bark and root is used as stimulants, also used to cure eruptions and the bites of poisonous animals. The green leaves are eaten raw for the cure of dysentery, also bruised and applied externally to cure eruption. The root is slightly purgative. Also used in rheumatism.
34.	*Ocimum sanctum* L.	Lamiaceae	Kalotulsi (Cultivated)	Leaves	Juice of leaves Mixed with honey to prepare medicine for cough and cold.
35.	*Ophiopogon intermedius* D. Don	Haemodoraceae	Murba	Tuber	Tubers are used in dropsy.
36.	*Oroxylum indicum* Vent.	Bignoniaceae	Totola, Kanaidingi	Bark	Bark dried then powdered then applied on boils, wounds and internally in jaundice. Also its flower fried and taken as vegetable.
37.	*Phlogacanthus thyrsiflorus* (Roxb.) Nees	Acanthaceae	Tamra basak	Leaf	Juice of leaves is used in cough and cold.
38.	*Polygonum glabrum* Willd.	Polygonaceae	Bigni	Plant and leaves	Plant is used as febrifuge and infusion of leaves used in colic.
39.	*Prunus amygdalo-persica* Rehder	Rosaceae	Satalu, aru	Flowers and fruits	Fls. used as diurectic, purgative. Fruits used as stomachic, demulcent, antiscorbutic also considered to be useful as vermifuge.
40.	*Rauwolfia serpentina* Benth. ex Kurz	Apocynaeae	Nagbel	Root	Root used in fever, spasmodic pain, reduces blood pressure, in painful affection of the bowel, decoction employed in labour to increase uterine contractions. Juice of the leaves used for removal of opacities of the cornea of the eyes.

No.	Botanical Name	Family	Local Name	Parts Used	Use
41.	*Rhamnus nepalensis* Wall. ex Roxb.	Rhamnaceae	Nakalingo	Fruit	Pounded fruit used in skin ulcers.
42.	*Schima wallichii* Choisy	Ternstraemiaceae	Chilauni	Bark	Bark is used as anthelmintic.
43.	*Smilax indica* Burm.f.	Smilacaceae	Kukurdani	Root	Root is used for birth contro.
44.	*Spermacoce hispida* L.	Rubiaceae	Madanghanti	Root	Decoction of the root is used as alterative. Seeds are burnt and vapour is inhaled to kill tooth worms.
45.	*Spilanthes acmella acmalla* Murr.	Asteraceae	Hobrou	Stem	Apical portion of the stem is used to enhance lactation in newly mothers.
46.	*Stephania hernandifolia Walp.*	Menispermaceae	Akandi,patha, nilotop	Root and leaves	Root & leaves are used in cholera, dysentery indigestion and even for birth control.
47.	*Sterculia villosa* Roxb.	Sterculiaceae	Udala	Resin	Resin is taken internally in urine infection.
48.	*Strophanthus wallichii* A. DC.			Plant	Plant used as poison.
49.	*Tamarindus indica* L.	Caesalpiniaceae	Piprise	Leaves	Paste of the lvs. is used in different skin diseases.
50.	*Terminalia arjuna* (Roxb. ex DC.) Wight & Arn.	Combretaceae	Arjun	Bark	Bark dust used in both high & low blood pressure, blood dysentery cardiac problem.
51.	*Terminalia chebula* Retz.	Combretaceae	Bahera	Fruit	Used in constipation.
52.	*Tinospora cordifolia* Miers.	Menispermaceae	Gulancha	Shoot	Juice of shoot is good for bed test, piles, cough & cold, jaundice and fever.
53.	*Trewia nudiflora* L.	Euphorbiaceae	Pitali	Stem and root	Stem used in swelling, bile and phlegmatic. decoction of root is given to relieve flatulence and applied locally in rheumatism.
54.	*Vallaris solanacea* Kuntze	Apocynaceae	Dudhibel	Stem	Milky juice is applied to old wounds & sores.
55.	*Woodfordia fruticosa* Kurz	Lythraceae	Daheri	Flowers	Flowers are dried and used for dysentery and sold in Darjeeling market, powdered flower applied on sores and boil, dried flowers used in piles and liver complaints.

Adina cordifolia

No.	Botanical Name	Family	Local Name	Parts Used	Use
56.	*Wrightia tomentosa* Roem. & Schult.	Apocynaceae	Dudh karabi	Roots and leaves	Red coloured oil obtained from the seeds is said to be useful for the treatment of the male sexual organ. Bark is given in menstrual and renal complaints. The bark & root bark are believed to be useful in snakebite and scorpion stings. Latex of the leaves is used for stopping hemorrhage.
57.	*Zanthoxylum budranga* Wall.	Rutaceae	Timur	Fruits	Fruits used in gastric problem.

Economic plants

The forests of BTR have great potentiality from economic point of view.

The Main economic plants of BTR are Sal (*Shorea robusta*) and Tea (*Camellia chinensis*). Some of the plants used for decoration, food, incense, detergent, cotton, medicine, spice, dye, basket making, broom, furnitures are :

Lagerstroemia reginae Roxb.
Baccaurea sapida Muell. Arg.
Schima Wallichii Choisy
Chukrasia tabularis A. Juss.
Shorea robusta Roxb. ex Gaertn. f.
Salmalia malabaria (DC.) Schott
Sterculia villosa Roxb. ex Sm.
Disoxylum binectiferum Hook. f. ex. Bedd.
Cinnamomum tamala T. Nees
Machilus villosa Hook. f.
Duabanga sonneratioides Buch.-Ham.
Emblica officinalis Gaertn.
Oroxylum indicum (L.) Venten
Abroma augusta (L.) L. f.
Terminalia chebula Retz.
Vitex sp.
Asparagus racemosus Willd.
Rubia cordifolia L.
Entada pursaetha DC.
Piper hamiltonii C. DC.
Piper longum L.
Pseudostachyum polymorphum Munro
Thysanolaena maxima (Roxb.) Kuntze
Imperata cylindrica (L.) Raeuschel.
Polypodium spp.

Status of Conservation

A rich floristic composition of the BTR supports the healthy population of wildlife in the area. This reserve is the habitat of many endangered species like Indian Tiger, Asian Elephant, Leopards, Indian Bison, Clouded leopard, wild dog, etc. It also helps environmental improvement by pollution absorption and supports local tribal population (ca 30% of the total population).

BTR is very rich in plant diversity. But this diversity is continuously declining on account of developmental activities, like increase in local population, expansion of agricultural land, severe threats of making Sankosh-Tista canal, making of new roads (Tala-Raidak road which is proposed by

Bhutan Govt.) through the forest, biotic interference and other socio-economic factors.

Conservation Strategies for the reserve

A comprehensive conservation Strategy should be taken up to protect the ecosystem of BTR. A few measures have been suggested below:

1) According to the official sources, more than one-lakh cattle graze in and around BTR area every day. Modern Cooperative Farmhouses could be introduced in that area if the authority is able to provide financial as well as technological support for a success of the project.

2) Collection of plant parts including fruits and seeds (NWFP and NTFP), from the forest may reduce the probability of natural regeneration of certain group of plants. These plants may be treated as economic plants and farming of these plants (surveying the demand of the market and return from the integrated farming) may be helpful for socioeconomic development of the local inhabitants.

3) Incorporation of rare and endangered species in Botanic Gardens (for BTR the nearest will be Indian Botanic Garden, Howrah) for *ex situ* conservation and re-plantation in wild.

Dendrobium formosum (Courtesy : H. J. Chowdhery)

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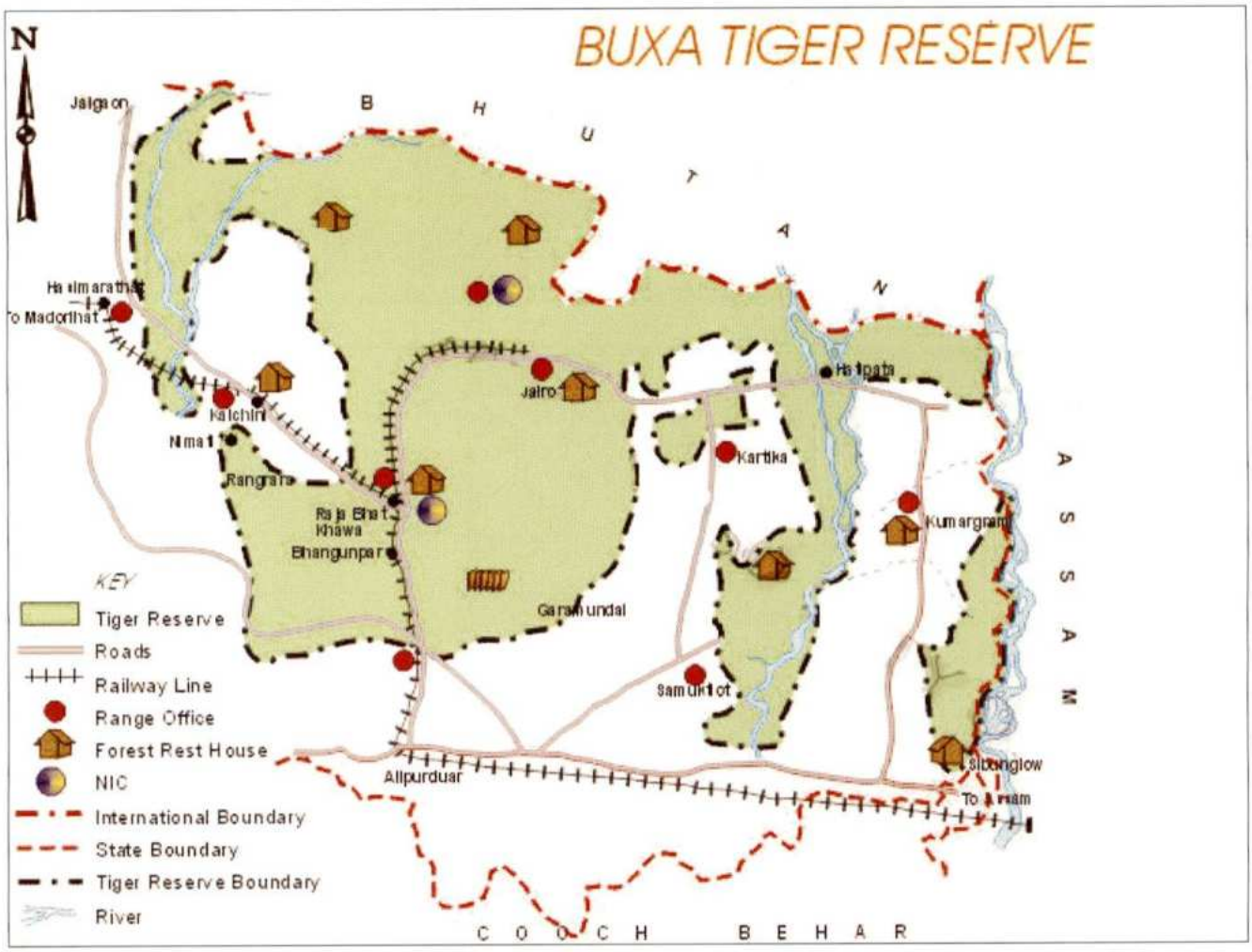

Map of Buxa Tiger Reserve

SALIENT FEATURES

Area

Core	:	385.02 sq km
Buffer	:	375.85 sq km
Total	:	760.87 sq km
Longitude	:	89° 22' to 89° 53' East
Latitude	:	26° 29' to 26° 51' North
Altitude	:	125 m to 1750 m above M.S.L.
Rainfall	:	3570 mm to 5600 mm

Temperature

Minimum	:	15°C
Maximum	:	39°C

Seasons

Winter	-	October to January
Summer	-	February to May
Monsoon	-	June to September

National Highway 31 C passes along the southern fringe in the buffer of BTR.

To go to Buxa Tiger Reserve, visitors have to come to Alipurduar from where Jayanti is about 30 km away. New Alipurduar station has got good train connection with Calcutta. Some good trains are Kanchenjunga Exp. (5657), Teesta-Torsha Exp. (3141), Kamrup Exp. (5959) and Saraighat Exp. (2345). From Alipurduar, two state buses go to Jayanti via Buxa Road - one in the morning and one at noon. Buxa goers have to get down at Santalabari. Day-visitors should hire a car from Alipurduar.

Tree fern *Cyathea*

Sundarban Tiger Reserve

Manas Ranjan Debta & HJ Chowdhery
Central National Herbarium
Botanical Survey of India, P.O. Botanic Garden, Howrah-3

The Sundarban Tiger Reserve with an area of 2585 sq km is situated in the extreme southeastern part of Sundarban, the world's largest deltaic complex, comprising of 56 low-lying islands, which are separated from one another by interconnected tidal rivers and number of meandering creeks and canals. The entire Sundarban has the total reserved forest area of 4266 sq km. The World Heritage Convention (1972) for the protection of cultural and natural heritage of humankind designated Sundarban Mangroves as one of the World heritage sites in 1985. It was subsequently declared as Sundarban Biosphere Reserve on 29.3.1989 by the Govt. of India. The Tiger reserve constitutes the core area of the Sundarban Biosphere Reserve. It falls within the districts of north and south-24 parganas of West Bengal and was notified as a Tiger Reserve on 23.12.1973 to conserve the dwindling population of Royal Bengal Tiger and other wildlife by conservation of their natural habitat. The S.T.R. lies within 89°10′ to 89° 51′ E longitude and 20° 31′ to 22°N latitude. Out of the total area of the Tiger reserve 1600 sq km is covered with mangrove forests and 985 sq km area is criss-crossed by various rivers, channels, and creeks. The Tiger reserve is encompassed by the reclaimed populated islands on the north, the Bay of Bengal on the south, the rivers Bidya and Matla on the west and the rivers Raimangal and Harenbhanga on the east. The buffer zone of the Tiger reserve spreads across 1255 sq km, which includes Sajnekhali Wild Life Sanctuary covering an area of 362 sq km, core area spreads in 1330 sq km that includes the National Park and ca 124 sq km of primitive zone to act as gene pool.

TOPOGRAPHY

The world's largest deltaic complex Sundarban is formed by the deposition of sediments carried away by by the Ganges and the Brahmaputra from the Himalayas. The Tiger reserve consists of a number of low-lying swampy islands and their connecting water channels and meandering creeks. The average elevation of the area is 5.6-6.1 m above mean sea level with several low-lying depressions. The area is interspersed with diversified habitats such as estuaries, swamps, tidal flats, intertidal creeks, coastal dunes, islands agricultural islands, and forest areas. The abundance of river sediments and continuous accretions and depositions of sand has led to the formation of many islands in the area.

GEOLOGY

The Bengal basin tilted eastward during the 12th century because of neotectonic movement. The raising of the western part of the river Ganges forms the area that today comprises the Indian Sundarban. This may be the cause of reduction of fresh water flow into the western part (Sanyal & al. 1984).

The alluvial fill of this Indo-Gangetic plain is essentially of quarternary age. From the past geological study it is assumed that though the Lower Ganga delta in Sundarban was under the river dominated allochthonous settings, but due to the neo-tectonic, geomorphic and catastrophic changes

Littoral Forest (Courtesy : H. S. Debnath)

in this deltaic region, the Sundarban delta has changed more or less into a tide dominated allochthonous formation. Here the dominant physical process is high tidal range with associated strong bi-directional tidal currents that took active parts for discharge of the sands and sediments and in the offshore form sub-tidal dispersed shoals (Naskar & Mondal, 1999).

VEGETATION AND FLORA

The Sundarban represents one of the most interesting mangrove vegetation controlled by several ecological factors. Sundarban boasts of its natural beauty along with its impressive and affluent mangrove diversity. This forest has been attracting the attention of many botanists. naturalists. and zoologists because of its richness in floral and faunal survival in such a fragile ecosystem from a long time. During the early period of 19th century Roxburgh with the help of Buchanon-Hamilton and William Carey collected many interesting plants from this region and were included in Hortus Benghalensis (1814). Kurz (1877) made several collections and reported the presence of *Aldrovanda vesciculosa,* the queen of insectivorous plants, from the saline lakes of this area. Clarke (1996) made a comprehensive list of Sundarban with several new species contributed by King and Gamble. Apart from this, the "Flora of Sundribuns" by David Prain (1930b) throws some light on the mangrove vegetation of Sundarban with many inputs from Heinig's flora. Blasco (1975) have reported about 50 species from Indian mangroves.

Out of 84 true mangrove species known in the world, Sundarban alone has nearly 35 true mangrove species in addition to 28 associated mangroves and 7 obligate mangroves under 29 families and 49 genera.

The halophytic vegetation of the Tiger reserve is continuously fringed with muddy salt water, creeks, and estuaries. The swampy mangrove forests is situated below the high tide level and submerged by the seawater whereas tidal mangrove forests are submerged only during spring tide and cyclone. Herbaceous plants belonging to the families Chenopodiaceae and Aizoaceae generally dominate the tidal mangrove forests. The forests in the Tiger reserve is covered with the gregarious mass of impenetrable small trees having a uniform canopy supported by an intricate system of arched aerial roots and pinnacles of numerous pneumatophores. These forests are the characteristics of the high tidal flooded zone. The biomass productivity in this ecosystem is very high and stands comparable to any other forested Tiger reserve of India. Some of the plant species like *Avicennia, Sonneratia, Excoecaria, Derris, Acanthus, Myriostachya, Porteresia* and underground roots and bulbs of many other species are good fodder for deer, monkeys and wild boars inhabiting the reserve.

Champion and Seth (1968) recognized the following forests types in the estuaring plain of West Bengal, which also include the area of the Sundarban Tiger Reserve:

1. Littoral forests on sandy beaches and dunes facing the sea
2. Mangrove scrubs or salt water forests
3. Mangrove forests
4. Salt water mixed forests of *Heritiera*
5. Brackish water forests
6. Palm swamp forests

The typical woody elements represented in the mangrove forests are: *Aegiceras* (Myrsinaceae), *Avicennia* (Avicenniaceae), *Amoora* (Meliaceae), *Bruguiera* (Rhizophoraceae), *Ceriops* (Rhizophoraceae), *Sonneratia* (Sonneratiaceae) and *Xylocarpus* (Meliaceae). The mixed forests of *Heritiera* are quite dense and spread fairly well in saline water. *Heritiera fomes, Excoecaria agallocha, Ceriops decandra, Xylocarpus granatum* and others occupy the top canopy in these forests. Some of the typical mangroves of moderate height are *Avicennia alba, Ceriops tagal, Xylocarpus moluccensis, Excoecaria sagallocha.* Some of the bushy shrubs like *Acanthus iliciflius, Dalbergia spinosa, Derris scandens, Desmodium umbellatum, Clerodendrum inerme* are found to form dense patches along the muddy flat lands on the riverbanks. Of the two species of palms met in the reserve area *Nypa fruticans* is a stemless palm with leaves upto 9m long is fast decreasing and occupying smaller areas than *Phoenix palludosa,* the other palm species with 2-3m stem having a crown of leaves of 1.5-2m diameter. These two palms once common in the forests are gregarious but much depleted due to over exploitation. The Sundarban Tiger Reserve harbours rich species diversity due to its location in the inter-tidal or tidal saline zones of Indian Sundarban which is continuously influenced by the variation in salinity, soil condition and tide level. These tidal influenced zones support the growth and proliferation of a range of true mangrove species. The mangrove species have developed several types of unique aerial and above ground root system, which are associated with gaseous exchange or may perform the functions like root zone respiration mechanism in these anoxious and anaerobic soil. Viviparous, crypto-viviparous or incipient viviparous seed germination and several other types of unique seed germination mechanism and seedling developmental stages distinguished these mangroves of the inter-tidal saline zones with the non-saline habitat flora or non-littoral species. These mangrove species have also possess special mechanism of overcoming the high salinity, viz.

their interaction on salty environment by salt exclusion, salt excretion and salt accumulation.

Naskar & Mondal (1999) recorded some major and minor mangrove species from Sundarban of which maximum number occur in the Tiger reserve. The major true mangrove elements are represented by 5 families, 8 genera, and 17 species as shown below.

Family	Genus	Species
Rhizophoraceae	a) *Rhizophora* L.	*R. mucronata* Lam. *R. apiculata* Blume
	b) *Bruguiera* Lam.	*B. gymnorrhiza* (L.) Lam. *B. sexangula* (Lour.) Poir. *B. cylindrical* (L.) Blume *B. parviflora* Wight & Arn. ex Griff.
	c) *Ceriops* Arnold	*C. decandra* (Griff.) Ding Hou *C. tagal* (Perr.) Robinson
	d) *Kandelia* Wight & Arn.	*K. candel* (L.) Druce
Avicenniaceae	*Avicennia* L.	*A. officinalis* L. *A. alba* Blume *A. marina* (Forssk.) Vierh
Sonneratiaceae	*Sonneratia* L.f.	*S. apetala* Buch.-Ham. *S. griffithii* Kurz *S. caseolaris* (L.) Engler
Combretaceae	*Lumnitzera* Willd.	*L. racemosa* Willd.
Arecaceae	*Nypa* Steck.	*N. fruticans* Wurmb.

Unlike the major mangrove elements, the minor mangrove elements do not form any pure community. These are distinct from the major mangroves and are represented by 6 famillies, 6 genera and 7 species that are shown below.

Family	Genus	Species
Sterculiaceae	*Heritiera* Aiton	*H. fomes* Buch.-Ham.
Meliaceae	*Xylocarpus* Roem.	*X. granatum* Koenig *X. mekongensis* Pierre
Euphorbiaceae	*Excoecaria* L.	*E. agallocha* L.
Myrsinaceae	*Aegiceras* Gaertn.	*A. corniculatum* (L.) Blanco
Rubiaceae	*Scyphiphora* Gaertn. f.	*S. hydrophylla* Gaertn. f.
Plumbaginaceae	*Aegialitis* R. Br.	*A. rotundifolia* Roxb.

Acanthus ilicifolius

The vegetation of the Tiger Reserve represents a seral type depending on the variations in salinity, tidal flow, and soil morphology. The vegetation is chiefly dominated by mangrove forests.

Naskar & Guhabaksi (1987) defined mangrove as "coastal tropical forest formation encircled or spread by the tidal rivers and/or sea water, flooded frequently by the tidal water." They have also mentioned that mangrove do not necessarily mean only forest formation and may be covered with herbaceous, bushy or arborescent vegetation or occasionally lacking any such vegetation, viz., fringing waterways.

The plant species of this Tiger Reserve are unique and adapted to withstand high salinity of river water, great velocity of tidal waves and less aeration in the sticky, muddy soils. Majority of plant species over the regions are viviparous and produce stilt roots, salty glands, and pneumatophores to bring a remarkable balance for surviving in these specialized ecological conditions (Banerjee, 1988).

The network of water and formation of several islands with different habitat conditions coupled with variations in ecological conditions have helped mangrove species forming different associations and zonations. According to Banerjee (1988) the Ganga-Brahmaputra deltaic complex of Sundarban Tiger Reserve has two topographic conditions depending upon the influence of tide, salinity and soil conditions. The first is the river mouth or outer estuarine regions where the elevation of tidal flats are

not more than 4m and influence of tide, salinity and soil conditions comparatively differs from that of the inner part of the riverine system. The environmental conditions here share more or less same that of the any open coastal environment. On the other hand, the second type where tidal flats along the inner part of the riverine system are associated with meandering creeks and channels are in a sheltered place and in proximity to the freshwater source with different salinity, tidal flow and soil conditions. The vegetation of Sundarban Tiger Reserve can be grouped in the following categories-

1. Outer Estuarine Mangrove Vegetation

The vegetation in this region is influenced by frequent tidal actions of 4-6 m height, high salinity, and soil comprising of silt and fine sands. The plant species grown under this type are physiologically very adaptive to withstand such dynamic ecological factors by forming salt excretory glands in leaves and petioles of some species. The dominant species here is *Avicennia marina* belonging to family Avicenniaceae. The other associated species are *Sonneratia griffithii, Bruguiera cylindrical, B. parviflora, Ceriops tagal, Aegilitis rotundifolia* intersparsed with less common *Avicennia alba* and *Phoenix paludosa.* The gregarious growth of *Parteresia coarctata* is marked in the region of newly formed tidal flats.

2. Inner Estuarine or Riverine Mangrove Vegetation

Mangrove formation is more developed and the flora becomes more rich in this zone because of varying condition of salinity, tide level, soil condition and the pattern of distribution of plant species is very distinct due to the availability of more fresh water. Distribution of mangrove species exhibits following three distinct zones:

a) True or Typical Mangrove Zone

This zone is characterized with maximum number of creeks and channels where tidal velocity is lower than that of the estuarine of true mangrove species that are generally characterized by stilt roots and viviparous mode of regeneration. The tree species of this zone are of low stature and attain an average height forming a uniform canopy. This zone has also more species abundance, which may be due to less salinity. The vegetation here is mainly dominated by *Rhizophora mucronata, R. apiculata, Kandelia candel* and *Aegiceras corniculatum.* The associated mangroves are *Bruguiera parviflora, B. gymnorrhiza, Ceriops decandra, Avicennia officinalis, A. alba, Excoecaria agallocha, Xylocarpus granatum, X. mekongensis, Sonneratia caseolaris, Aegialitis rotundifolia, Brownlowia lanceolata, Dalbergia spinosa* and *Phoenix paludosa.*

b) Semi or Less Pronounced Mangrove Zone

This zone comprises of the mid-part of the riverine system with a little more elevation of the former type and endowed with less number of tidal creeks and channels. The vegetation here enjoys low salinity, sticky and muddy soil. The physiologically adaptive features of the tree species of this zone are- the formation of pneumatophores, peg-like woody root suckers and buttresses to withstand the less aerated conditions of the muddy soils and to support their massive boles. The dominant species of this zone are *Sonneratia apetala, Heritiera fomes, Nypa fruticans, Excoecaria agallocha* in association with *Brownlowia tersa, Sonneratia caseolaris, Xylocarpus mekongensis, Bruguiera gymnorrhiza, Avicennia officinalis, Aglaia cucullata (Amoora cucullata), Cerbera manghas, Intsia bijuga, Cynometra iripa* and *Phoenix paludosa.*

c) Transitional or Hinterland Mangrove Zone

This zone is marked towards the hinter part of the riverine system where tidal flats are more elevated and creeks and channels are almost absent because of the formation of sand bars. Tidal flow is of seldom occurrence in this part and mostly mangrove associates and back mangals dominate the vegetation. The common floral components of this zone are:

Pongamia pinnata, Excoecaria indica, Acanthus ilicifolius, A. volubilis, Brownlowia lanceolata, Clerodendrum inerme, Premna corymbosa, Hibiscus tiliaceous, H. tortuosus, Thespesia populnea, Tamarix gallica, T. indica, Derris scandens, D. trifoliata, D. indica, Dalbergia spinosa, Caesalpinia bonduc, C. crista, Cynometra ramiflora, Atalantia correa, Sarcolobus globosus, S. carinatus, Pentatropis microphylla, Suaeda monorica, S. maritime, S. nudiflora, Sanlicornia brachiata, Heliotropium curassivicum, Ipomoea pes-caprae, Solanum trilobatum, Sesuvium portulacastrum, Hydrophyllax maritime, Viscum monoicum, V. orientale, Macrosolen cochinchinsis, ruppia maritime, Viscum monoicum, V. orientale, Macrosolen cochinchinsis, Ruppia maritime, Cryptocoryne ciliata, Crinum defixum, Porteresia coarctata, Myriostachya wightiana, Phragmits karka, Imperata arundinacea, Hemarthria compressa, Cyperus javanica, C. inundatus, S. scariosus, Pandanus foetidus, Acrostichum aureum, etc. Owing to the proximity of this zone towards the source of freshwater some elements like *Salvadora persica, Syzygium rusifolium, Carissa spinarum, Ochna obtusata, Manilkara hexandra, Diospyros cordifolia, D. buxifolia, Trewia nudiflora, Kleinhovia hospita, Salacia chinensis, Barringtonia racemosa, Aristolochia indica,* etc. can also be seen.

The slightly elevated dried lands formed due to the deposition of sands in the S.T.R. which are highly saline because of the constant accumulation and evaporation of tidal water supports a kind of halophytic vegetation consisting of species like: *Sesuvium portulacastrum, Salicornia brachiata, Suaeda monoica, S. maritima, Aeluropus lagopoides, Trianthema portulacastrum, Scirpus littoralis* and *Tamarix troupii.*

In addition to halophytic species some non-littoral tree species found associated in the halophytic ecosystem are: *Barringtonia acutangula, B. racemosa, Cerbera odollum, Crataeva roxburghii, Dolichindrone spathacea, Lumnitzera racemosa, Pandanus fascicularis, P. foetida, Premna mucronata, Sapium indicum, Syzigium nuscifolium,* etc.

The sand dunes or sand bars support xerophytic vegetation mainly composed of species like: *Tamarix gallica, Opuntia dillenii, Aristolochia indica, Canavalia cathertica, Rothia trifoliata, Wedelia scandens* and *Launea sarmentosa.*

The common climbers found in the Tiger reserve are: *Finlaysonia obovata, Derris scandens, Tylophora tenuis, Acanthus volubilis, Hoya parasitica, Sarcolobus carintus, Solarium surattense, S. trilobatum, Salicia chinensis, Desmodium umbellatum, Canavalia cathertica, C. lineata,* etc.

Further, this region supports the sustance of some pteridophytic elements like *Pteris vittata, Ceratopteris thalictrodes, Asplenium falcatum, A. esculentum, Polypodium adnascens, P. proliferum, Aerostichum aureum, A. palustre* and *Psilotum triquetrum.*

SEDGES AND GRASSES

The sedges and grasses are found near the village area of the Tiger reserve in the elevated regions, which are comparatively less saline. Some of them also grow in the region of halophytic vegetation. *Pycreus polystachysus, Cyperus malaccensis, C. procerus, C. exaltatus, C. scariosus, C. rotundus, C. kyllinga, C. javanicus, C. platystylis, C. dubius, C. iria, Mariscus albescens, Eleocharis capitata, Fimbristylis ferruginea, F. halophylla, F. aestivalvis, F. sub-bispicata, F. dichotoma, Scirpus grossus, S. littoralis, S. tuberosus. Scirpodendron costatum, Fuirena ciliaris* are among the common sedges found in the reserve.

Paspalum scrobiculatum, P. distichum, P. distichum, Panicum proliferum, P. myurus, P. colonum, Echinochloa crus-galli, Setaria verticillata, S. tomentosa, Chamaeraphis spinescens, Leersia hexandra, Zoysia pungens, Z. matrella, Saccharum benghalense, Andropogon squarrosus, A. internudius, Chloris dolichostachya, Eleusine aegyptica, Eragrostis dyarrhena, Myriostachya wightiana, Porteresia coarctata, Aleuropus lagopoides, Anthistiria gigantea,

Palm swamp Forest (Courtesy : H. S. Debnath)

Desmostachya bipinnata, Apluda mutica, Brachiaria reptans and *Heteropogon contortus* are the common grasses found in the Tiger reserve.

WEEDS AND INTRODUCED SPECIES

In addition to the native flora, a number of exotic weeds from different regions have well established themselves in the Tiger Reserve of which *Opuntia dillenii, Rothia trifoliata* and *Aeluropus lagopoides* are most common. Besides, some species introduced in the reserve have become naturalized such as: *Casuarina equisetifolia, Acacia nilotica, Parkinsonia aculeat, Polyalthia longifolia, Anacardium occidentale,* etc. Some marshyland weeds are: *Crinum defixum, Cyperus exaltatus, C. iria, Scirpus grossus, Eragrostis diarrhena, Leersia hexandra, Paspalum scrobiculatum* and *Phragmites karka.*

MEDICINAL PLANTS

A range of medicinal plants is found in the Tiger Reserve. Some of them are : *Finlaysonia obovata, Hemidesmus indicus, Acanthus ilicifolius, Avicennia officinalis, A. alba, A. marina, Bruguiera gymnorrhiza, B. cylindrica, Ceriops decandra, Rhizophora mucronata, Sarcolobus carinatus, Sonneratia apetala, Xylocarpus granatum, Excoecaria agallocha, Amoora cucullata, Aristolochia indica, Crinum defixum, Opuntia dillenii, Sonneratia caseolaris, Caesalpinia crista, Salicornia brachiata, Clerodendrum inerme, Flagellaria indica, Suaeda monoica, Solanum trilobatum, Ipomoea pes-caprae, Derris scandens, Boswellia serrata, Hibiscus tiliaceous, Thespesia populnea, Viscum monoicum, V. oriantale,* etc.

Fruits of *Acanthus ilicifolius* are used as blood purifier, *Sonneratia apetala* for increasing esysight,

Bruguiera gymnorrhiza and *B. cylindrical* as local medicine (Banerjee, 2002).

Bark of *Avicennia officinalis, A. alba* and *A. marina* is used in curing skin diseases and wounds. Bark of *Ceriops decandra* is used to stop haemorrhage. A decoction of bark of *Rhizophora mucronata* is used for leprosy, diarrhoea, and dysentery. Bark of *Xylocarpus granatum* is used to cure cholera (Banerjee, 2002).

Pneumatophores of *Bruguiera gymnorrhiza* and *B. cylindrica* are used in preparing scent. Seed paste of *Xylocarpus granatum* is used to relief breast tumor (Banerjee, 2002).

ECONOMICALLY IMPORTANT PLANTS

The mangrove forests are of paramount importance. They protect soil erosion from storms and cyclones surges from the Bay and strong tidal water current. It helps in the development of socio-economic structure of the inhabitants by providing them with timbers, tannins, thatching materials, honey, fish, crabs, prawns, etc. The fuel wood is very efficient and ignites easily making less smoke. Plants used for food, fuel and fodder are: *Boswellia serrata, Casuarina equisetifolia, Acacia nilotica, A. leucophloea, Parkinsonia aculeata, Polyalthia longifolia, Anacardium occidentale, Eucalyptus* spp. *Acacia nilotica* is also used for house building purpose. The resin and wood obtained from *Boswellia serrata* is used in making incense stick. The leaves of *Nypa fruticans* (Golpata), straw from paddy, *Porteresia coarctata* and *Myriostachya wightiana* are used as thatching material in making huts. The common plants which serve as the fuel wood are: *Avicennia* sp., *Aegialitis* sp., *Excoecaria* sp., *Lumnitzera* sp., *Dalbergia* sp., *Acanthus* sp., *Rhizophora* sp., *Sonneratia* sp., *Ceriops* sp., etc. Some of the common timber plants used for making household articles, electric poles, and boats are *Heritiera fomes, Xylocarpus granatum, Ceriops decandra* and *Excoecaria agallocha.* A considerable number of mangrove species like *Bruguiera cylindrica, B. parviflora, B. gymnorrhiza, Ceriops decandra, Rhizophora apiculata, Xylocarpus granatum, Lumnitzera racemosa,* etc. yield an important tannin which is used in fishing net, leather industries, dyeing fabrics, making inks, etc. The Sundarban Biosphere Reserve has the potential to yield about 700-1000 quintal of honey and 500-600 quintal of wax per year. It has been observed that *Acanthus ilicifolius, Aegiceras corniculatum, Ceriops decandra, Phoenix paludosa* and *Xylocarpus mekongensis* are the most preferred tree species for making honey combs by the honey bees.

RARE, ENDANGERED AND THREATENED PLANTS

Some plants found in this Tiger Reserve are recorded as rare and endangered. These are *Ceriops decandra, C. tagal, Heritiera fomes, Nypa fruticans, Rhizophora apiculata, R. mucronata, Sarcolobus carinatus, Cerbera manghas, Sonneratia griffithii, Flagellaria indica, Intsia bijuga, Kandelia candal.*

Ceriops, Exocoecaria, Lumnitzera and *Acanthus* are some threatened genera found in the Tiger reserve. Besides, some examples of threatened orchid species found in the reserve are *Acampe rigida, Dendrobium anceps, Oberonia gammiei, Trias oblonga* (Giri & Nayar, 1983).

WILD LIFE

Owing to the presence of the Tiger Reserve in an aqua-terrestrial habitat it is represented by both aquatic and terrestrial fauna. The faunal species diversity of Sunderban is very rich which is distinct by the presence of 163 species of birds, 40 species of mammals, 56 species of reptiles, 165 species of fish, 8 species of prawns, 67 species of crabs and 23 species of molluscs (Debnath, 2001). The land animals are tigers, spotted deers, barking deers, monkeys and wild boars. Fish, prawns, tortoises, crabs and crocodiles represent the aquatic fauna. Some of the plant species which act as a good fodder for deer, monkeys and wild boars are *Avicennia* species of, *Sonneratia* species of, *Excoecaria* species of, *Derris* species of, *Acanthus* species of, *Myriostachya* species

Tidal swamp Forest (Courtesy : H. S. Debnath)

of, *Porteresia* species of, etc. The Sundarban tigers adopt their preferable dens in the palm groves of *Phoenix paludosa.* The main preys of this regal tigers are spotted deer, chitals, wild boars, rhesus monkey, and barking deer.

THREAT TO THE FLORA

The importance of mangrove forests is evident as it protects the coastal zone ecosystem from several natural calamities and soil erosion. This forest also provides enormous food to the marine and freshwater fauna and the rural people. Several consumer groups of organisms have to depend on these producer groups of mangrove flora and on the halophytic vegetation. As such, these mangrove zonations are considered as the world's most productive ecosystem. Several threats to these mangroves are gradually increasing and need urgent conservation measures. These are:

1. Wood cutting and poaching of firewood has increased to meet the day-to-day need of local people.
2. Several hectares of afforested mangrove forests are converted for integrated fisheries and shrimp farm development has adverse effect on the local ecosystem.
3. Diversion of river flow and chocking of estuarine mouth cause repeated damage of these deltaic zones.
4. Population growth tends to exert heavy pressure on this ecologically fragile mangrove vegetation.

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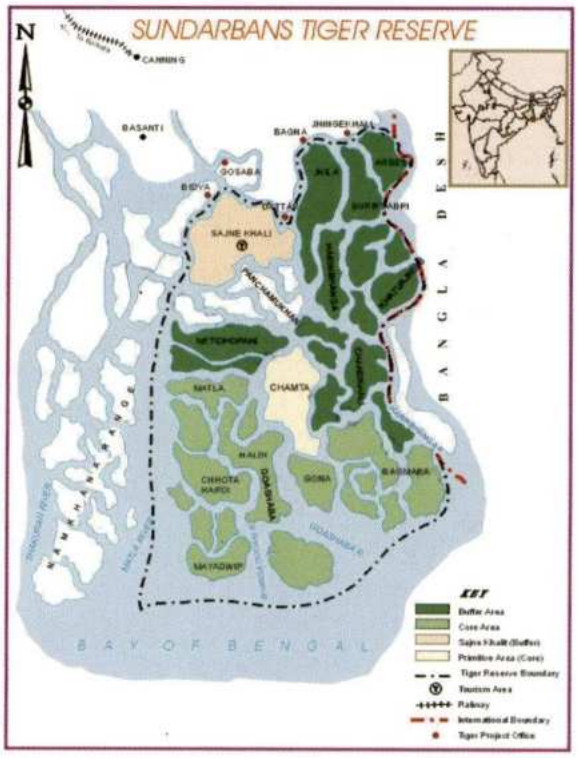
Mixed Forests (Courtesy : H. S. Debnath)



Map of Sundarban Tiger Reserve

SALIENT FEATURES

Area

Core	:	1330 sq km
Buffer	:	1255 sq km
Total	:	2585 sq km
Longitude	:	88° 37' to 89° 09'E
Latitude	:	21°30' to 22°14' N
Altitude	:	5.8 m to 6.1 m
Rainfall	:	Average annual 1920.30 mm

Temperature

Minimum	:	20° C
Maximum	:	33.88° C

Seasons

Winter	-	October to January
Summer	-	February to May
Monsoon	-	June to September

Proposal for National Waterways through Sundarban: The proposed National water ways if declared through the mangrove forests of Sundarbans particularly through the portion of Tiger Reserve will adversely affect the ecosystem destroying the flora and fauna due to large scale human activities within the protected area, dredging of streams and oil spills of numerous water crafts and vessels carrying cargo.

The entry is restricted only within buffer area. There is one tourist lodge at Sajnakhali to provide accommodation facilities for the tourists. Zilla Parishad, 24 Pgs(N) has also created accommodation facility at Hemnagar close to the Northern boundary of Sunderbans Tiger Reserve.

By Air

Dum Dum (166kms), is the nearest airport at Calcutta.

By Rail

The nearest railhead is at Canning, 48 km away. The nearest town is Gosaba, 50 km away. Sunderbans is accessible only by riverine waterways. From Calcutta there are suburban trains to Canning and buses to Namkhana, Raidighi, Sonakhali and Najat from where motor launch services are available for Sunderbans.

By Road

Means of road transport are available from Calcutta for the places like Namkhana (105 km), Sonakhali (100 km), Raidighi (76 km), Canning (64 km), and Najat (92 km), which are all near the Sunderbans and have access to the riverine waterways leading to it.

Waterways

The approximate time taken between various points is :From Namkhana - Bhagabatpur Crocodile Project (2.5 hours) Sagar Island (2.5 hours) Jambudwip (3.5 hours)From Sajnekhali-Sudhanyakhali (40 minutes) Buridabri (Tiger Project Area) (5 hours) Netidhopan (3.5 hours) Holiday Island (3 hours)From Sonakhali - Gosaba (1 hour) From Raidighi - Kalas (5 hours).

Palm swamp Forest (Courtesy : H. S. Debnath)

MAP SHOWING CIRCLES OF BOTANICAL SURVEY OF INDIA
COVERING DIFFERENT STATES
JAMMU & KASHMIR
HIMACHAL PRADESH
PUNJAB
UTTARAKHAND
HARYANA
BOTANIC GARDEN OF INDIAN REPUBLIC (BGIR), NOIDA
ARUNACHAL PRADESH
SIKKIM
NAGALAND
ASSAM
MANIPUR
MEGHALAYA
TRIPURA
MIZORAM
RAJASTHAN
UTTAR PRADESH
BIHAR
WEST BENGAL
JHARKHAND
GUJARAT
MADHYA PRADESH
CHATTISGARH
ORISSA
HEAD QUARTERS
BOTANICAL SURVEY OF INDIA
SALT LAKE CITY, KOLKATA
MAHARASHTRA
ANDHRA PRADESH
GOA
KARNATAKA
TAMIL NADU
LAKSHADEEP
KERALA
PONDICHERRY
ANDAMAN & NICOBAR ISLANDS
NORTHERN CIRCLE
DEHRADUN, UTTRAKHAND
ARID ZONE CIRCLE
JODHPUR, RAJASTHAN
WESTERN CIRCLE
PUNE, MAHARASHTRA
SOUTHERN CIRCLE
COIMBATORE, TAMIL NADU
DECCAN CIRCLE
HYDERABAD, ANDHRA PRADESH
CENTRAL NATIONAL HERBARIUM
HOWRAH, WEST BENGAL
CENTRAL CIRCLE
ALLAHABAD, UTTAR PRADESH
EASTERN CIRCLE
SHILLONG, MEGHALAYA
ARUNACHAL PRADESH CIRCLE
ITANAGAR, ARUNACHAL PRADESH
SIKKIM HIMALAYAN CIRCLE
GANGTOK, SIKKIM
ANDAMAN & NICOBAR CIRCLE
PORT BLAIR, ANDAMAN & NICOBAR ISLANDS
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