

EASTERN GHATS BIODIVERSITY

STRATEGY AND ACTION PLAN

Coordinator

Prof. T. PULLAIAH
Dean, Faculty of Life Sciences &
Head, Department of Botany
Sri Krishnadevaraya University
ANANTAPUR 515 003 AP

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Executive summary

Geographical profile

The Eastern Ghats are located between $76^{\circ} 50'$ and $86^{\circ} 30'$ E Longitudes and $11^{\circ} 30'$ and $22^{\circ} 0'$ N Latitudes. They extend in a north-east south-west strike in the Indian Peninsula covering an area of about 75,000 Sq. Km. with an average width of 220 Km in the north and 100 Km in the south. They extend over a length of 1750 Km between the rivers of Mahanadi and Vaigai along East Coast of India across the states of Orissa, Andhra Pradesh and Tamil Nadu. The Eastern Ghats do not form a continuous range because of the great rivers Mahanadi, Godavari and Krishna cut across them. In the northern section of the Eastern Ghats most of the terrain lies about 400 m with a few peaks exceeding 1100 m. People conveniently divide Eastern Ghats into 3 regions, the northern section starting in Orissa and terminating near Guntur just south of the Krishna river, the middle section extending up to the border of Tamil Nadu with Andhra Pradesh and the last section entirely located in Tamil Nadu (Legris and Mohr-Homji, 1982). The component hills of middle section of Eastern Ghats include Nallamalais, Yerramalais, Palakonda, Velikonda, Seshachalam and Kambakkam hills whose average elevation is 750 m. In the last section the Eastern Ghats run in a West-South-West direction meeting the Western Ghats in the Nilagiris. The component hills of Eastern Ghats of Tamil Nadu region are the Javadu hills, Kollimalai, Pacchamalai, the Kalrayans, Shervaroyas, Alagar hills and a group of small hillocks together called Sirumalai or Chinnamalai group of hills lying in Tiruchirapalli, Dindigul, Karur and Sivagangai districts.

The region falls under tropical monsoon climate receiving rainfall from both south-west monsoon and north-east retreating monsoon. In the northern part the rainfall ranges from 120 cm to 160 cm whereas in the central and southern parts, it is

60 cm and 100 cm respectively exhibiting semi-arid climate except in the hilly peaks. The mean temperature in January ranges between 20°C and 25°C indicating a north-south increasing trend. The maximum temperature shoots up to 41°C during hot season.

The wide and varied physiography of the Eastern Ghats encompasses in its fold equally wide array of major natural ecosystems often in their pristine beauty. Thus the varied major/minor hill ecosystems, flowing water systems, river/streams, a variety of erosive habitats (Running water ecology) in addition to placid lake/pond ecosystems all eagerly awaiting scientific explorations/studies for documenting their immense biodiversity. Further Eastern Ghats is a major source of water for drinking, for irrigation and for electricity generation. Major dams like Srisaïlam, Nagarjunasagar, Machkund, Sileru and a number of smaller dams have been constructed in this region. Hence there is every necessity to prepare a Biodiversity Strategy and Action Plan for this fragile region.

Vegetation: The vegetation in the Eastern Ghats can be divided into

(a) Evergreen forests, (b) Tropical semi-evergreen forests, (c) Tropical Moist deciduous forests, (d) Southern Tropical dry deciduous forests, (e) Northern mixed Dry Deciduous Forests (f) Dry Savannah forests, (g) Dry evergreen forest (h) Dry evergreen scrub

Species diversity:

1. Plant Diversity: Eastern Ghats are rich floristic diversity. More than 2500 species of Angiosperms occur in this region which constitute about 13% of the flowering plants of India.
2. Animal diversity: Much to the animal taxonomists' delight, quite a few systematic studies do exist, documenting among others, at least well known groups of animal phyla, especially the higher groups viz. Mammals, birds or

avifauna, the herpetofauna (or reptiles), fishes and the insect life (Entomofauna), happily enough, through organised comprehensive faunal explorations, especially during the mid-twentieth century

Proximate causes of the loss of biodiversity:

(a) **Introduction of Exotics:** Several exotics have been introduced into Eastern Ghats. Some of them are causing havoc to native biodiversity.

(b) **Habitat destruction and conversion:** Eastern Ghats are under severe environmental stress and many of the natural resources therein are not being managed on sound ecological principles to ensure sustainable yields. The forest cover in the Ghats is diminishing at a much faster rate than the replenishment.

© **Shifting (Podu) cultivation :** Nearly 27 tribal communities with a total population of 11,08,839 inhabit the Eastern Ghats of Andhra Pradesh. Vegetation of a particular area is greatly influenced by past treatment, which is highly manifested in shifting cultivated Podu areas. The most significant feature, which has affected the vegetation of Eastern Ghats, is the practice of shifting cultivation, locally known as Podu cultivation. Extensive areas of Eastern Ghats are subjected to shifting cultivation

(d) **Industrialisation:** The precarious position of the existing biodiversity calls for adoption of some drastic steps by the Government. The revenue records reveal that in earlier days even the plains around Nallamalais were full of bamboo. Rapid industrialisation and excessive exploitation of raw materials are some of the reasons for the disappearance of many plants and animals. Bamboo is being supplied to the paper mills in Rajahmundry, Bhadrachalam, Kurnool, Sirpur and a pulp factory at Devanagaram near Giddalur in Prakasam district.

(e) **Dams and Canals:** The dams at Srisailem, Nagarjuna Sagar, Sileru and Machkund have submerged considerable part of the forests. In addition to this settlements around these projects increase exploitation of forests. According to the

latest estimates regarding the digging of canals and the construction of reservoirs for the Telugu Ganga scheme, about 10,378 ha (7265 ha under the reservoir in Kurnool, Cuddapah and Nellore districts and 3113 ha under canals in the forest divisions of Atmakur, Nandyal, Proddatur, Nellore and Chittoor) of reserved forest have been cleared which may further deteriorate the verdant forests of Eastern Ghats to bring about the irreversible ecological disruption

(f) Forest Fire: Forest fire is an annual problem in Eastern Ghats. Mostly, fire is caused by humans either wilfully or accidentally. Principally wild fire destroys young seedlings and damages the quality of timber either by making hallows in the trunks or by charring the same. The rich humus is burnt and wasted. The permeability of the soil is also affected resulting in loss of fertility, soil erosion and siltation of water reservoirs.

(g) Cattle: Biotic interference has had a marked effect on the vegetation of Eastern Ghats leading to extinction of rare and valuable plants and animals. In Eastern Ghats herds of cattle, goats and sheep moving from place to place is a common sight. These animals come from the peripheral villages.

(h) Unscientific Extraction of Non-Timber Forest Produce: Tribals like Chenchus, Konda Reddis, Yanadis extract gum and resin by making incisions on trees like *Sterculia urens* (Gum Karaya), *Anogeissus latifolia* (Velama), *Givotia rottleriformis* (Poliki) and *Lannea coramandeliana*. Unscientific and reckless tapping weakens the trees and causes their premature death. This has led to the extermination of *Sterculia urens*, a typical gum yielding plant, in several areas in Eastern Ghats.

(i) Mining: Mining in Eastern Ghats is one of the main cause for the loss of Biodiversity. Limestone is quarried extensively in Yerramalais, which led to the destruction of forests. Bauxite is being mined in the Northern Eastern Ghats in vast stretches which is also leading to the extermination of valuable species. Coal mining

Khammam district has resulted in clearance of vast stretches of deciduous forests. Other mining activities responsible for loss of biodiversity include phosphate mining, granite.

In the past careless mining operations have brought devastation in the entire environment of the Eastern Ghats, destroying the highly valuable flora and fauna.

(j) **Monoculture:** The Plantation programme by forest departments in Eastern Ghats are specifically of the monoculture type which have not had much success and made biological invasions into species composition and structures.

(k) **Killing of animals:** The onslaught of killing of different species of fauna like several snakes (King Cobra, Python), bison etc. has posed a serious threat to their very survival.

ONGOING BIODIVERSITY RELATED INITIATIVES (including assesment of their efficacy)

- (i) **Governmental :** Much of the biodiversity in the Eastern Ghats owe their continued survival to the system of Protected Areas. .
 - (a) Andhra Pradesh Tribal Development Project:
 - (b) Andhra Pradesh Forestry Projects
 - (c) Medicinal Plants Conservation Area (MPCA) involving Tamilnadu and Andhra Pradesh Forest Department.
- (ii) **NGO's**
 - (a) M.S. Swaminathan Research Foundation, Chennai
 - (b) Save the Eastern Ghats Organisation (SEGO) Chengam Taluk & Javadi Hills) - involved in work to traditional paddy varieties.
 - (c) Green Foundation (Thalli block, Dharmapuri District) – Conservation of Finger and other millets.
 - (d) IRDT (Dharmapuri District) - crops
 - (e) Low External Input Sustainable Agriculture (LEISA)
 - (d) Conventional Centre for Development (CCD) (Ramnad, Madurai and Virudhunagar) - Medicinal plants

- (e) Medicinal Plants Conservation Areas by FRLHT.

**REQUIRED ACTIONS TO FILL GAPS, AND TO ENHANCE/ STRENGTHEN
ONGOING MEASURES**

- (i) **Actions to conserve and sustainably use (where relevant) natural ecosystems and wild plant and animal diversity**

- (a) Sensitization of governmental agencies, NGOs and Panchayats on biodiversity issues is an urgent need.

Action: Government, NGOs, Educational Institutions.

- (b) Special area programmes for Eastern Ghats to be initiated. Action: DRDA

- (c) Land use planning through micro and macro watershed programme, and the role of women in collecting firewood and other NTFP must be highlighted, a data base may be developed.

Action: Government departments and others.

- (d) Enabling the local communities to document region's flora and fauna and publish the same in local language and dissemination of information to the local communities.

Action: University faculty, BSI, ZSI and National Research Institutions.

- (e) Study of the population status of all threatened plant and animal species (including medicinal plants) of the region.

Action: University faculty, ZSI, BSI, FRLHT.

- (f) Mapping of natural ecosystems to identify the zones of biotic interference through remote sensing for the immediate protection and conservation of species in the region. Action: Government departments and Universities.

- (g) Strengthening and promoting the Peoples Bio-diversity registers programme.

Action: Deccan Development Society, CWS, Local community and NGO networks and University faculty.

- (h) Conducting awareness campaigns in the rural and urban areas regarding the environmental conservation, ranging from protection of species to proper disposal of solid waste.

Action: NGO networks, State Environmental organizations and Universities.

- (j) Listen to local communities on approaches to sustainable collection of forest products, and converting this learning into training materials for the governmental, non governmental and local communities, especially, gum yielding plants and medicinal herbs.

Action: NGO networks, forest department and scientists.

- (i) **Actions to conserve and sustainably use agro-ecosystems and domesticated plant and animal diversity:**

- (a) Establishment of seed banks and networking for exchange of traditional knowledge regarding varieties of crops and breeds of Eastern Ghats.

Action: ICAR, IARI, NBPGR, NBAGR, NBFGR lead by local communities.

- (iii) **Actions to conserve and sustainably micro-organisms:**

To Safeguard the microbial diversity of Eastern Ghats, establish a Microbial Type Culture Collection Centre in the southern part of the country, possibly at Tirupati to identify, conserve, utilize and claim rights over the microbial resources of Eastern Ghats.

- (iv) **Actions to achieve equitable decision- making, people's (including women's) empowerment and participation, equitable sharing of benefits, cross-sectoral integration, policy and legal changes, financial measures and other such steps.**

- (a) Strategy: Development of Biodiversity as a discipline with a holistic approach encompassing social, scientific, cultural and ethical approaches

Action Plan: Designing curriculum on biodiversity at all levels in educational institutions .

Actors: Universities, State level School Boards in collaboration with local grassroot CBOs and NGOs

Net working with educational institution including school, colleges, universities by mobilising students.

- (b) Strategy: Establish the linkages between biodiversity and local people's livelihoods both in negative and positive aspects. Shift from mere protection approach to management of biodiversity with local control over biological resources.

Action plan: Documentation and analysis of the linkages between biodiversity and local people's way of life.

Actors: Anthropologists, archaeologists, NGOs in collaboration with local CBOs

Action plan: Capacity building at local community level to understand and take control over biodiversity resources for effective management.

Actors: NGOs, CBOs, Funding agencies, Government Administrators.

- (c) Strategy: Instead of sectoral approach policies should be in harmony with other policy objectives at wider level.

Action Plan: MOEF should have an integrated approach in designing, implementation and coordination of various policies and objectives with a priority for bio-diversity.

- (d) Action Plan: Interlinking Forest development policies and Biodiversity conservation Policies.

Actors: Different divisions in MOEF in collaboration with local CBOs and NGOs.

- (e) Strategy: Thrust should be given to development planning comprising the regeneration of Biological resources and sustainable utilization of the same.

Action plan: Biodiversity friendly development models at micor-levels have to be documented and action plans have to be prepared

- (f) Action plan: Strengthening the regulatory mechanism to control the industrial pollution affecting biodiversity.

- (g) Media strategy should be evolved at all levels with appropriate medium.

Action Plan: Revival of local cultures and festivals to disseminate the message in local languages.

- (h) Biodiversity parks should be developed at Mandal/Taluk level exhibiting locally endangered plants and animals.
- (i) Biodiversity related products and local markets controlled by local people should be established. Promotion of biodiversity friendly products have to be prioritised.
- (j) Fishing activities by huge technology based fishing companies should be banned and only traditional fishing activities have to be permitted to conserve aqua biodiversity throughout the coastal areas and inland lakes and canals.
- (k) Inter-eco-regional networking and sharing of experiences has to be facilitated.

1. INTRODUCTION

i. Brief background of the SAP

India is one of the very few mega-biodiversity countries of the world. It harbours an enormous diversity of plants, animals and microbes, both domesticated and wild and impressive array of genes species and ecosystems. This biodiversity sustains at present the food, medicinal, clothing, shelter, spiritual, recreational, moral and other needs of Indian people. It also has the potential for all future needs. India's biodiversity is now very seriously threatened due to human-induced changes and has to be conserved and protected at whatever cost. Thus, there is an urgent need to formulate strategies and action plans at all levels involving the entire cross-section of the people of various categories to assess, document, protect, conserve and sustainably use our biodiversity and equitably share the benefits arising from such sustainable use.

In 1999, Government of India, Ministry of Environment and Forests prepared a National Policy and Macrolevel Action Strategy on Biodiversity through a consultative process. It was however felt necessary to prepare detailed action plans at substate, state, regional and national levels based on this framework document.

The NBSAP project envisages the assessment and stocktaking of biodiversity-related information at various levels, including distribution of endemic and endangered species and site-specific threats and pressures. Key features of this project include an emphasis on gender sensitive decentralised planning, and the use of interdisciplinary working groups to involve all sections concerned with biodiversity conservation. These detailed action plans (at sub-state, state and regional levels) will be consolidated and a national level action plan will be developed.

It was proposed to prepare the NBSAP through a process of widespread consultation and participation across India.

The wide and varied physiography of the Eastern Ghats encompasses in its fold equally wide array of major natural ecosystems often in their pristine beauty. Thus the varied major/minor hill ecosystems, flowing water systems, river/streams, a variety of erosive habitats (Running water ecology) in addition to placid lake/pond ecosystems all eagerly awaiting scientific explorations/studies for documenting their immense biodiversity. Further Eastern Ghats is a major source of water for drinking, for irrigation and for electricity generation. Major dams like Srisaïlam, Nagarjunasagar, Machkund, Sileru and a number smaller dams have been constructed in this region. Hence there is every necessity to prepare a Biodiversity Strategy and Action Plan for this fragile region.

ii. Scope of SAP

National Biodiversity Strategy and Action Plan (NBSAP) process is one of the largest environmental planning exercises being carried out in the world and certainly the largest ever in India. The scope of SAP includes the entire spectrum of biodiversity, including both wild and domesticated plants, animals and microbes at all the three conventionally recognized levels of biodiversity: Genes, Species and Ecosystems (both wild and agro-ecosystems).

iii. Objectives of SAP:

- ❖ Conservation of Biodiversity of all kinds.
- ❖ Sustainable use of biological resources, implying their use in such a manner as will not imperil their long – term existence or will not in other ways threaten biodiversity.

- ❖ Social, economic, ethical, cultural, scientific and economic dimension, including gender relations and equity.

(Source: National Biodiversity Strategy and Action Plan: A call for participation).

iv. Contents of the SAP:

The Strategy and Action Plan consists of:

1. A detailed profile of the Eastern Ghats Ecoregion, including, origin, history, Physiography, biodiversity and human ecology.
2. Factors responsible for loss of biodiversity
3. An outline of various recommendations made for the conservation and sustainable use of biodiversity/biological resources.
4. A specific Action Plan for the Ecoregion.
5. An outline of the process involved

v. Brief description of the methodology used in preparation of SAP.

- ❖ Review of Literature.
- ❖ Brainstorming sessions and workshops, with scientists, non governmental agencies, forest departmental officials, governmental agencies, industrialists.
- ❖ Preparation of Draft Action Plan and circulate the same for inputs and comments.
- ❖ Interviews and discussions with individual scientists and others with knowledge of Eastern Ghats.

2. PROFILE OF THE EASTERN GHATS ECOREGION

i. Geographical profile

The Eastern Ghats are located between 76° 50' and 86° 30' E Longitudes and 11° 30' and 22° 0' N Latitudes. They extend in a north-east south-west strike in the Indian Peninsula covering an area of about 75,000 Sq. Km. with an average width of 220 Km in the north and 100 Km in the south. They extend over a length of 1750 Km

between the rivers of Mahanadi and Vaigai along East Coast of India across the states of Orissa, Andhra Pradesh and Tamilnadu. The Mahanadi basin marks the northern boundary of the Eastern Ghats while the southern boundary is the Nilagiri hills. To the west lie the tips of Bastar, Telangana and Karnataka plateaus and Tamil Nadu uplands. The coastal area in the east limits its eastern part.

The Eastern Ghats do not form a continuous range because of the great rivers Mahanadi, Godavari and Krishna cut across them. In the northern section of the Eastern Ghats most of the terrain lies about 400 m with a few peaks exceeding 1100 m. The geographers consider the Simlipal massif lying to the North West of the Khondmal hills in the Phulbani district of Orissa as the starting point of Eastern Ghats. People conveniently divide Eastern Ghats into 3 regions, the northern section starting in Orissa and terminating near Guntur just south of the Krishna river, the middle section extending up to the border of Tamil Nadu with Andhra Pradesh and the last section entirely located in Tamil Nadu (Legris and Mohr-Homji, 1982). The component hills of middle section of Eastern Ghats include Nallamalais, Yerramalais, Palakonda, Velikonda, Seshachalam and Kambakkam hills whose average elevation is 750 m. In the last section the Eastern Ghats run in a West-South-West direction meeting the Western Ghats in the Nilagiris. The component hills of Eastern Ghats of Tamil Nadu region are the Javadu hills, Kollimalai, Pacchamalai, the Kalrayans, Shervaroys, Alagar hills and a group of small hillocks together called Sirumalai or Chinnamalai group of hills lying in Tiruchirapalli, Dindigul, Karur and Sivagangai districts.

The region falls under tropical monsoon climate receiving rainfall from both south-west monsoon and north-east retreating monsoon. In the northern part the rainfall ranges from 120 cm to 160 cm whereas in the central and southern parts, it is

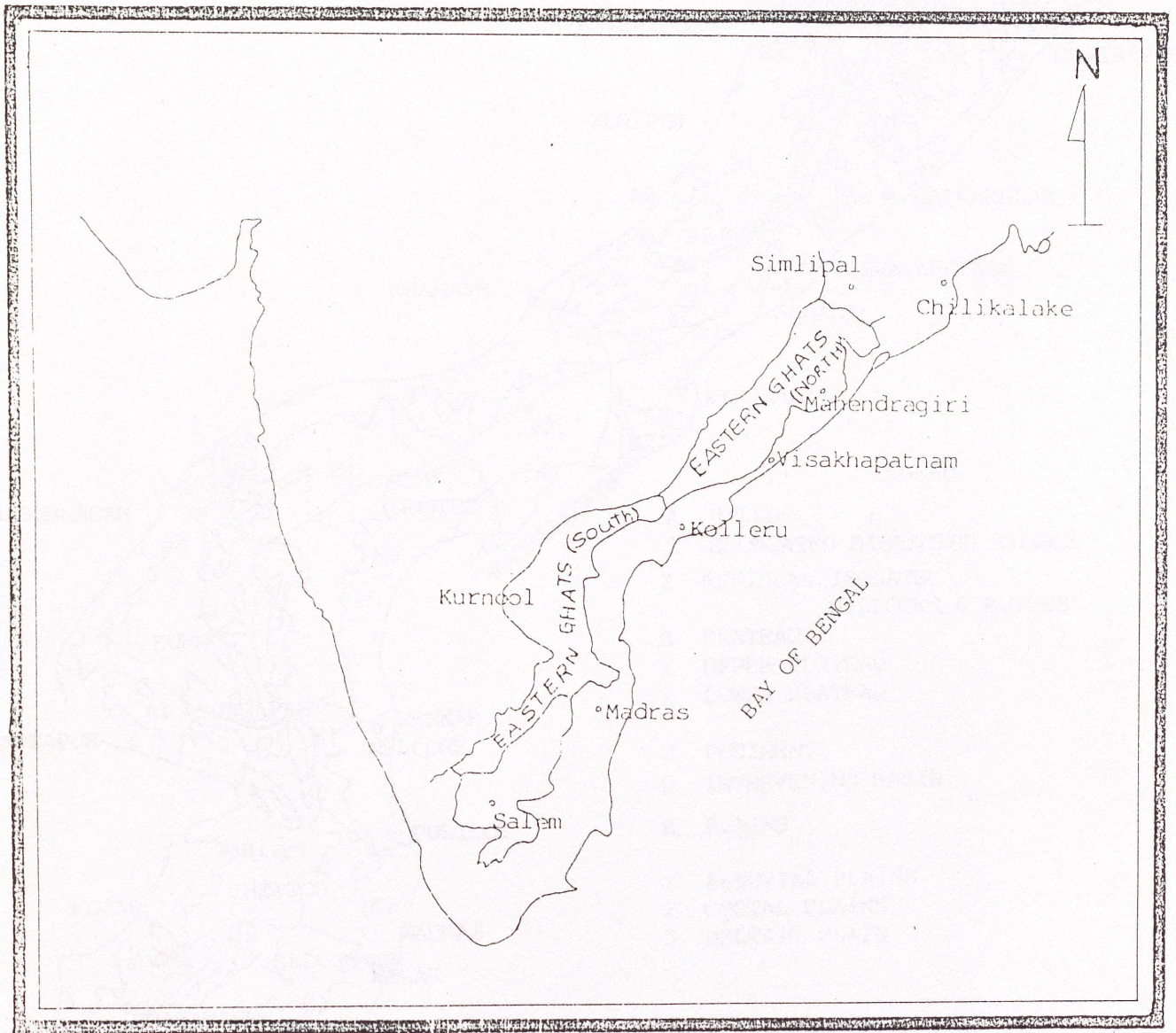


Fig. 1: Location map of Eastern Ghats in India.

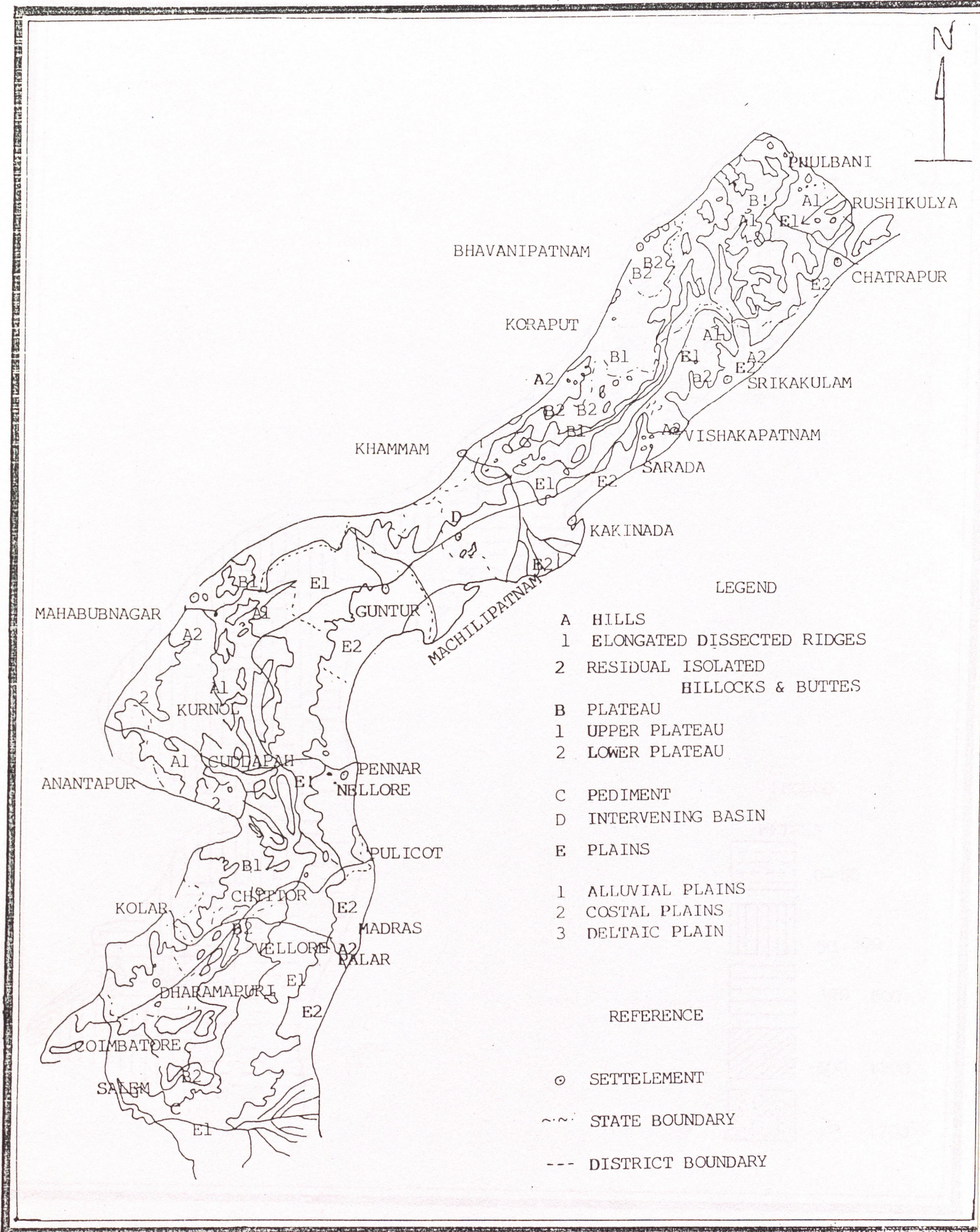


Fig. 2: Eastern Ghats, Hills, Plateaus and Plains.

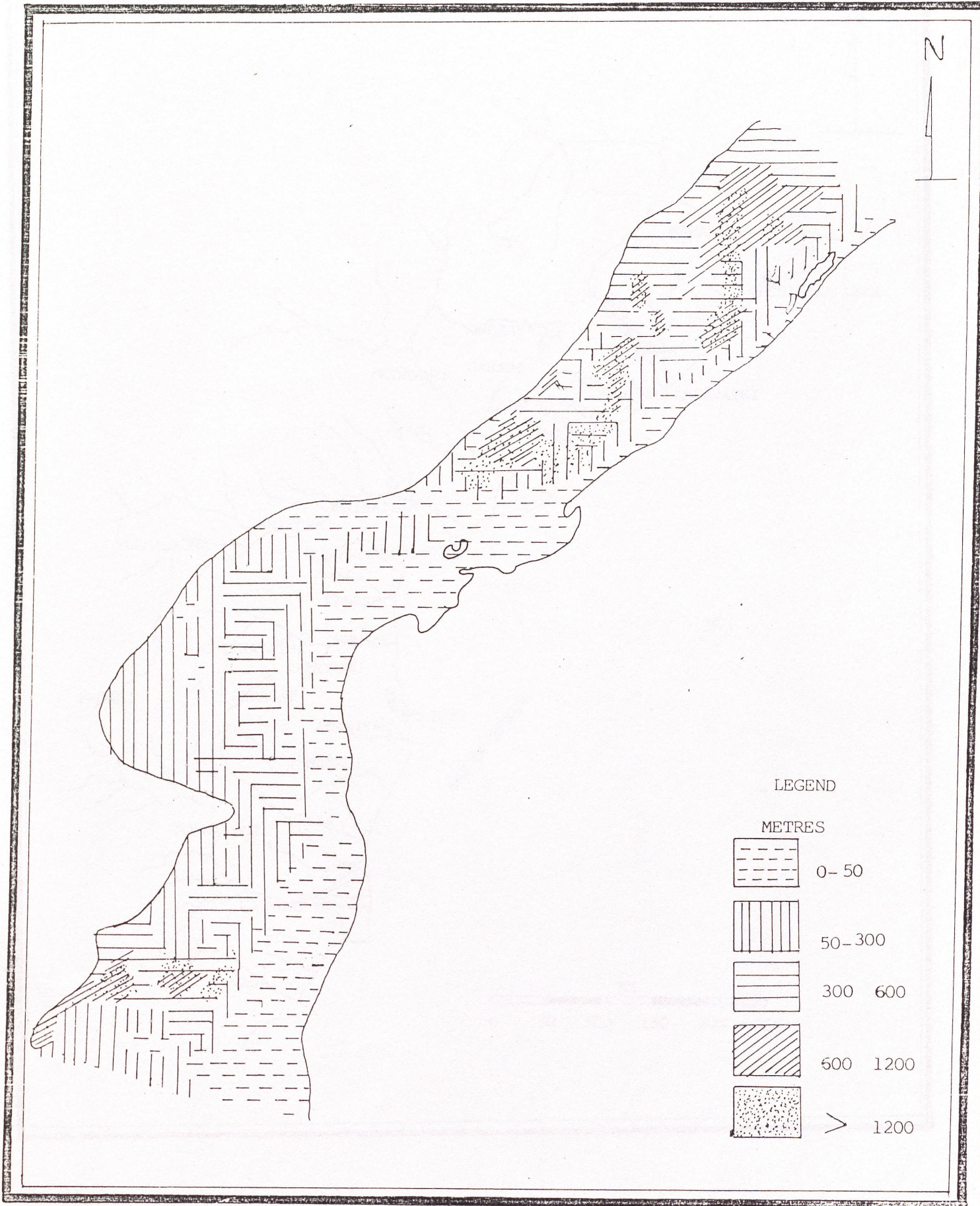


Fig. 3: Eastern Ghats elevation.

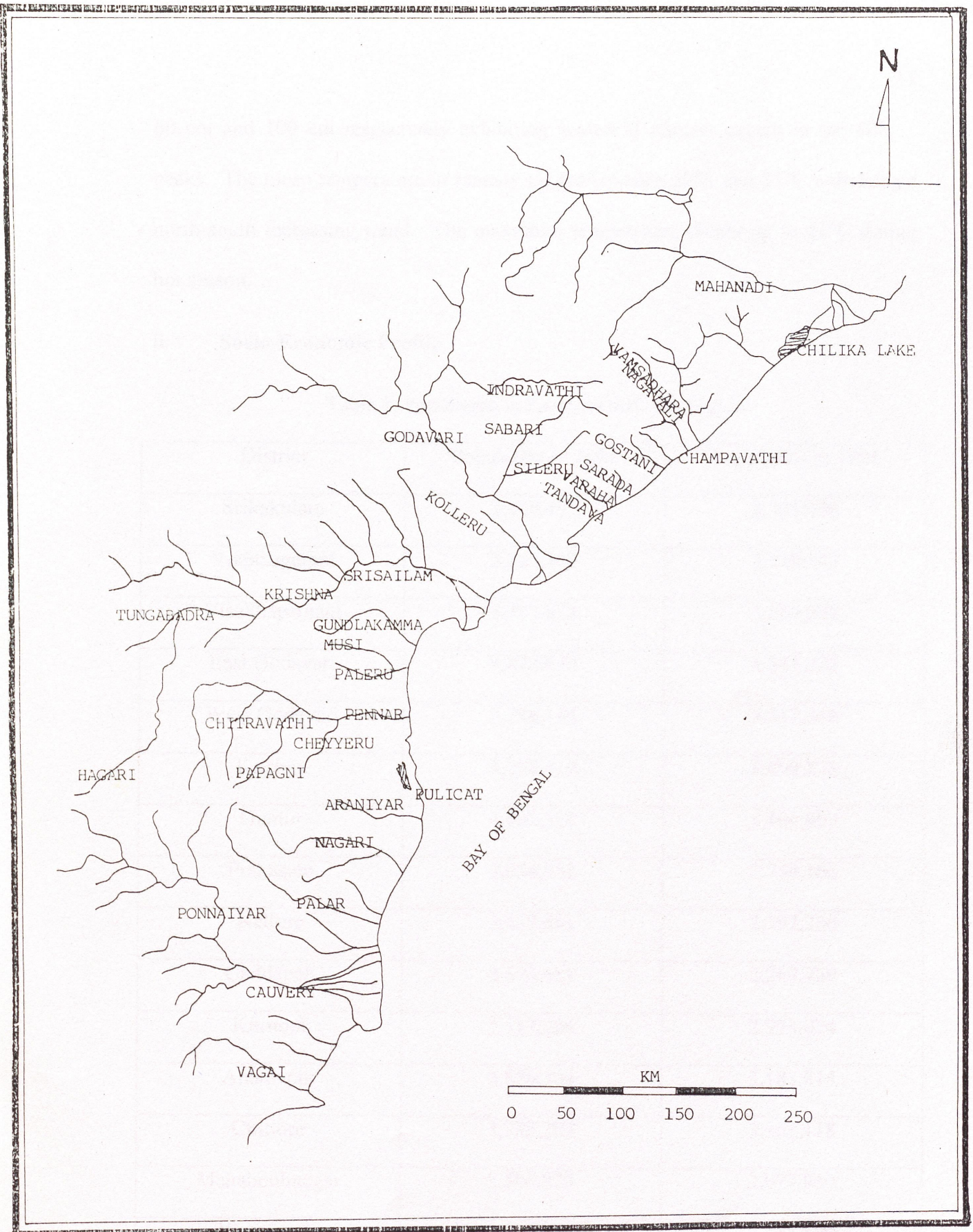


Fig. 4: Eastern Ghats rivers.

60 cm and 100 cm respectively exhibiting semi-arid climate except in the hilly peaks. The mean temperature in January ranges between 20°C and 25°C indicating a north-south increasing trend. The maximum temperature shoots up to 41°C during hot season.

ii. **Socio-Economic Profile**

Table 1: Population in Eastern Ghats Ecoregion

District	Population in 2001	Population in 1991
Srikakulam	2,528,491	2,321,126
Vizianagaram	2,245,103	2,110,943
Visakhapatnam	3,789,823	3,285,092
East Godavari	4,872,622	4,541,222
West Godavari	3,796,144	3,517,568
Krishna	4,218,416	3,698,833
Guntur	4,405,521	4,106,999
Prakasam	3,054,941	2,759,166
Nellore	2,659,661	2,392,260
Cuddapah	2,573,481	2,267,769
Kurnool	3,512,266	2,973,024
Anantapur	3,639,304	3,183,814
Chittoor	3,735,202	3,261,118
Mahaboobnagar	3,506,876	3,077,050
Khammam	2,565,412	2,215,809

Tribals of Eastern Ghats in Orissa

Among the States of Indian Union, Orissa has got second highest percentage of tribal population (23%). Most of them live in Eastern Ghats. There are 62 different tribes in Orissa, most of them live in Eastern Ghats. These tribes of Eastern Ghats in Orissa include Khonds (Kandho), Gond, Santal, Soara, Kolha, Shabar, Munda, Paroja, Bhotada, Bhunya (Bhuiyan), Kissan, Oraon, Bhumiya, Bhathudi, Kharia, Binjhal, Koya, Kol, Saunti, Gadabas, Mirdhas and Juang. These tribals have their own culture, customs, religious rites, taboos, legends, food-habitats and a rich knowledge in traditional herbal medicine.

Tribals of Andhra Pradesh Eastern Ghats

About 27 tribal communities are confined to the isolated hills and adjacent plains of Eastern Ghats in Andhra Pradesh. The major groups among them are Bagatas, Chenchus, Jatapus, Khonds (Samantas), Konda doras, Konda Kammaras, Konda Reddis, Koyas, Lambadis (Sugalis), Nuka doras (Muka doras), Porjas (Gadabas), Savaras and Valmiki with a total population of 1,412,450 (according to 1981 Census). Tribe-wise and district-wise population of the study area based on 1981 Census are given in Table 2 and 3.

TABLE 2

Tribe wise population in Eastern Ghats of Andhra Pradesh

(1981 Census)

Name of the tribe	Population
Bagatas	89567
Chenchus	29297
Jatapus	86762
Khonds	50726
Konda doras	142374
Konda Kammaras	36295
Konda reddis	54473
Koyas	362341
Lambadis	405187
Nuka doras	17948
Porjas	16374
Savaras	81121
Valmikis	40985
Total	1412450

TABLE 3

District-wise tribal population

(1991 Census)

District	Tribal Population
Srikakulam	134,067
Vizianagaram	190,185
Visakhapatnam	468,886
East Godavari	176,083
West Godavari	84,648
Krishna	91,767
Guntur	181,588
Prakasam	98,854
Nellore	214,062
Chittoor	104,938
Cuddapah	47,414
Kurnool	56,455
Mahaboobnagar	227,405
Khammam	558,958

All the above tribes are aboriginals except Lambadis (Sugalis).

Lambadi's have migrated from North-West to Southern India and settled in Khammam, Kurnool and Prakasam districts.

In the upper Godavari region the tribes commonly found are Bagatas, Jatapus, Konds, Konda doras, Konda Kammaras, Nuka doras, Porjas and Savaras. The Godavari valley is inhabited mainly by Konda Reddis and Koyas. In Nallamalai region Chenchus are the oldest inhabitants.

The vegetation has much influence on the tribal life. Some of the villages are named after local plants, such as Maddhiveedu (house of *Terminalias*), Dora mamidi (Half-ripened mango), Chintha moggu (Juice of Tamarind), Bodda revulu (place of *Ficus racemosa*) and Aratimaku loddhi (place of *Musa*).

The status of woman in the society is quite high in many respects, as she is responsible for the quest for food, maintaining the off-spring etc. The division of the labour is not clear-cut, with both men and women equally participating in collection of forest produce and in agricultural activities.

Most of the communities have traditional tribal council which play an important role in the social and religious life. The head man as well as the priest controls the social behaviour of the community and also the religious ceremonies.

Language among these tribals is traditionally passed on without a written document.

The main occupation of these tribes is agriculture. All except Chenchus and Lambadas practice Podu cultivation (shifting cultivation) on the hill slopes; plough cultivation in plains is done by all. Podu cultivation is done in an area initially for 3-5 years and shift the area, leaving the already cultivated land depleted of nutrients to

rejuvenate itself. They return to the same old place after a lapse of 3-5 years or more. The practice keeps most of the unused virgin forest areas in tact.

Fishing is a leisure-time occupation and the tribes still use the age-old methods. Each tribe carries with him a bow and arrows and a knife ever since his child-hood, not only for hunting but also for self-protection. Hunting is a seasonal practice and they mostly do it during summer, after celebrating the festival.

The tribes rear pigs, cows, goats, fowls etc., which play an important role on their economy. They make baskets, leaf plates, granaries, mats, brooms, ropes, etc., for their domestic use and also to be sold in market.

Tribals of Tamil Nadu Eastern Ghats:

The native tribal people of Shevaroy's are called Malayalis. As per 1981 Census, the tribal population was 32,746. They are living in nearly 100 conically shaped huts, scattered in various parts of the plateau. The ethnic group of Pacchamalais is also called Malayalis and their mother tongue is Tamil. As per 1991 Census calculation nearly 10,006 tribals are living in this area. Of these, in Tenparanadu revenue village 3024 tribals are living in 998 families, in Vayanadu revenue village 4041 tribals are living in 946 families, in Kombai revenue village 1820 tribals are living in 427 families; in Thalugai 336 tribals are living in 67 families, in Sobanapuram revenue village 292 tribals are living in 56 families, in Sookalampalli revenue village 493 tribals are living in 90 families. Most of them are labourers. The tribal people of Sirumalai group of hills are either Malayalis or Paliars. In Sirumalai alone there are ten tribal villages depending mainly on working as labourers or in collecting minor forest produce like gall nut, Indian Goseberry, Phoenix leaves, mango fruits and bothai grass.

Socio-economic problems

It has become difficult now for tribal people to lead their traditional life due to drastic cultural changes, as a result of widened tourism (including religious tourism), better transportation means, construction of Hydroelectric projects and rail and road networks.

During the lean season of the year the tribals work for daily wages either with the neighbouring agricultural communities or with forest department/contractors. They are in general, poorly paid for their work. They sell their agricultural and forest produces for a very low price to the traders/State Government agencies and also weekly markets (Shandies). They are exploited by the traders and money lenders.

It is an accepted fact that festivals, marriages and religious ceremonies play an important role in the socio-economic life of the tribals. The intoxicants like toddy and country liquors are limitlessly used during these occasions. The tribal economy is also not able to meet even their socio-cultural needs. Therefore they are compelled to approach money lenders.

iii. Political profile

All the hill ranges of Eastern Ghats are under the control of Forest Departments of States of Orissa, Andhra Pradesh and Tamil Nadu. A major area of all the hill ranges are protected under Reserve Forests. Excepting Yercaud which is a Town Municipality all the hills have only scattered villages with a few hamlets here and there. All these are administered by village panchayats. The Biodiversity present in the Reserve Forests is protected by the Wild Life Protection Act by the Government of India as well as by the States' Forest Laws. The wild life is protected outside forest areas by peoples participation like JFM groups, Peoples committes and NGO activities.

iv. **Ecological profile**

Vegetation: The vegetation in the Eastern Ghats can be divided into

(a) Evergreen forests:

This type of vegetation is seen only in very few valleys in Shevaroy hills.

(b) Tropical semi-evergreen forests:

These forests are found in moist valleys and on hills of about 800 m. The Simlipal forests of Mayurbhanj district, Atai, Mahendragiri and Banguri forests of Keonjhar districts, parts of Puri, Ganjam and Koraput districts; Sapparla, Dhara Konda, Galikonda, Thanjavanam, Minumuluru, some areas near Anantagiri in Visakhapatnam district, Nulakamaddi and Maredumilli in East Godavari district show tropical semi-evergreen forests.

(c) Tropical Moist deciduous forests:

Northern tropical moist deciduous forests are found in parts of the districts of Bastar, Kalahandi, Phulbani, Ganjam, Koraput and Srikakulam districts. Southern Tropical deciduous forests are prevalent in parts of Guden-Rampa agency tracts of Visakhapatnam and East Godavari districts, Gundlabrahmeswaram in Kurnool district, Thalakona forests in Chittoor district, parts of Tamil Nadu and Biligirirangaen hills.

(d) Southern Tropical dry deciduous forests:

These forests are widely distributed in Orissa, Andhra Pradesh and Tamil Nadu. Sal occurs in some forests of Srikakulam and north of it, whereas teak occurs in some of the southern forests.

(e) Northern mixed Dry Deciduous Forests:

These forests are prevalent in Sukinda Rebna-Keonjargarh area, Nigirda-Lulung area in Mayurbhanj district, parts of angul division, Kalahandi, Ganjam and Koraput districts and hills of Bastar.

(f) Dry Savannah forests:

These forests are seen on the peripheries of all forests.

(g) Dry evergreen forest:

This type of forest is seen in south Cuddapah and Mamandur valley in Chittoor district.

(h) Dry evergreen scrub:

Found in Sondapet division and Madhurantakam in Tamil Nadu.

Species diversity

Eastern Ghats are rich in floral diversity. More than 2500 species of Angiosperms occur in this region which constitute about 13% of the flowering plants of India. Ellis (1987-90) made several intensive collections from Nallamalais and enumerated 843 species under 419 genera belonging 109 families. Ranjitakaani (1998) who made a floristic survey of Kolli hills in Salem district reported 854 species of Angiosperms, 57 pteridophytes and 5 Gymnosperms. Senthil Kumar and Krishnamurthy (1993) extensively surveyed the flora of Shevaroy hills and reported 1184 species of flowering plants under 674 genera belonging 150 families. Professor T. Pullaiah of Sri Krishnadevaraya University is working on Flora of Eastern Ghats. They reported 328 species legumes (Pullaiah and Sriramamurthy, 2001), 69 species of Convolvulaceae, 14 species Boraginaceae, 16 species of Cordiaceae and 34 species of Solanaceae (Venkatappa *et al.*, 1998, Venkatappa, 1998). Saxena and Brahmam (1994) gave detailed account of Flora of Orissa, while Pullaiah *et al.* (1997) gave an account of Flora of Andhra Pradesh and Nair and Henry (1983) gave flora of Tamil Nadu. These three floras cover most of Eastern Ghats.

Animal diversity

Much to the animal taxonomists delight, quite a few systematic studies do exist, documenting among others, at least well known groups of animal phylas, especially the higher groups viz. Mammals, birds or avifauna, the herpetofauna (or

reptiles), fishes and the insect life (Entomofauna), happily enough, through organised comprehensive faunal explorations, especially during the mid-twentieth century. Notable among these are the pioneering studies of Whislerr & Kinnear (1930 to 1937) (The Vernay Scientific Survey of the Eastern Ghats, 1930-1937), Mani (1986) (Eastern Ghats Insects, ZSI, Chennai), Mishra (1930) (Fishes of Eastern Ghats) and Pillai and Murthy (1983) (Herpetofauna).

On the institutional scale, the Zoological Survey of India (ZSI), Calcutta and The Bombay Natural History Society (BNHS), Bombay have played lead roles in exploration/documentation of the faunal diversity, including wild life, in all its existing array of life forms. The recent State Fauna Series on Orissa and Andhra Pradesh on few well studied animal phylas serve as the state of art report on occurrence, distribution and habitat of some well worked out-groups. (ZSI State Fauna Series – Fauna of Orissa and Andhra Pradesh (1993). The ENVIS Centre, of the Union Ministry of Environment & Forests (MOEF), at the EPTRI, Hyderabad 500032 has also played key role in bringing together, on a single platform, research institutes/academic bodies and other NGOs for deliberation and evolving Action Plan for future strategy.

Of no less significant importance have been endeavors by individuals/group of workers to document common, but lesser known forms of animal life viz. The entomofauna, again in all its array of varied life form viz – butterflies (Best, 1954; Khatri, 1986 a,b,c, Kartikeyan 1991, 1992, 1994; Smith 1977 & others), Odonates (Kumar & Khatri, 1985), Dipters (Joseph & Parui, 1999), general entomofauna (Lakshminarayana and Sai Kumar, 1998). The higher forms of animal wild life in the region, especially the National Parks, have been extensively treated (Nagulu et al., 1998).

The biodiversity at the ecosystem levels, especially with respect to freshwater wetlands, too needs attention and calls for efforts to consolidate gains already made by Andhra University, Waltair, and ZSI, FBS Hyderabad on some select wetland ecosystems.

Hopefully, if approved and executed/ implemented in its entirety, the proposed strategy for encompassing the whole gamut of faunal diversity in Eastern Ghats, will lay a road map for all future endeavors in the area.

Finally a cursory review of various systematic institutional, team and individual Efforts have yielded an impressive tally of faunal diversity and endemism of fauna the Eastern Ghats have been home too (Table 4).

Table 4. A general complexion of faunal diversity in major animal groups in Eastern Ghats

Group	No. of species	Remarks
Mammals	81 spp.	5-6 spp, highly endemic, most with Threatened status, following habitat Destruction/loss
Birds	363 spp.	Quite a few endemic/restricted form, A few species highly threatened
Reptiles	59 spp.	3 spp. of lizards, 26 spp. of snakes Golden Gecko sighted >115 years. Threatened status.
Amphibians	14 spp	One rare sp. of toad endemic, one Anuran, <i>Philautus (Phaco phoridae)</i> , new to science
Entomofauna	ca 4000 spp.	80-90 spp. of butterflies (Lepidoptera) 15-20 Odonates, ca 13 spp. Gryllidaes (Orthoptera), 191 spp. of Heteroptera, 36 spp. of Hemiptera, 32 spp. of Diptera (Asilidae), 11 new spp. of Robber flies and one new record from India
Wetland Fauna		
Malacofauna	5-6 spp,	No comprehensive studies exist
Zooplankton Rotifers	Ca 30 spp;	documenting wetland faunal diversity especially at ecosystem level
Cladocera	15 spp	
Copepoda	16-20 spp;	
Annelids	6 spp;	
Hirndinea	3 spp etc.	

Insect life

The insect life of the Eastern Ghats is essentially an integral part of the Peninsular fauna, but characterized by certain peculiarities, correlated entirely with wide differences brought about by human impact. These factors have contributed to certain amount of geographical and climate isolation, through large scale destruction of natural habitats by man and consequent floral-faunal impoverishment, discontinuity, localization and other significant changes in the composition and distributional pattern of species. A general outline of some of the salient features of the insect life of the Eastern Ghats is, however, presented here.

Over four thousand species of insects may be said to have been reported so far from Eastern Ghats, representing without doubt only a small fraction of those that actually exist there. Curiously enough, many groups, which occur abundantly, do not appear to have been collected by earlier workers and even others, which have been studied, were largely cursorily dealt with and the data is also sketchy and greatly scattered. Future explorations are bound to greatly increase the total number of species found in the region.

Broadly speaking, three major groups may be recognized among the Eastern Ghats Insects. (i) A large number of species, widely distributed in India, and often also in Burma and Sri Lanka, occur commonly in different parts of the Eastern Ghats. (ii) A second group comprises species found both in the Western Ghats, and Eastern Ghats, and indeed represent Peninsular distribution. (iii) Lastly we have a small group of species, which are apparently restricted to the Eastern Ghats and represent either mostly localized and discontinuous geographical relicts or to a very small extent true endemic, even if not strictly autochthonous, forms. Besides, a very small number of subspecies seems to have differentiated on some of the hills and often with a series of

transitional forms. Recent studies under the Eastern Ghats Insects Survey Project have brought to light many species not known earlier to occur in the region.

Herpetofauna

An assessment of the Herpetofauna indicates that there are about 15 amphibian species belonging to 7 genera and 5 families while the Reptilion fauna comprises 55 species belonging to 39 genera 14 families. Some rare/endangered species like the Golden Hill Gecko, the Indian monitor, the python, the solitary species of uropeltid snake and king cobra are available in this area, not to mention the burrowing limbless shink, *Barkudia insularis*.

Rana tigerina, *R. hexadactyla*, *R. hmnocharis* and *R. crassa* are some of the common amphibians. *Bufo hololius* was recently collected from Nagarjunasagar. Golden gecko *Calodactylodes aureus* was recently discovered from Chittoor area (Daniel and Bharat Bhushan, 1986). Other reptiles such as *Hemidactylus brooki*, *H. giganteus*, *Mabuya carinata*, *Calotes versicolor*, *Veranus bengalensis* are common. Among the snakes Cobra, King cobra, Russell's viper, Green pit viger, Python, Rat snake, Whip snake, keel back and Krait are common.

Birds

The Eastern Ghats are very rich in avifauna. However very few systematic surveys have been held compared to the active fieldwork in other parts of the country. The ornithological surveys carried out by several experts helped to list over 295 species of birds belonging to about 178 genera in 54 families. The avifauna of Eastern Ghats includes the great Indian bustard, Jerdon's courser, lesser florican, grey pelican, several species of water fowl, waders, ducks and teals, raptors, flycatchers, warblers, babblers, game birds, woodpeckers etc. (Whistler and Kinnear, 1930-37). Krishna Raju (1985) listed 300 bird species from Visakhapatnam region.

Jerdon's courser (*Cursoris bitorquatus*) long considered extinct has been rediscovered in 1986 near Siddavatam in Cuddapah (Bharat Bhushan, 1986). The endangered great Indian Bustard and lesser florican occur in plains. The pinkheaded duck, now considered extinct, was earlier recorded from the region (Abdulali, 1945).

The occurrence of some bird species in Eastern Ghats is of Zoogeographical interest (Krishnamraju, 1976, 1984). Such species include tree sparrow, Abbot's babbler (Ripley and Beehler, 1985) and little spider hunter, which have been collected recently from Eastern Ghats. Several species found in Eastern Ghats are considered to be relict fauna showing discontinuous distribution.

Some important species known to be having restricted breeding ranges in the Eastern Ghats are *Picumuns innominatus*, *Dicrurus leucopheus*, *Dendrocitta formosa*, *Culicicapa ceylonensis*, *Trichotstoma abbotti* (Abbots babbler), *Passar montanus* (Tree sparrow), *Arachnothera longirostris* (Little spider hunter), *Hemicircus canate*, *Pericrocotus rosetis* and *Stachyris rufifrons*.

The recent field studies indicate a gradual but decline in the diversity and abundance of birds in the Ghats, swing to the fast changing forest habitat. The coffee plantations, exotic and monoculture forest plantation might be responsible for the observed alarming trends.

Mammals

Eastern Ghats has a variety of mammals ranging from tree shrew (*Anathana ellioti*) to tiger (*Panthera tigris*) among the primates, bonnet macaque (*Macaca radiata*) and rhesus macaque (*Macaca mulatta*) are common, the former generally confined to the south, while the latter to the north. Common langur (*Presbytis entellus*) is seen in the northern hilly areas. Slender loris (*Loris tardigradus*) seems to occur in the forests of Sri Venkateswara Sanctuary.

Among the cats, leopard (*Panthera pardus*), tiger (*Panthera tigris*) and jungle cat (*Felis chaus*) are present in most districts. The common mongoose (*Herpestes edwardsi*) and small Indian civet are seen generally in northern parts of the Eastern Ghats.

The striped hyena (*Hyaena hyaena*) is still the common scavenger in the country side. This created havoc in Anantapur district between 1980 and 1990 by resorting to lifting of children. Indian wolf (*Cams lupus*) which was recorded earlier from Eastern Ghats is now confined to Deccan plateau. The jackal (*Cams aureus*) is still very common, while the fox (*Vulpes bengalensis*) is relatively rare.

Indian wild dog (*Cuon alpinus*) is seen almost in all the forest districts of Eastern Ghats. Ratel (*Mellivora capensis*) is found mostly in Visakhapatnam-Vizianagaram forests. The sloth bear (*Melursus ursinus*) is very common in Eastern Ghats. Porcupine (*Hystrix indica*) occurs in all districts in suitable habitats. The Indian hare (*Lepus nigricollis*) is equally common, though there has been great reduction in their numbers. Indian gaur (*Bos gaurus*) is distributed in the well forested tracts of Northern Circars. Chowsingha (*Tetracereus quadricornis*) is common in the forests of Visakhapatnam and Vizianagaram, while Nilgai (*Boselphus tragocamelus*) in Nallamalais.

v. Brief history of Land/water use

There is lack of adequate information on this. However, the available information is summarised below.

Barring Shevaroy hills in Salem district, the hill ranges of Eastern Ghats were always described in the British Colonial records as malaria-infested low lying hill ranges. Malaria prevented the entry into the hills both of the people living in the plains as well as the whites (the Britishers). The following are some of the historical

events relating to land/water use and governance of natural resources in Eastern Ghats.

- Difficulties are encountered during the early 1800's surveys due to presence of Malaria.
- Large-scale and extensive extraction of timber found in the hills for the construction of Southern railway leading to forest destruction in the 1840s.
- Forest reservation in 1880s and social protest associated with it.
- Formalisation of forest management leading to extraction of forest timber and other NTFP and construction of roads and rest houses during 1890s.
- First World War had a great impact on Global Markets for Indian forest produce as well as on Local resources use patterns during the 1920s.
- Similarly the Second World War, also had an impact on Global Markets for Indian forest produce and Local resources use patterns in the 1940s.
- During the post-Independence period the use of pesticides minimised malaria incident in Eastern Ghats and there was neo-colonisation of these hills by people from plains.
- This was followed by the expanding road network, markets, PDS, in flow - out flow of goods, people and the consequent land use changes.

3. CURRENT (KNOWN) RANGE AND STATUS OF BIODIVERSITY

(i) State of Natural Ecosystems and Plant/Animal species

A. Plant Diversity

Shevaroy hills: The flora of Shevaroy has been studied by several investigators in the past (see detailed literature in Senthil Kumar, 1991; Senthil Kumar and Krishnamurthy, 1989, 1992, 1993; Sivaraj and Krishnamurthy, 1989, 1992). As per the most recent analysis there are 1184 species of Angiosperms, 50 species of ferns and other Pteridophytes (Subramanyam *et al.*, 1960), 111 species

of lichens (Hariharan, 1991), about 60 species of mosses (Kumar, unpublished data) and a variety of fungi (as per work carried out by the Department of Botany, Madras University).

Several natural ecosystems in Shevaroy have been affected seriously due to very many reasons. They are now either in partially or fully degraded state. 204 species of cultivated, introduced, planted and weedy elements are now found in Shevaroy. 62 species of flowering plants which have been earlier reported have become extinct in this region. 21 species have become endangered moderately or critically. 3 species are highly endemic.

Pacchamalais: The flora of Pacchamalais has been studied by Mathew (1975) who recorded 349 species of angiosperms belonging to 269 genera, which come under 82 families. 20 different species of lichens and a variety of fungi including micro fungi have been reported (unpublished data of Hariharan, 2000). There is lack of information on algae and gymnosperms.

Semmalai: The flora of Semmalai hills has been studied by Michael (1998). As per the analysis 767 species of angiosperms are recorded.

Alagar hill: The Alagar hill flora has been studied by Sriganesan (1990). There are about 900 species of angiosperms belonging to 526 genera under 126 families. The reasonably protected valley is rich in pteridophytic flora, including climbing ferns belong to the genus *Lygodium* (Subramanyam and Henry, 1959; Sriganesan, 1990).

Nallamalais: Ellis (1987-90) surveyed the Nallamalais intensively and enumerated 743 taxa belonging to 419 genera and 109 families.

4. STATEMENT OF THE PROBLEMS RELATING TO BIODIVERSITY

(i) Proximate causes of the loss of biodiversity:

(a) Introduction of Exotics

Several exotics have been introduced into Eastern Ghats. Some of them are causing havoc to native biodiversity. *Lantana camara* is invading interior forests and is threatening the native species. Similarly *Ageratina adenophora* and *Chromolaena odorata* are invading the forests. *Eicchornia crassipes* is invading ponds, tanks and famous Kolleru lake threatening aquatic biodiversity. In recent times *Parthenium hysterophorus* has invaded not only plains but also open forests causing several health problems to humans and eliminating several local weeds. Other weeds that invaded that invaded Eastern Ghats include *Ipomoea carnea*, *Lagascea mollis*, *Xanthium strumarium*, *Acanthospermum hispidum*, *Physalis minima*, *Argemone mexicana*, *Datura metel*, *Datura stramonium*, *Jatropha curcas*, *Cassia occidentalis*, *Cassia tora* and *Croton bonplandianum*.

(b) Habitat destruction and conversion

Eastern Ghats are under severe environmental stress and many of the natural resources therein are not being managed on sound ecological principles to ensure sustainable yields. The forest cover in the Ghats is diminishing at a much faster rate than the replenishment.

Kirandul-Kothavalasa railway line for the transportation of iron ore of Bailadilla across Eastern Ghats offers a small example of how the Ecosystem of Eastern Ghats is disturbed. The railway line necessitated the stripping of hill flanks and tunnelling of some of the hills resulting in the disturbance to the present erosion pattern of the Eastern Ghats. A similar pattern has also been observed in Nallamalais where large strips of forests have been denuded to lay broad gauge railway line.

(c) **Shifting (Podu) cultivation**

Nearly 27 tribal communities with a total population of 11,08,839 inhabit the Eastern Ghats of Andhra Pradesh. The largest among them are Bagatha, Chenchus, Jatapu, Konda dora, Konda Reddy, Savara, Yanadi etc.

Vegetation of a particular area is greatly influenced by past treatment, which is highly manifested in shifting cultivated Podu areas. The most significant feature, which has adversely affected the vegetation of Eastern Ghats, is the practice of shifting cultivation, locally known as Podu cultivation. Extensive areas of Eastern Ghats are subjected to shifting cultivation. Vegetation in the Podu area depends on the cycle of shifting cultivation. Due to increase in population and reduction of available forest area, the cycle of shifting cultivation has inevitably shortened and whatever re-growth develops is clear-felled and burnt. The natural vegetation has been destroyed and the end results scrub forest or bamboo forests or grass with or without a few scattered trees (mostly fruit trees such as Mango, Tamarind, Oranges and *Caryota urens*) and subject to annual fire, a pre climax savannah type. In extreme cases, due to prolonged shifting cultivation, the vegetation has been completely vanished, exposing the parent rock. *Eupatorium* and *Lantana* have also invaded such clearings in hill slopes altering and probably considerably delaying further succession.

Shifting cultivation was in vogue till very recent times in Keonjhar plateau and in the Khondamal hills. The Ranchi plateau which is at present almost completely deforested was the object of shifting cultivation in the past. In the Saranda hills this practice has left its mark by way of even-aged forest stands. In the Phulbani region turmeric (*Curcuma longa*) is grown for four years and then the plot is abandoned to become the forest follow for 10 years. The tops of the hill ranges are totally barren. The local hill tribes prefer the summit areas for cultivation rather than the slopes, the climate being healthier and the erosion being less intensive. Since hill tops are the

source of water, their denudation leads to the elimination of source of water. In fact many small streams observed a few decades ago in the region have gone dry. With the absence of the streams the valleys, now present drier conditions. As a result moisture-loving species are not to be seen in these areas. For example, *Psilotum nudum* and *Equisteum* which were luxuriantly growing here in 1950's are very rarely seen now.

Industrialisation: The precarious position of the existing biodiversity calls for adoption of some drastic steps by the Government. The revenue records reveal that in earlier days even the plains around Nallamalais were full of bamboo. Rapid industrialisation and excessive exploitation of raw materials are some of the reasons for the disappearance of many plants and animals. Bamboo is being supplied to the paper mills in Rajahmundry, Bhadrachalam, Kurnool, Sirpur and a pulp factory at Devanagaram near Giddalur in Prakasam district.

The following industries are also contributing to the loss of biodiversity.

- a. Kolab valley in Koraput district
- b. NALCO at Damanjodi
- c. Defence establishment on Koraput plateau
- d. Plywood industries in Rampachodavaram Agency
- e. Thermal Power Plant at Kondapalli

Dams and Canals: The dams at Srisailem, Nagarjuna Sagar, Sileru and Machkund have submerged considerable part of the forests. In addition to this settlements around these projects increase exploitation of forests. Srisailem was surrounded by dense forests before the dam was constructed but vast stretches of this area are now bare. Similar is the case with other dams.

According to the latest estimates regarding the digging of canals and the construction of reservoirs for the Telugu Ganga scheme, about 10,378 ha (7265 ha

under the reservoir in Kurnool, Cuddapah and Nellore districts and 3113 ha under canals in the forest divisions of Atmakur, Nandyal, Proddatur, Nellore and Chittoor) of reserved forest have been cleared which may further deteriorate the verdant forests of Eastern Ghats to bring about the irreversible ecological disruption. In addition to the above, another area of 1060 ha of forest land is required for the needs of Srisailem Right branch Canal Scheme.

Forest Fire: Forest fire is an annual problem in Eastern Ghats. Mostly, fire is caused by humans either wilfully or accidentally. Principally wild fire destroys young seedlings and damages the quality of timber either by making hollows in the trunks or by charring the same. The rich humus is burnt and wasted. The permeability of the soil is also affected resulting in loss of fertility, soil erosion and siltation of water reservoirs.

Cattle: Biotic interference has had a marked effect on the vegetation of Eastern Ghats leading to extinction of rare and valuable plants and animals. In Eastern Ghats herds of cattle, goats and sheep moving from place to place is a common sight. These animals come from the peripheral villages.

Unscientific Extraction of Non-Timber Forest Produce: Tribals like Chenchus, Konda Reddis, Yanadis extract gum and resin by making incisions on trees like *Sterculia urens* (Gum Karaya), *Anogeissus latifolia* (Velama), *Givotia rottleriformis* (Poliki) and *Lannea coramandeliana*. Unscientific and reckless tapping weakens the trees and causes their premature death. This has led to the extermination of *Sterculia urens*, a typical gum yielding plant, in several areas in Eastern Ghats.

Mining: Mining in Eastern Ghats is one of the main cause for the loss of Biodiversity. Limestone is quarried extensively in Yerramalais, which led to the destruction of forests. Bauxite is being mined in the Northern Eastern Ghats in vast stretches which is also leading to the extermination of valuable species. Coal mining

Khammam district has resulted in clearance of vast stretches of deciduous forests. Other mining activities responsible for loss of biodiversity include phosphate mining, granite.

In the past careless mining operations have brought devastation in the entire environment of the Eastern Ghats, destroying the highly valuable flora and fauna.

Monoculture: In the British period vast stretches of forest area has been cleared and Teak plantation was taken up. The result is loss of native biodiversity.

The Plantation programme by forest departments in Eastern Ghats are specifically of the monoculture type which have not had much success and made biological invasions into species composition and structures.

Killing of animals: The onslaught of killing of different species of fauna like several snakes (King Cobra, Python), bison etc. has posed a serious threat to their very survival.

Impact of Human activity on Nagarjunasagar-Srisailem Tiger Reserve:

Nagarjunasagar-Srisailem Wild Life Sanctuary is in Nallamalais. This sanctuary envelops about 120 villages of which 24 Chenchu settlements are in core while the rest consisting mixed tribes and sects in non-core zone. Abutting the boundary within 2 Km distance there exists 200 villages, over 12 mandals of parts of five districts.

Nearly 200 villages all together somehow or other are creating a substantial impact on the ecology of the sanctuary. Some of the villagers adjoining the project area have adopted smuggling as a subsistence occupation next to their own traditional profession. Following localities in the sanctuary are subjected to heavy illicit felling where predominantly huge timber trees are occurring in the following localities.

- Hardwickia Forests along Krishna valley.
- Guvvalakunta, Indirewaram, Peddacheruvu plateaus
- Guttalachenu plateau

- Amrabad plateau

Most of the people in this wild life sanctuary live below poverty line. They heavily depend on Non Timber forest produce. For Chenchus, NWFP is the primary source of income accounting for 45%. The Non Timber forest produce include Gum Karaya (*Sterculia urens*), Tumki (Tendu)(*Diospyros melanoxylon*) leaves, Mahuva flowers, Nannari (Maredu gaddalu - *Decalepis hamiltonii*) roots, Honey, Soapnut (*Sapindus emarginatus*), Tamarind (*Tamarindus indica*) etc.

About 50% of the people (other than Chenchus) living close to the sanctuary do collect NWFP and sell them to the middle men. About 34 varieties of species of NWFP have been identified as economically beneficial to the Tribals of this region. The species wise NWFP purchased by GCC from Chenchus is given in Table 5.

TABLE 5

Various types of NWFP purchased by GCC from Chenchus between 1995-98

Species	1995-96 Wt. in Kgs	1996-97 Wt. in Kgs	1997-98 Wt. in Kgs
Gum Karaya	85453	56256	47448
Mahuva seeds	123511	102374	113984
Nux vomica (<i>Strychnos nux-vomica</i>)	50053	14775	45405
Honey	32039	18603	32000
Soapnut	134192	162547	33997
Maredugaddalu (<i>Decalepis</i>)	25087	35911	217116
Kondagogu gum	12852	8359	13559
Seed Tamarind	820	2509	80

There is a necessity to study the global market of these NWFP and the impact of collection of NWFP on biodiversity.

(iii) Root causes of the loss in biodiversity

- (a) The conflict between the tribal interests and the forest laws seems to be endless. While in the theory the tribal people seem to be given the facility to make use of certain kinds of timber in certain forest areas around their habitations for bonafide needs, in practice, lack of clear-cut demarcation

between the so-called reserve forest and the village forest and the irresistible temptation of the forest department personnel to exploit the gullibility of the tribals seem to be creating perpetual problems.

- (b) A few zones where shifting cultivation is still being practised, happen to be areas which are least developed and which are least exposed to outside contacts. The welfare and development efforts on the part of the Government need to be stepped up. Minor irrigation projects, construction of wells and establishing of water-lifts even on a demonstration scale, can certainly wean the tribals away from shifting cultivation. The present situation in Elagiri and Javadi hills offers a hope in this regard. A combination of agriculture and dairy development is best suited for these areas.
- (c) Almost all these tribes living in hill ranges, augment their meagre economic resources through collection of minor forest produce. The afforestation schemes should keep the vital interest of the tribals in mind. The *Eucalyptus* plantations over wide stretches of hill ranges are not considered suitable to this ecosystem. Ecologically too, it raises questions whether it is desirable to replace the natural forests over these hills with *Eucalyptus* forests. Particularly in the vicinity of tribal habitations, the interests and livelihood needs of the people should be borne in mind in pursuing afforestation schemes.
- (d) Unsustainable use of natural water resources in the forests and political interference in conservation activities.
- (e) Construction activities by tourism and other departments including dams in the name of facility for pilgrims in Tirumala, Srisailam and other religious places are causing irreversible damage to the fragile ecosystem.
- (f) Forest fires – man made and burning of wood for production of native coal is causing lot of damage to the bio-diversity.
- (g) Pollution of land and water resources by pilgrims in Tirumala and Srisailam hills, questioning the very survival of animal species in forests. The postmortem of one of the wild animal in Tirumala hills recently revealed the accumulation of plastic bags in its stomach.
- (h) Over exploitation of wild animal resources for their livelihood by local communities. Large number of *Varanus benghalensis* are being caught by

tribals as they have good market value as Aphrodisiac and hence the species is on the verge of local extinction.

- (i) Some wild animals including endangered one are causing havoc to the agricultural fields and consequently affecting the livelihoods of local communities. The rampant increase in wild boar population is the best example in this regard.

5. MAJOR ACTORS AND THEIR CURRENT ROLES RELEVANT TO BIODIVERSITY

i. Governmental

Pre colonial rulers had set up hunting reserves in many parts of India. However, hunting reserves in Eastern Ghats were largely those established by the British in the 19th Century. With the taking over of the forests and wild life by the British, restrictions on shifting cultivation first came in 1948 (Buchy, 1996). Subsequently the Madras Government banned shifting cultivation in 1860 (Subhas Chandran, 1997).

ii. Citizen groups, NGOs and Research Institutions.

Several Non-Governmental Organisations are working in Eastern Ghats region.

- (a) In Nagarjunasagar-Srisailam Tiger Reserve Ten Non-Governmental Organizations have been working. These are working under Abhayaranya Samrakshan through Holistic Resource (Array) Management (ASHRAM).
- (b) M.S. Swaminathan Research Foundation - Community Biodiversity Conservation programme.
- (c) SOCO Trust, Madurai in collaboration with FLORA, an NGO of Biology Teachers organized photo exhibitions at Madurai, Erode, Namakkal, Trichy and Tirunelveli as well as other awareness programs to highlight the need to conserve our forest wealth in both Eastern and Western Ghats. The task force

of student volunteers of this organization visited Pacchamalai hills to impress on the tribes the need to conserve their forest wealth.

(d) Anantha Paryavarana Parirakshana Samithi

This is a network of NGOs in Anantapur district started in 1992. The network for the first time introduced the concept of natural regeneration of forest among the NGO community and also could able to build up a common action for natural regeneration of forest through community based initiatives. Activities of this Samithi include training to VSS members and organising Village Eco-management Committees in 100 villages.

(e) Praja Paryavarana Parirakshana Udyamam - Chittoor

This is a network of 56 NGOs in Chittoor district established in 1996.

(f) Cuddapah Paryavarana Parirakshana Samithi

This is a network of 15 NGOs in Cuddapah formed in 1994.

(g) Kurnool Paryavarana Parirakshana Samithi

This is a network of 28 NGOs of Kurnool district.

(h) Foundation for Revitalisation of Local Health Traditions (FRLHT) has created a network of Medicinal plant conservation areas (MPCAs) in Eastern Ghats of Tamil Nadu and Andhra Pradesh. These patches of forests serve in protecting not only the medicinal plants, but also the traditions of people that have evolved around the conservation and use of such plants.

(i) Organizations involved in Scientific research and/or activism related

to biodiversity and its conservation in Eastern Ghats include Bombay Natural History Society (BNHS), Botanical Survey of India, Zoological Survey of India, Sri Krishnadevaraya University (Anantapur), Andhra University (Visakhapatnam), Sri Venkateswara University (Tirupati), Bharathidasan University (Tiruchirapalli), Berhampur University (Berhampur, Orissa) etc.

- (j) Bird Watchers Society of Andhra Pradesh, 8-2-545, Road No. 7, Banjara Hills,
Hyderabad 500034.
- (k) Centre for Environmental Concerns, 3-4-142/6, Barkatpura, Hyderabad 500027
- (l) National Tree Growers Coop Concerns (NTGCF), 17-89-F2, Gandhi Road,
Madanapalle 517325, Chittor District.
- (m) Wildlife Protection Society of Orissa, Shantikunj, Link Road, Cuttack 753 012
- (n) Nature and Wildlife Conservation Society of Orissa, Mayur Bhavan, Janpath,
Shaheed Nagar, Bhubaneswar 751 015, Orissa.
- (o) Regional Centre for Development Cooperation (RCDC), 424, Shahid Nagar,
Bhubaneswar 751 007, Orissa.

iii. Local communities, rural and urban

In several villages and forest regions local communities are taking lot of interest to preserve the forest and Biodiversity.

iv. Donors:

International donor agencies including Japanese, British, Swedish, Norwegian and Danish have supported conservation and sustainable development in Eastern Ghats. Other international donor agencies that have contributed extensively to research and conservation in Eastern Ghats include the World Bank, Swedish International Development Authority (SIDA) etc.

6. ONGOING BIODIVERSITY RELATED INITIATIVES (including assesment of their efficacy)

(ii) Governmental :

Much of the biodiversity in the Eastern Ghats owe their continued survival to the system of Protected Areas (National Parks and Wild Life Sancturries).

There are 23 wild life sancturries in Eastern Ghats.(see Annexure)

Department of Indian Systems of Medicine and Homeopathy, Government of India, Ministry of Health and Family Welfare, in its letter DO No. Z

18020/4/97 dt. March 16, 1998, has enclosed a list of 29 medicinal plants (listed below) recommended by the committee of the Ministry of Environment and Forests for inclusion in the first negative list of exports to become effective from April 1998 (as per the minutes of the meeting of committee held on 5-2-98).

Aconitum spp.

Gentiana kurroo

Swetia chirata

Dactylorhiza hatagira

Frerea indica

Paphiopedilium spp.

Vanda coerulea

Saussurea costus

Cycadaceae spp.

Orchidaceae spp.

Aquilaria malaccensis

Ceropegia spp.

Gnetum spp.

Euphorbia spp.

Nardostachys grandiflora

Panax pseudoginseng

Pterocarpus santalinus

Coscinum fenestratum

Rauvolfia serpentina

Dioscorea deltoidea

Taxus wallichiana

Coptis teeta

Podophyllum hexandrum

Picrorhiza kurroa

Cycas beddomei

Nepenthes khasiana

Renanthera inschootiana

Kaempheria galanga

Cyatheaceae spp.

- (a) Andhra Pradesh Tribal Development Project: The project funded by International Fund for Agricultural Development (IFAD) covers 2077 villages predominantly occupied by shifting cultivators in the districts of Srikakulam, Vijayanagaram, Visakhapatnam and East Godavari districts. The shifting cultivation practiced on slopes excess of 28.5 degrees.
- (b) Andhra Pradesh Forestry Projects: This project is funded by the World Bank. The important aspect of this project is the constitution of Vana Samrakshana Samithis (VSS) consisting of all the villagers. The programme planning and implementation for protection and development of degraded forest areas have to be taken up through these committees.
- (c) Medicinal Plants Conservation Area (MPCA) involving Tamilnadu and Andhra Pradesh Forest Department.
- (ii) **NGO's**
- (a) M.S. Swaminathan Research Foundation, Chennai: Crops and Traditional knowledge project in some parts of Tamilnadu Eastern Ghats - community Gene Bank has been established - Agrobiodiversity Conservation Crops (ACC) has been established.
- (b) Save the Eastern Ghats Organisation (SEGO) Chengam Taluk & Javadi Hills - involved in work to traditional paddy varieties.
- (c) Green Foundation (Thalli block, Dharmapuri District) - Conservation of Finger and other millets.
- (d) IRDT (Dharmapuri District) - crops
- (e) Low External Input Sustainable Agriculture (LEISA) (Perambalur and Pudukkottai districts) - crops.
- (f) Conventional Centre for Development (CCD) (Ramnad, Madurai and Virudhunagar) - Medicinal plants
- (iii) Medicinal Plants Conservation Areas:
 Since 1993, FRLHT has initiated a pioneering collaborative programme in response to the crisis of dwindling medicinal plant resources. FRLHT in collaboration with the state forest departments, local NGOs and research institutes has established a chain of conservation sites in the Western and Eastern Ghats across the states of Kerala, Tamilnadu, Karnataka, Andhra Pradesh and Maharashtra. The network is called the Medicinal Plant

Conservation Network' (MPCN). It is a major step towards the conservation of wild genetic resources – the first of its kind in India. The MPCN is today conserving 1400 species of medicinal plants including 70 red listed species.

The MPCN has adopted a two-pronged strategy. On one hand, there are forest reserves where wild populations of medicinal plants are conserved in their natural habitats so that they can freely breed, evolve and multiply. This ensures their long-term survival. About 50 Medicinal Plant Conservation Areas (MPCAs) have been set up with the cooperation of the State Forest Departments to conserve the medicinal plant diversity in a range of vegetation types and ecosystems.

On the other hand, medicinal plants, especially threatened species are being conserved in ethnomedicinal gardens. Fifteen ethnomedicinal conservation parks have been established in collaboration with NGOs and research institutes to conserve plants known and used by various ethnic communities of Southern India.

In the MPCN, local communities are being motivated to form management and protection committees to secure long term conservation of forest reserves. Training Programmes and material have been developed on conservation and utilisation of medicinal plants.

7. GAP ANALYSES

- (i) **Gaps in information :**
 - (a) Inventory of the Flora, specially relating to non-flowering plants and microbes from the region.
 - (b) Analysis and documentation of various ecosystems, their current ecological status, stakeholders and their livelihoods.
 - (c) Precise data on threatened plant and animal taxa are lacking.
 - (d) Information on keystone species and their threat status is lacking.
 - (e) Paucity of studies on species interaction, especially between plants and animals, pollination, dispersal biology, status of pests and diseases, major links in trophic - food chains.
 - (f) Inadequate information on Indigenous knowledge systems and practices relating to ethnobotany, ethnomedicine, agriculture, land races etc.

- (g) There is insufficient data on wild relatives of cultivated/domesticated plants/animals.
- (h) No complete inventory of the sacred elements of the region is available. No comprehensive studies on the flora and fauna encountered in the sacred groves although they harbour many endemic and endangered plant and animal species.
- (i) The local communities are unaware of the significance of sacred groves and unable to recognize that their traditional knowledge holds the key for the long term security of their forests.
- (j) No legislation for the protection of sacred groves.
- (k) Some of the sacred landscapes like Tirumala is heavily polluted, affecting the quality of life and questioning the very survival of species. Dumping of plastic and other non-biodegradable materials in the valleys and hills of Seshachalam are harmful to the ecologically sensitive ecosystems.
- (l) Erosion of traditional and cultural values in the local communities over the years.
- (m) No reports of any Governmental or non-governmental agencies adopting sacred landscapes of the region.
- (n) No educational awareness programmes on sacred grove importance.
- (o) Documentation of cultural and traditional knowledge of local communities regarding their usage of plants.
- (p) Scientific information on the loss of bio-diversity especially the threatened species due to illegal collection and trade of medicinal plants is lacking.
- (q) Legal restrictions on the collection and marketing of the threatened medicinal plant species. Apart from GCC, many private firms from other states are collecting valuable medicinal resources in the forest areas at very low cost. Exploitation of local tribes by traders is a common feature in the area.
- (r) The traditional knowledge of the local communities regarding their conservation practices and medicinal plants are not being appreciated by different agencies concerned with conservation activity.
- (s) The inclination of the student community to mathematical science and technology rather than on to natural sciences due to improper exposure at school level.
- (t) Inadequate environmental conservation campaigns at local level.

- (u) Most of the information on bio-diversity is in English language and hence not accessible to local communities, and local languages.
- (v) Except with some vertebrates like bird and angiospermic plants no exclusive research on lower plants and especially invertebrates. Further, so far not even a single database is available for the animal species either at regional or state level.
- (w) The researchers working on the taxonomy of animals and plants are very limited and the trained people are shifting their research interests to other fields due to lack of encouragement and appreciation for field studies.

(ii) Gaps in vision:

- (a) Understanding and identification of suitable and right expertise in Bio-diversity has been an issue, which has to be addressed.
- (b) Emphasis on Bio-diversity conservation, instead of management of Bio-diversity created lot of contradictions. When Bio-diversity and peoples livelihoods are inter-linked, without enhancing livelihood based Bio-diversity strategies and action plans, the objective of Bio-diversity conservation can not be achieved.
- (c) Lack of harmony between various policies related to Bio-diversity issue. Policy level contradictions are visible in forest promotion activities without concern for Bio-diversity and Bio-diversity conservation policies.
- (d) Growth oriented development model neglected the long term concern like conserving and sustainably using the available bio-diversity resources. In their model, regeneration of bio-diversity resources was not given prominence and micro-level development models were sidelined.
- (e) Undermining of indigenous knowledge and practices as unscientific is a major threat to bio-diversity.
- (f) Career counselling for youth, interested in bio-diversity conservation has not been taken up by the government.

(iv) Gaps in policy and Legal structure:

There are lacunae in National and International Laws regarding conservation and sustainable use of bio-diversity elements. There was no attempt to empower the indigenous knowledge systems and practices in the present laws

and policies. The present conservation acts are not in conformity with the basic needs of the local communities and further the latter are not being educated about the threatened taxa.

The Wild Life (Protection) Act of 1972 (and its 1991 amendment) and the Forest Conservation Act (1980) have generally governed the conservation of forests and wild life. There are, however nearly 200 other Indian Laws and Policies, which directly or indirectly relate to the management of Environment and bio-diversity (see Annexure 5). It is important that the other relevant laws/ policies are made available to a wider audience (including students of Law), who are not aware of the existence of such an array of legal instruments that concern the management of environment and bio-diversity, especially outside the system of protected areas.

(iv) Gaps in Institutional and Human capacity:

- (a) Lack of incentive to taxonomy and taxonomists in general, lack of promotion of taxonomic studies, lack of interest among student community for studies / research in taxonomy, lack of Herbaria, Natural History Museums, Field gene banks etc.
- (b) Lack of expertise on socio economic aspects of bio-diversity resources in Eastern Ghats region.
- (c) Environmental and biodiversity education at all levels including non-formal education.
- (j) Lack of enough NGOs genuinely interested in Eastern Ghats Eco-region conservation.

8. MAJOR STRATEGIES TO FILL THESE GAPS, AND TO ENHANCE/STRENGTHEN ONGOING MEASURES

(ii) Understanding/studying biodiversity

- (a) Consolidate from literature/data available on various aspects of biodiversity till date and prepare a document, which would form a bench mark for a future course of action for Eastern Ghats.

Action: Universities located in the Eastern Ghats, ZSI and BSI.

- (b) Set up Regional office of BSI exclusively for Eastern Ghats.

Action: Ministry of Environment & Forests.

- (c) Publication of Red data book on Eastern Ghats bio-diversity.

Action: S.K.University , B.S.I., Z.S.I.

- (d) Formulate a programme for ethno-biological studies in Eastern Ghats

Action: Universities located in Eastern Ghats region, funding agencies: MOEF, DST, CSIR, UGC, DBT etc. This effort should be led by local communities. Otherwise it will be a work of outsiders and the local communities will have no ownership over their own knowledge.

- (e) Establish a network of linkages with all institutions working on the biodiversity of Eastern Ghats for creation and dissemination of a common database on the biological wealth of the Eastern Ghats.

Action : National Institutes.

- (f) Land races and wild relatives of crop plants/domesticated animals have to be conserved.

Action: NBPGR, NBAGR, NBFGR led by local communities

- (g) A complete inventory of the sacred landscapes along with the information of the communities associated should be taken up.

- (h) The flora and fauna encountered in the sacred groves should be documented with special reference to endemic and endangered species.

- (i) Documentation of indigenous knowledge of the local communities regarding the use of wild plants as medicine. Empower and create structures for the documentation by the local communities of their knowledge regarding the use of wild plants as medicine.

- (j) Empower and create structures and support for the local communities for comprehensive documentation of their life systems including folklore, handicraft and special skills, traditional medicinal systems, valuable cultivars of domesticated plants and animals should be carried out.

(ii) Conserving Bio-diversity:

- (a) Notifying of at least 3 areas in Orissa/ Andhra Pradesh as Biosphere Reserves in Eastern Ghats.

Action: Forest Departments of Orissa, Andhra Pradesh and MOEF

- (b) Monitoring of fresh Water bodies in Eastern Ghats to solve the drinking water problem of the people, improve ground water sources and prevent pollution. This will have to lead to integrated water harvesting and conservation including changes in cropping pattern. Cleaning of lakes and

water bodies linking with the plan of Government of India for River and Lake Conservation may also be promoted. Also study the water harvesting structures and methods used by the local communities in the past and if found useful for confronting current challenges, bring them back into active use.

Action: Local communities, ZSI, Andhra University, Orissa Environmental Society.

- c) Bio-diversity utilization without disturbing the ecological balance like collection of NWFP without destroying the plants.

Action: State Forest and Environment Departments, community based organizations, NGOs, Government Tribal departments like ITDA, TDCCOL, GCC etc.

- (d) Conservation and regulated management of all natural resources in Eastern Ghats through eco-development plans

Action: Planning and State Environment Departments.

- (e) In situ regeneration and sustenance of rare and important species having some utility value by using appropriate technology

Action: State Forest Departments and Agriculture Departments, National Institutes like CIMAP.

- (f) Alternative system to meet daily requirements like fodder, firewood through social forestry, non-conventional energy sources so that the threat to bio-diversity may be reduced.

- (g) Ear marking funds in the State Budget specially for conservation programmes in the Eastern Ghats.

- (h) A proper solid waste management policy should be adopted in the sacred landscape like Tirumala and there by to prevent the loss of animal diversity (like plastic waste is harming the animal diversity).

- (i) The local communities must be helped by government and non-governmental organizations to readopt the sacred groves for their effective conservation.
- (j) An awareness campaign has to be undertaken in habitations in and around the forested areas, regarding the significance of sacred groves in bio-diversity conservation. Large scale cinema shooting activities in the sacred landscapes like Talakona should be curtailed. This awareness campaign should be directed towards governmental and non governmental institutions as well as the younger generation of the adivasi and other local populations to make them understand the significance of the sacred groves and their conservations imperatives.
- (k) Success stories on the preservation and conservation of bio-diversity in the sacred groves should be widely focussed through electronic and print media as well as published in local language for a wide local dissemination.
- (l) Intensive training programmes have to be organised for governmental and non governmental institutions as well as adivasis and other communities regarding the sustainable collection of medicinal plant species.

(iii) Socio-Economic Environment

- (a) Impact of ecological degradation on the socio-economic and cultural practices of indigenous and local communities and evaluate the symbiotic relationship between forests and people livelihood. Traditional farming will bring back these cultural practices.

Action: Tribal Welfare and Environment Departments, and Community based NGOs.

- (b) Eco-restoration efforts as well as future development plans to be under taken with participation of all stakeholders.

Action: Local communities, Panchayats, State Government, State Forest Department and all Development Departments, CBOs and Industry.

- (c) Programmes should be developed through integration of sector activities addressing specific local issues such as 'Podu' cultivation.

Action: Adivasi communities, Tribal panchayats, Concerned Government Departments and CBOs.

- (d) In ecologically sensitive areas construction of dams should be avoided and alternatives should be planned.

Action: Concerned Government Agencies.

- (e) Enterpreneurship programmes should be initiated for the local communities with focus on sustainable utilization of biological resources.

Action: Concerned Government agencies and industry.

- (f) Good marketing avenues have to be created for the local communities regarding medicinal plant trade while taking care that it does not lead to unsustainable overexploitation of these resources.

- (g) The knowledgeable informants of medicinal plants in the local communities should be recognised in special meetings by different agencies.

(iv) **Institutional, Legal and Policy measures**

- (a) Enabling policy framework should be developed for scrutiny of resources and tenure rights of local and indigenous communities to check problems such as increasing immigrant population in and around protected areas.

- (b) Effective implementation of existing laws and constitutional provisions pertaining to scheduled areas.

Action: Tribal Welfare, State Environment and Forestry Departments.

- (c) The encroachment in Reserve Forest areas by tribal population prior to 1980 may be surveyed and regularized.

Action: Forest Department.

- (d) All major sacred groves in the region (recorded in WWF report, 1995) should be declared as mini – heritage sites and adequate legal protection has to be imparted.

- (e) Some of the forest areas with high medicinal plant diversity should be given special legal protection. The establishment of Medicinal Plant Conservation

Areas of FRLHT – Forest Department is one good example. The existing MPCA's have to be strengthened and new areas are to be recognised and adopted by the state forest department in collaboration with local communities and NGO's.

- (f) To have an integrated rural environmental policy for the region to bring concepts and capacity building amongst adivasis and rural people to integrate livelihood projects and development programmes including socio-economic aspects as part of a sustainable development package.

Other Action Points:

- (a) All the threatened species should be studied immediately for their population status.
- (b) Detailed Anthropological Studies may be taken up for studying the cultural diversity as manifested by the lifestyles of various tribes living in Eastern Ghats and its integral relationship with the biological diversity of the region. Simultaneously the study must also look at the impact on them of the forest development schemes being planned and under implementation.
- (g) Authentic scientific studies have to be conducted to know the impact of coffee plantation being promoted by the government development departments on bio-diversity.
- (h) Studies on Adaptive Management Strategies of people with regard to bio-diversity should be conducted.
- (i) Promote and strengthen the Bio-diversity register programme activity.
- (g) Addressing the survival of the community through value added production.

9. REQUIRED ACTIONS TO FILL GAPS, AND TO ENHANCE/ STRENGTHEN ONGOING MEASURES

- (i) **Actions to conserve and sustainably use natural ecosystems and wild plant and animal diversity**
- (i) Sensitization of governmental agencies, NGOs and Panchayats on biodiversity issues is an urgent need.

Action: Government, NGOs, Educational Institutions.

- (j) Special area programmes for Eastern Ghats to be initiated.
Locally planned bio-diversity through bottom/up approach by involving the community with a special focus on women.
Action: DRDA.
- (k) Land use planning through micro and macro watershed programme, and the role of women in collecting the firewood and other NTFP must be highlighted, a data base may be developed.
Action: Government departments and others.
- (l) Enabling the local communities to document the region's flora and fauna and publish the same in local language and dissemination of information to the local communities.
Action: Local community organisations, University faculty, BSI, ZSI and National Research Institutions.
- (m) Study of the population status of all threatened plant and animal species (including medicinal plants) of the region.
Action: University faculty, ZSI, BSI, FRLHT.
- (n) Mapping of natural ecosystems to identify the zones of biotic interference through remote sensing for the immediate protection and conservation of species in the region.
Action: Government departments and Universities.
- (o) Strengthening and promoting the Peoples Bio-diversity registers programme.
Action: Deccan Development Society, CWS, Local community and NGO networks and University faculty.
- (p) Conducting awareness campaigns in the rural and urban areas regarding the environmental conservation, ranging from protection of species to proper disposal of solid waste.
Action: NGO networks, State Environmental organizations and Universities.
- (q) Listening to local communities on approaches to sustainable collection of

forest products, and converting this learning into training material for the governmental, non governmental and local communities especially on gum yielding plants and medicinal herbs.

Action: NGO networks, forest department and scientists.

(iii) Actions to conserve and sustainably use agro-ecosystems and domesticated plant and animal diversity:

(b) Establishment of seed banks and networking for exchange of traditional knowledge regarding varieties of crops and breeds of Eastern Ghats.

Action: ICAR, IARI, NBPGR, NBAGR, NBFGR led by local communities.

(iii) Actions to conserve and sustainably micro-organisms:

To Safeguard the microbial diversity of Eastern Ghats, establish a Microbial Type Culture Collection Centre in the southern part of the country, possibly at Tirupati to identify, conserve, utilize and claim rights over the microbial resources of Eastern Ghats.

(iv) Actions to achieve equitable decision-making, people's (including women's) empowerment and participation, equitable sharing of benefits, cross-sectoral integration, policy and legal changes, financial measures and other such steps.

(l) Strategy: Development of Biodiversity as a discipline with a holistic approach encompassing social, scientific, cultural and ethical approaches

Action Plan: Designing curriculum on biodiversity at all levels in educational institutions.

Actors: Universities, State level School Boards in collaboration with local grassroot CBOs and NGOs

Net working with educational institution including school, colleges, universities by mobilising students.

(m) Strategy: Establish the linkages between biodiversity and local people's livelihoods both in negative and positive aspects. Shift from mere protection

approach to management of biodiversity with local control over biological resources.

Action plan: Documentation and analysis of the linkages between biodiversity and local people's way of life.

Actors: Anthropologists, archaeologists, NGOs in collaboration with local CBOs

Action plan: Capacity building at local community level to understand and take control over biodiversity resources for effective management.

Actors: NGOs, CBOs, Funding agencies, Government Administrators.

- (n) Strategy: Instead of sectoral approach policies should be in harmony with other policy objectives at wider level.

Action Plan: MOEF should have an integrated approach in designing, implementation and coordination of various policies and objectives with a priority for bio-diversity.

Actors: Concerned Government agencies and MOEF.

- (o) Action Plan: Interlinking Forest development policies and Biodiversity conservation Policies.

Actors: Different divisions in MOEF in collaboration with local CBOs and NGOs.

- (p) Strategy: Thrust should be given to development planning comprising the regeneration of Biological resources and sustainable utilization of the same.

Action plan: Biodiversity friendly development models at micor-levels have to be documented and action plans have to be prepared

Actors: Concerned Government departments and universities.

- (q) Action plan: Strengthening the regulatory mechanism to control the industrial pollution affecting biodiversity.

- (r) Media strategy should be evolved at all levels with appropriate medium.

Action Plan: Revival of local cultures and festivals to disseminate the message in local languages. Community radio should be established at local

levels for educating people on biodiversity. Participatory media programmes have to be designed for effective response.

Actors: CBOs, NGOs and development media practitioners.

- (s) Biodiversity parks should be developed at Mandal/Taluk level exhibiting locally endangered plants and animals.

Actors: Local CBOs, NGOs, Government departments.

- (t) Biodiversity related products and local markets controlled by local people should be established. Promotion of biodiversity friendly products have to be prioritised.

- (u) Fishing activities by huge technology based fishing companies should be banned and only traditional fishing activities have to be permitted to conserve aqua biodiversity throughout the coastal areas and inland lakes and canals.

- (v) Inter-eco-regional networking and sharing of experiences has to be facilitated.

Table 6. Wild life Sanctuaries in Eastern Ghats

(Source: Kutty & Kothari. 2001. Protected Areas in India – A profile)

Name	Area in hectares	Location (District)
Badrama	30,403	Sambalpur
Hadgarh	19,106	Mayurbhanj & Keonjhar
Karlapat	14,796	Kalahandi
Khalasuni	11,600	Sambalpur
Kotagarh	39,905	Phulbani
Lakheri valley	18,587	Gajpathi
Similipal	2,20,000	Mayurbhani
Sunabeda	50,000	Kalahandi
Kinnerasani	65,600	Khammam
Papikonda	59,100	Khammam, East & West Godavari
Nagarjuna Sagar, Srisailam	3,56,809	Guntur, Prakasam, Kurnool, Mahaboobnagar, Nalgonda
Kolleru (Bird)	67,300	West Godavari
Nelapattu (Bird)	440	Nellore
Pulicat (Bird)	50,000	Nellore
Coringa Kakinada	23,600	East Godavari
Sri Venkateswara	15,394	Cuddapah & Chittoor
Rollapadu	614	Kurnool
Krishna	19,500	Krishna & Guntur
Gundlabrahmeshwaram	1,19,400	Kurnool & Prakasam
Sri Lankamalleswara	46,400	Cuddapah
Kaundinya	35,800	Chittoor
Vedanthangal Water bird Sanctuary	30	Chengalpattu
Annamalai	91,995	Coimbatore

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ANNEXURE i

Full Description of Process

Meeting and workshops have been held at the following places

1. Inaugural Workshop at
Department of Botany
Sri Krishnadevaraya University
Anantapur
Andhra Pradesh
On 2nd and 3rd December, 2000
Coordinator: Prof. T. Pullaiah
2. Meeting held at
District Upadhya Bhavan
Anantapur
Andhra Pradesh
On 15-3-2001
3. Meeting held at
D. Beemaram
Addateegala Mandal
East Godavari District
Andhra Pradesh
during 28th - 30th March, 2001
Organised by Girijana Deepika and YAKSHI
4. Meeting held at
Tiruchirapalli, Tamilnadu
On 5-4-2001
by Prof. K.V. Krishnamurthy
Professor & Head
Department of Plant Sciences
Bharathidasan University
Tiruchirapalli
Tamilnadu
5. Meeting held at
Visakhapatnam, Andhra Pradesh
On 8-4-2001
by Dr. Kameswara Rao
Head, Department of Environmental Sciences
Andhra University
Visakhapatnam - 530003
6. Meeting held at
Berhampur, Orissa
On 17-4-2001
by Dr. M.K. Misra
Head, Department of Botany
Berhampur University
Berhampur

Orissa

ANNEXURE II

7. Meeting held at
Srisailam, Andhra Pradesh
Organised by Prof. R.R. Venkata Raju
Sri Krishnadevaraya University
Anantapur
Andhra Pradesh
8. Meeting held at
Vani penta, Cuddapah District
Organised by Dr. B.Ravi Prasad Rao,
Sri Krishnadevaraya University
Anantapur
9. Meeting held at
Sr Krishnadevaraya University
On 2nd and 3rd March 2002
Organised by the Coordinator.

3. Dr. C. Sukumar
Department of Botany
Sri Krishnadevaraya University
Anantapur 515 003
Phone: Res. 08554-272240

4. Dr. B. Ravi Prasad Rao
Department of Botany
Sri Krishnadevaraya University
Anantapur 515 003
Phone: Res. 08554-274344

5. Prof. K. V. Krishnamurthy
Professor & Head
Department of Plant Sciences
Bharathidasan University
Tiruchirappalli 620 024
Tamilnadu
Phone: Res. 0431-459686
Office: 0431-660851
Email: kvk@bdu.ac.in
Fax: 0431-660245/660120

ANNEXURE ii

Full list of people who contributed to the SAP

1. Prof. T. Pullaiah (Working group Coordinator)
Dean, Faculty of Sciences &
Head, Department of Botany
Sri Krishnadevaraya University
Anantapur 515 003
Phone: Res. 08554 - 278181
Off. 08554-255561
Email: pullaiaht@yahoo.co.in
2. Prof. R.R. Venkata Raju
Department of Botany
Sri Krishnadevaraya University
Anantapur 515 003
Phone: Res. 08554-273788
3. Dr. C. Sudhakar
Department of Botany
Sri Krishnadevaraya University
Anantapur 515 003
Phone: Res. 08554-272240
4. Dr. B. Ravi Prasad Rao
Department of Botany
Sri Krishnadevaraya University
Anantapur 515 003
Phone: Res. 08554-224344
5. Prof. K.V. Krishnamurthy
Professor & Head
Department of Plant Sciences
Bharthidasan University
Tiruchirapalli 620024
Tamilnadu
Phone: Res. 0431-459686
Off. 0431 - 660351
Email: kvkbdu.ernet.in
Fax: 0431-660245/660320

6. Dr. Ravishankar
Principal Scientist
M.S. Swaminathan Research Foundation
Kakinada
East Godavari District, A.P.
7. Dr. N. Rama Rao
Scientist SE
Forest Research Centre
Indian Council of Forestry Research & Education
Dulapally
Hakimpet P.O.
Hyderabad 500 014
8. Dr. N. Venugopal
Botanist, Chemiloids
R&D Centre, Shed No.1. Phase III
Antonagar, Vijayawada-7, AP.
Email: plantex@md3vsnl.net.in
9. Dr. S.Z. Siddiqui
Zoological Survey of India (ZSI)
Freshwater Biological Station
1-1-300B Ashok Nagar
Hyderabad 500 020
Phone: 040-7603514
Fax: 040-7634662
10. Sri K. Pandudora
Girijana Deepika
D. Bheemaram (Vill. & Post).
Addateegala Mandal
East Godavari District 53333 428, AP.
11. Ms. N. Kantham
Girijana Deepika
D. Bheemaram (Vill. & Post).
Addateegala Mandal
East Godavari District 53333 428, AP.
12. Ms. Usha
YAKSHI
124 Sainikpuri, Vayupuri
Secunderabad 500 094
Phone: 040-7113167
Email: yakshi@satyam.net.in
13. Sri M.L. Sanyasi Rao
ANTHRA
124 Vayupuri
Secunderabad 500 094

Other who contributed to the SAP

14. Sri. R. Suneel Kumar
SARDS
Tangutur 523 274
Prakasam (Ct.) AP.
Phone: 08592-42867/42342
15. Dr. G.J. Suvarna Rao
REED
Anurag Nilayam
DARSI - 523 247
Prakasam (Dt.), AP.
16. Dr. P. Venu
Scientist SE
Botanical Survey of India, Southern Circle
TNAU Campus
Lawley Road P.O.
Coimbatore 641 003, Tamilnadu
17. Dr. G.V.S. Murthy
Scientist SE
Botanical Survey of India, Southern Circle
TNAU Campus
Lawley Road P.O.
Coimbatore 641 003, Tamilnadu
18. Dr. K. Misra
Reader & Head
Department of Botany
Berhampur University
Bhanja Bihar
Berhampur - 760007, Orissa
Phone: Off. 0680-203404/282172
Res. 0680-242242
19. Dr. K. Sri Rama Murthy,
Head, Department of Botany,
Andhra Loyola College,
Vijayawada -8
20. Dr. S.Sandhya Rani,
Research associate,
Department of Botany,
Sri Krishnadevaraya University,
Anantapur -515003

21. Sri Vijaya Bhaskara Reddy,
YAKSHI
124 Sainikpuri, Vayupuri
Secunderabad 500 094
Phone: 040-7113167
Email: yakshi@satyam.net.in
22. Dr. Suvarna, Project Director, DRDA,
Anantapur
23. Organisation for Rural Reconstruction Movement,
Anantapur
24. P.V.Satheesh, Deccan Development Society,
Hyderabad.
25. Mr. Sanjeet Pattnaik, Secretary, S.O.V.A.,
Pujariput street, Koraput, Orissa
26. Mr. Pradeep, Secretary, KOYA, Malkanagiri, Orissa
27. Mr. Venkat Rao, Director, OPDSC, Raniguda Farm, Rayagada,
Post Box – 117, Dist. Rayagada, Orissa
28. Mr. Nagendra Nanda, Secretary, SACAL, Neelanchal Nagar, 4th Line,
Berhampur, Orissa.
29. Mr. A.V.Swami, Secretary, VISWAS, Nuapada, Orissa.
30. Ms Ranjitha Dash, Director, LIPICA, Godavarish Nagar II, Berhampur, Orissa
31. Mr. Badal Tah, Director, Ankurah, Rayagada, Orissa.
32. Mr. Jose, Secretary, AKSSSS, Post Box. No. 26. Rayagada, Orissa.
33. Mr. A. Jagannath Raju, Director, Centre for Community Development,
College Hostel Road, Parlakhemundi, Dist. Gajapathi, Orissa.
34. Mr. D.Jagannath Raju, Secretary, SWWS, Near DFO office, Parlakhemandi,
Dist. Gajapathi, Orissa.
35. Mr. Suresh Chandra Sahu, Secretary, CARD, Corporation Road, Giri Market
Area, Berhampur 760002
36. Sri Jacob Thundial, Director, PREM, Mandiapalli, Bhanja Bihar, Berhampur
760007, Orissa.
37. Mr. Mangaraj, Secretary, United Artists Association, Ganjam, Orissa
38. Mr. Achyut Das, Director, Agragamee, Kashipur, Dist. Rayagada, Orissa
39. Ms. Minati Padhi, Secretary IWD, Institute for Women Development,
Hilpatane, Berhampur, Orissa.
40. Mr. Sulapani Satapathy, DFOoffice, Bhajjiput, Via Bhanjanagar 761127, Oriss
41. Mr. Joe Madiath, Executive Director, Gram Vikas, Mohuda, via –Berhampur
42. Mr. R.C.Das, Director, NIPDIT, Main Road, Phulbani, Dt. Khandamala, Oriss
43. Mr. Subhas Mahapatero, Secretary, NEED, At Gopalbandhy Nagar, P.O.
Jeypore, Dt. Koraput, 764001, Orissa.
44. Dr. Razzak Daud Girach, Research Officer (Botany), Regional Research
Institute of Unani Medicine, Bhadrak, 756108, Orissa
45. Prof. Premananda Das, Director, Regional Plant Resource Center, Nayapalli,
Orissa.
46. Dr. Pradeep K.Das, Lecturer in Botany, Nowarangpur college, Nowrangpur.
47. Dr. S.N.Patro, Reader, Department of Botany, S.K.C.G.College,
Parlakhemudi, Dist. Gajapathi, Orissa.
48. Dr. Sailabala Padhy, Reader, Dept. of Botany, Berhampur Univ, Orissa
49. Dr. Brahma Bihari Panda, Reader, Department of Botany, Berhampur
University, Orissa.
50. Dr. S.N.Das, Secretary, Vigyan Prasara Panigada, Berhampur, Orissa.

ANNEXURE iii

Relevant lists of Biodiversity

Insect Diversity

Widely Distributed Species

As examples of the widely distributed species occurring also in the region, the following are important.

HETEROPTERA: *Brachyplatys punctipes*, *Coptosoma crirabria*, *C. pulchellum*, *Scutellera nobilies*, *Chrysocoris marginellus*, *Dalpada versicolor*, *Halyomarpho picas*, *Antestia cruciata*, *Agonoscelis nubila*, *Nezara viridula*, *Canthecona furcellata*, *Tessaratomya papilosa*, *Cyclopelta siccifolli*, *Aspongopu janus*, *Homoeocerus variabdis*, *Leptocorisa varicornis*, *Serineta abdominalis*, *Lygaeus hospes*, *Graptostethus servus*, *G. argentipes*, *G. quadrisignatus* and *Geocoris tricolour*.

COLEOPTERA: *Scarabeus brahminus*, *Gymnopleurua cyaneus*, *G. konigii*, *G. parvus*, *G. gemmatus*, *G. aethiops*, *Sisyphus longipes*, *Catharsius molossus*, *Caccobius aterrimus*, *C. meridionahs*, *Onthophagus hystrix*, *O. tarandus*, *O. griseosetosus*, *O. banasras*, *O. recteocornutus. discecdens*, *O. gemma*, *O. quadridentatus*, *O. politus*; *O. fasciatus*, *O. bifasciatus*, *Oniticellus pallipes*, *Onitis falcatus* and *O. virens*, *Calosoma orientale*, *Siagona plana*, *Gnaphon loyola*, *Scaritis selene*, *S. inconspicuous*, *S. praedator*, *S. puncticollis*, *Oxylobus porcatus*, *Coryza maculata*, *Tachys blandus*, *Hespera lomasa*, *Chaetocnema basalis*, *Ophrida marmorea*, *Longitarsus belgaumensis* and others.

Insects Common to the Eastern and Western Ghats

The second group of species, which is common to the Eastern Ghats and Western Ghats and which may be considered as truly Peninsular forms, is exemplified by the following, among many others:

HETEROPTERA: *Chrysocoris purpureus*, *Homaeocerus albiventris*, *H. montanus*, *Corizus rubicundus*, *C. macropictus*, *Geocoris dubreulli*, *Appolonius picturatus*, *Aphanus discoguttatus*, *Physorhynchus nigroviolaes*, *Hubertiella cardamomi* and others.

COLEOPTERA: *Oxylobus follis*, *Tachys nilgiriensis*, *T. nannodes*, *T. nigellus*, *Anoctus myrmecophilus*, *Caccobius gallinus*, *Onthophagus oculatus*, *O. imperialis*, *O. bronzea*, *O. igneus*, *O. spinifx*, *O. ndigiriensis*, *O. violaceotinctus*, *O. laevigatus*, *O. pardalis*, *O. fi7urei*, *O. truncaticornis*, *O. turbatus*, *O. centricornis*, *O. ampicoma*, *Scarabaeus sanctus*, *S. erichsoni*, *Gymnopleurus spilotus*, *G. dejeani*, *Sisyphus araneolus*, *Catharsius pithecus*, *Copris repertus*, *C. signatus* and others.

Mention may be made briefly of one interesting peculiarity of this group. Some of the species, which are common to the Western and Eastern Ghats occur widely in the Western Ghats but on the Eastern Ghats are curiously localized on greatly isolated hills

The distribution is peculiarly discontinuous. A variety of evidence seems to indicate recent origin of this discontinuity.

Species Restricted to the Eastern Ghats

Example of species restricted to the region of the Eastern Ghats include among others, the following:

HETEROPTERA: *Coptosoma nilgiriensis*, *C. signaticolle*, *Bozius exsiccus*, *B. resperaus*; *Chrysocoris simplex*, *Holca nigrorufa*, *Podops longispina*, *Dalpada*

pilicornis, *D. taur-urmis*, *Halys nilgiriensis*, *Adria parvula*, *Agonoscelis campbelli*, *hitellus orientates*, *Pseudaniasida fallase*, *Homoeocerus indus*, *Nysius melanicus*, *Macropes dilutus*, *M. consobrinus*, *M. consimilis*, *M. abbreviatus*, *Geocoris polytretus*, *Eucosmetus nigroniteus*, *Chgenes sexnotatus*, *Rhodbclia convictionis*, *Odontopus sanguinulens*, *Dindymus ceneaeus*, *Monanthia nilgiriensis*, *Carcinicornis hampsoni*, *Canthesancus hellno*, *Reduvius esan*, *Physorhynchus rubromaculatus*, *Harpactor nilgiriensis*, *H. pigmeus*, *Sphedanolestes stigmatellus*, *Sycanus albofasiatus*, *Macrocanthopsis hampsoni*, *Zanessa sanguinolenta*, *Miris alkinsoni*, *Megacoelum hampsoni*, *Lygus sordidus*, *Zaratus repandus*, *Heleocoris bergrothi* and others.

COLEOPTERA: The Coleoptera include many interesting species like *Gnaphon costatus*, *Oxylobus alveolatus*, *O. montanus*, *O. lateralis*, *Clivina costata*, *C. forcipata*, *Dyschirius lacustris*, *Bembidion braminum*, *Trachys brachys*, *T. stenoderus*, *T. elegans*, *Gvntnopleurus spilotus*, *G. koenigi*, *Catharsius sagax*, *Phalops divisus*, *Caccobius indicus*, *Onthophagus cavia*, *O. besetus*, *O. viridus*, *O. refulgens*, *O. bengalensi*, *O. urellus*, *O. difcilis*, *O. unifasciatus*, *Phacosma tristes*, *P. laetum*, *Cassolus humerahs*, *Onitis siva*, *Chrysolina indica*, *C. carinata*, *C. andrewesi*, *Chalcolampra octodecinguttata*, *Monarthra dumola*, *Philophona inornata*, *P. nilgiriensis*, *Hyphasoma submetallica*, *H. discipennis*, *Ephitrea indica*, *Chalaenosoma virides*, *C. metallicum*, *Podagrira semicoerulea*, *P. madurensis*, *Pseudophthona humeralis*, *Chalera decemplagiata*, *Longitarsus hratus*, - *L. funidus*, *Aphthona nilgiriensis*, *Sebaethe pallidicincta*, *S. fimbriata*, *S. intermedia*, etc.

Other Insects

The examples listed above are limited nearly all to teiricole forms, occurring mostly on the ground or on low vegetation and with limited flight range. The list is by

no means either comprehensive or exhaustive, since numerous other species and many other groups have been entirely omitted from here for one reason or another. The examples actually selected here merely serve to illustrate the distributional peculiarities known at present. Other similar form, with relatively limited powers of active dispersal, include grasshoppers, Dermaptera, Embioptera, Blattids like *Corydia petivariana* Mantodea, Staphylinids like *Lispinus madurensis*, *Tetrapleurus indicus*, *Priochorus pentagoanlis*, *P. longicornis*, *Bledius*, *Stenus carinipennis*, *S. albidicornis*, etc. Even among active flying forms. Many interesting species typical of the Eastern Ghats include Syrphids like *Eristalis quinquelineatus*, *Xylota carbonaria*, *Eumerus albifrons*, *Microdon unicolor*, *Chrytoxum baphyrs*, etc. Many Odonata like *Lestes umprina*, *L. thorasica*, *Indoneura obscura*, *Enallagma insulea*, *Rhinocypha bisignata*, *Yestalis gracitis*, *Alesogomphus lineatus*, *Megalogomphus superbus*, *Orthetrum chrysastigma*, etc., are typical of the Eastern Ghats. Among Lepidoptera-Rhopalocera we find numerous subspecies endemic to Eastern Ghats.

A. Endemic Taxa (Plants) in Eastern Ghats

Source: Nayar et al (1984)

Name of the taxon (1)	Habit (2)	Distribution (3)
ACANTHACEAE		
<i>Andrographis beddomei</i> C.B. Clarke	Undershrub	Andhra Pradesh: Circars, Nallamalais 670 m & Cuddapah hills 330 m
<i>Andrographis nallamalayana</i> Ellis	Herb	Andhra Pradesh: Kurnool Dist. Hills.
<i>Barleria morrisiana</i> Bor ex C.E.C. Fischer	Shrub or undershrub	Andhra Pradesh: Circars.
<i>Dicliptera beddomei</i> C.B. Clarke	Herb	Andhra Pradesh: Nallamalais, Kurnool Dist.
<i>Justicia gingiana</i> Sebastine & Rama Murthy	Shrub	Tamil Nadu: Gingee R.F., South Arcot
<i>Neuracanthus neesianus</i> C.B. Clarke	Undershrub	Tamil Nadu: Arcot Dist.
<i>Nilgirianthus circarensis</i> (Gamble) Bremek.	Shrub	Andhra Pradesh: Circars, hills of Visakhapatnam Dist. Orissa (Kalahandi 670-1700 m).
<i>Phlebophyllaan jeyporen-</i> Bremek.	Shrub	Orissa: Koraput. Andhra Pradesh: Circars, hills of Visakhapatnam & Godavari.
<i>Rostellularia vahlii</i> (Roth) Nees var. <i>rupicola</i> Ellis	Herb	Andhra Pradesh: Srisailam, Nallamalais, Kurnool Dist.
<i>Santapaua madurensis</i> Balakr. ex Subramanyam	Herb	Tamil Nadu: Alagar hills, Madurai 200 m, Pudukottal & Tanjore Dist.

Name of the taxon (1)	Habit (2)	Distribution (3)
ANNONACEAE		
<i>Alphonsea madraspatana</i> Bedd.	Tree	Orissa: Barkuda island. Chilka Lake. Andhra Pradesh: Visakha patnam-Cuddapah Dist. Tamil Nadu: N. Arcot 1000 m.
<i>Uvaria eucinata</i> Bedd.	Scandent or straggling	Orissa: Ganjam, Mahendragiri hills. Goomsur forest: West Russelkonda 670 m.
APIACEAE		
<i>Berpleururn andhricum</i> Nayar & Banerji	Herb	Orissa: Koraput, Ganjam, Kalahandi. Andhra Pradesh: Circars-Araku, Palakonda, Devagiri.
<i>Pimpinella tirupatiensis</i> Balak. & Subramanyam	Herb	Andhra Pradesh: Tirupati hills. Japalatirtha, Dharmagiri and Talakona.
ASCLEPIADACEAE		
<i>Brachystelma ciliatum</i> Arekal & Rama krishna	Herb	Karnataka: Kolar Dist., 920 m.
<i>Brachystelma glabrurn</i> Hook. f.	Herb	Andhra Pradesh: Cuddapah hills.

- Brachystelma kolarensis* Herb Karnataka: Kolar Dist.
 Arekal & Rama Krishna
- Brachystelma volubile* Twining herb Andhra Pradesh: Cuddapah hills,
 Hook. f 670m
- Caralluma indica* N.E. Br. Fleshy herb Andhra Pradesh: Circars &
 Nellore Dist.
- Caralluma lasiantha* Herb Andhra Pradesh: Hills of
 N.E. Br. Chittoor and Anantapur Dist.
- Toxocarpus roxburghii* Twining shrub Andhra Pradesh: Circars.
 Wight & Am.

ASTERACEAE

- Notonia shevaroyensis* Scapigerous Tamil Nadu: Shevaroy, Salem
 Fyson herb DisL, 1500m
- Vernonia shevaroyensis* Tree Andhra Pradesh: Southern Gamble
 Circars. Tamil Nadu: Salem Dist.

BORAGINACEAE

- Cordia domestica* Roth Shrub or Tamil Nadu: Kambakam hills,
 small tree Chingleput Dist.
- Cordia evolutior* Small tree Karnataka: Mainhalli. Tamil
 Gamble Nadu: Melpat, S. Arcot.

BURSERACEAE

- Boswellia ovalifoliolata* Tree Andhra Pradesh: Nallamalais,
 Balakr. & Henry Kurnool Dist. Tirupati hills,
 Chittoor Dist., 300 m.

CELASTRACEAE

- Maytenus bailadillana* Shrub or Orissa: Kalahandi-Koraput.
 (Swamy & Mooney) small tree Madhya Pradesh: Bastar.
 Raju & S. Biswas

CONVOLVULACEAE

- Argyreia arakuensis* Twiner Andhra Pradesh: Araku valley,
 Balakr. Visakhapatnam Dist.

CRASSULACEAE

- Kalanchoo cherukondensis* Succulent Andhra Pradesh: Cherukonda 1100
 Subba rao & Kumari herb Visakhapatnam Dist.

CYCADACEAE

- Cycas beddomei* Shrub Andhra Pradesh: Cuddapah &
 Dyer Tirupati hills, Chittoor Dist.,
 340-1000 m

DIPTEROCARPACEAE

- Shorea tumbergaia* Tree Andhra Pradesh: Cuddapah,
 Roxb. Nellore Veligonda, Tirupati
 hills, Chittoor Dist. Tamil
 Nadu: N. Arcot, Chingleput, 1000m

EUPHORBIACEAE

- Bridelia cinerascens* Tree Andhra Pradesh: Palkonda hills,
 Gerhm Cuddapah, Veligonda-Nellore.
 Tamil Nadu: Chingleput.
Chaemaesyce linearifolia Herb Andhra Pradesh: Nallamalais,
 (Roth) J. Sojak Kurnool Dist.

- Chaemaesyce senguptae* Herb Andhra Pradesh: Guvvala cheruvu,
(Balakr. & Subr.) Cuddapah Dist., Ramanapenta,
V.S. Raju & P.N. Rao Nallamalais, Kurnool Dist.
- Croton scabiosus* Bedd. Tree Andhra Pradesh: Cuddapah &
Kurnool Dist. 300-1200 m.
- Lasiococca comberi* Tree Andhra Pradesh. N. Circars,
Haines Visakhapatnam Dist. 1000-1400 m.
- Phyllanthus narayan-* Undershrub Andhra Pradesh: N.Circars, Rampa
swamii Gamble hills, Godavari, Cherukonda
Visakhapatnam Dist. 1500 m.
- Tragia gagei* Haines Herb Orissa: Mals of Puri. Andhra
Pradesh: Circars.
- FABACEAE
- Alysicarpus mehabubnaga-* Herb Andhra Pradesh: Forest of
rensis Raghava Rao *et al.* Mehaboob nagar district.
- Cajanus cajanifolia* Undershrub Orissa: Khurda-Ganjam.
(Haines) Maesen Andhra Pradesh: Visakhapatnam, ,
(= *Atylosia cajanifolia* Haines) Godavari. Madhya Pradesh: Bastar.
- Crotalaria madurensis* Undershrub Andhra Pradesh: Srisailam.
Wt. var. *kurnoolica* Ellis & Swam.
- Crotalaria paniculata* var. Undershrub Andhra Pradesh: Nagarjunakonda,
nagarjunakondensis Willd. var. Nalgonda Dist.
Thothathri
- Crotalaria sandoorensis* Undershrub Karnataka: Sandoor hills of
Bedd. Bellary.

- Crotalaria shevaroyensis* Undershrub Tamil Nadu: Shevaroy hills,
Gamble Salem, Madura Dist. 1000 m.
- Indigofera barberi* Undershrub Andhra Pradesh: Cuddapah,
Gamble Nallamalais, 325 m. Kurnool
Dist. Tamil Nadu: S. Arcot Dist.
and Salem Dist.
- Pterocarpus santalinus* Tree Andhra Pradesh: Cuddapah,
L.f. Kurnool. Tamil Nadu: Arcot,
Chingleput up to 500 m.
- Rhynchosia beddomei* Undershrub Andhra Pradesh: Cuddapah hills,
Baker Tirupati & Horsleykonda.
Karnataka: Bellary Dist.
- Sophora interrupta* Bedd. Shrub or Andhra Pradesh: Cuddapah,
small tree Nellore and Mehboobnagar. Tamil
Nadu: N. Arcot, 1000 m.
- Tephrosia roxburghiana* Undershrub Orissa: South of Ganjam. Andhra
J.R. Drumm. Pradesh: Circars, Hills of
Visakhapatnam and Godavari Dist.
Karnataka: Bellary Dist.

LAMIACEAE

- Leucas diffusa* Benth. Herb Andhra Pradesh: Godavari
Southwards. Tamil Nadu:
Shevaroy.
- Leucas Lavandulifolis* Herb Andhra Pradesh: Nagalapuram
nagalapuramiana Chand. hills, Chittoor Dist.

- Leucas mollisima* Straggling Andhra Pradesh: Visakhapatnam
 Wall.var. *sebastiana* herb Dist.
 Subba Rao & Kumari
- Leucas mollisima* Straggling Andhra Pradesh: Visakhapatnam
 Wall.var. *silvestriana* herb Dist.
 Subbarao & Kumari
- Leucas mukerjiana* Herb or Andhra Pradesh: Cherukonda,
 Subba Rao & Kumari Undershrub Ballikonda near Aruku valley,
 Visakhapatnam.
- Leucas nepetaefolia* Shrub Deccan: Hyderabad and Guntur
 Benth. Dist.
- LAURACEAE
- Actinodaphne madras-* Tree Andhra Pradesh: Cuddapah,
patana Bedd. Nellore, Nagari hills, Chittoor
 1000 m. Tamil Nadu: Chingleput
 Dist. 600-800 m
- LILIACEAE
- Urgineae nagarjunae* Bulbous herb Andhra Pradesh: Nalgonda Dist.
 Hemadri & Swahari
- MALVACEAE
- Decaschistia cuddapah-* Shrub Andhra Pradesh: Cuddapah,
ensis T. K. Paul & Chittoor Dist. Tamil Nadu:
 Nayar North Arcot Dist. 150-600 m.

Decaschistia rufa Craib Shrub
Tamil Nadu: Tiruvallur &
Kambakam hills in Chingleput
Dist. Andhra Pradesh: Balapally,
Cuddapah Dist.

MELASTOMATACEAE

Memecylon madgolense Shrub
Gamble Andhra Pradesh: Circars, Madagol
hills, Visakhapatnam Dist.
1000-1500m.

MELIACEAE

Aglaia haslettiana Tree
Haines Orissa: Angul, Mals of Puri.

Cedrela breyipetiolata Tree
Orissa: Mals of Orissa.

MIMOSACEAE

Albizia orissensis Tree
Sahani & Bennet Orissa: Near Panasa.

Albizia sikharamensis Tree
Sahani & Bennet Andhra Pradesh: Sikharam,
Srisailam.

ORCHIIDACEAE

Habenaria panigrahiana Herb
var. *panigrahiana* S. Misra Orissa: Ganjam Dist., Mohana on
foot hills.

Habenaria panigrahiana Herb
var. *parviloba* Orissa: Ganjam Dist.,
Bhanjanagar.

S. Misra

- Habenaria ramayyana* Herb Andhra Pradesh: Mahboobnagar
S.T.Ramachandrachary Dist.
& J.J.Wood
- Vanilla wightiana* Herb Andhra Pradesh: Rajavommangi.
Lindl area (East Godavari Dist.),
Ramakuppam (Chittoor Dist.)
Tamil Nadu: Hills in Tiruchi &
Salam Dist.
- POACEAE
- Arundinella setosa* Herb Andhra Pradesh: Cuddapah,
Trin. var. *lanifera* Magilikuppa 1000 m.
C.E.C. Fischer
- Chrysopogon velutinus* Herb Andhra Pradesh: Cuddapah Dist.
(Hook. f.) Bor
- Dimeria mahendragiri-* Herb Orissa: Mahendragiri hills.
ensis Saxena & Brahmam
- Dimeria orissae* Bor Herb Orissa: Koraput Dist.
- Iseilema venkateswarlui* Herb Andhra Pradesh: Guntur
Satyavathi
- Oryza jeyporensis* Herb Orissa: Koraput Dist.,
Govind. & Krish. Borigumma, Boiparguda-Jeypore.
- Parahyparrhenia bella-* Herb Andhra Pradesh: Gooty Fort hills
rensis (Hack.) near Guntakal adjoining Bellary.
Clayton
- Themeda mooneyi* Herb Orissa: Near Potangi-Koraput
Bor Dist. 1300 m.

- Themeda saxicola* Herb Orissa: Raissili village,
Bor Koraput Dist. 1000 m.
- RUBIACEAE
- Lasianthus truncatus* Shrub Orissa: Mahendragiri, Ganjam
Bedd. 1500 m. Andhra-Pradesh:
Visakhapatnam hills.
- Pavetta madrassica* Shrub Andhra Pradesh: Krishna, Nellore
Bremek. & Visakhapatnam Dist. Tamil
Nadu: Odyan Kolopatte,
Andyarbeach, Madras.
- Wendlandia gamblei* Tree Orissa: Mahendragiri Hills,
Cowan Ganjam 1500 m. Andhra Pradesh:
Ventala-Rampa hills,
Visakhapatnam Dist.
- RUBIACEAE
- Triphasia reticulata* Spiny shrub Andhra Pradesh: Balapalle,
Smith var. *parvi-* Seshachalam hills, Cuddapah
flora Santapau Dist.
- STERCULIACEAE
- Eriolaena lushingtonii* Dunn Tree Andhra Pradesh: Circars,
Nallamalais. Rampa hills of
Godavari Dist., Karnataka, Tamil
Nadu, Kerala, 300-900 m.
- VERBENACEAE
- Premna hamiltonii* Tree Andhra Pradesh: N. Circars,
(Buch.-Ham.) Ellis Nallamalais. Rampa hills of
Godavari Dist.

ANNEXURE IV

A. Endangered Plants in Eastern Ghats

- 1 *Acacia campbelli* Arn. (Fabaceae)
- 2 *Albizia thompsoni* Brandis (Fabaceae)
- 3 *Ceropegia spiralis* Wt. (Asclepiadaceae)
- 4 *Cycas beddomei* Dyer (Cycadaceae)
- 5 *Decaschistia rufa* Craib (Malvaceae)
- 6 *Eriolaena lushingtonii* Dunn. (Sterculiaceae)
- 7 *Hildegardia populifolia* (Roxb.) Schott. & Endl. (Sterculiaceae)
- 8 *Indigofera barberi* Gamble (Fabaceae)
- 9 *Isonandra villosa* Wt. (Sapotaceae)
- 10 *Leucas mukherjiana* Subba Rao & Kumari (Lamiaceae)
- 11 *Nilgirianthus circarensis* (Gamble) Bremek (Acanthaceae)
- 12 *Phlebophyllum jeyporensis* (Bedd.) Bremek. (Acanthaceae).
- 13 *Phyllanthus narayanaswami* Gamble (Euphorbiaceae)
- 14 *Pimpinella tirupatensis* Balakr. & Subr. (Apiaceae)
- 15 *Rhynchosia beddomei* Baker (Fabaceae)
- 16 *Toxocarpus longistigma* (Roxb.) Wt. & Arn. ex Steud. (Asclepiadaceae)
- 17 *Andrographis beddomei* C.B. Clarke (Acanthaceae)
- 18 *Dicliptera beddomei* C.B. Clarke (Acanthaceae)
- 19 *Dimorphocalyx kurnoolensis* Venkataraju & Pullaiah (Euphorbiaceae)
- 20 *Euphorbia senguptae* Balakr. & Subr. (Euphorbiaceae)
- 21 *Habenaria rariflora* Rich. (Orchidaceae)
- 22 *Iseilema venkateswarlui* Satyavath. (Poaceae)
- 23 *Oianthus disciflorus* Hook. f. (Asclepiaceae)

- 24 *Scyphiphora hydrophyllacea* Gaertn. (Rubiaceae)
- 25 *Vanilla wightiana* Lindl. (Orchidaceae)
- 26 *Cyathea spinulosa* Wall. ex Hook. (Cyatheaceae)
- 27 *Cyathea gigantea* (Wall. ex Hook.) Holtt. (Cyatheaceae)
- 28 *Cyathea nilgirensis* Holtt. (Cyantheaceae)
- 29 *Equisetum ramosissimum* Desf. (Equisetaceae)
- 30 *Psilotum nudum* (L.) Beauv. (Psilotaceae)
- 31 *Shorea tumbaggaia* Roxb. (Dipterocarpaceae)
- 32 *Vernonia shevaroyensis* Gamble (Asteraceae)
- 33 *Uvaria eucineta* Dunn. (Annonaceae)

B. Wild relatives of Crop Plants occurring in Eastern Ghats

(Source : Ellis, 1982)

- 1 *Oryza meyeriana* (Zollin. & Mor.) Baill. (Poaceae)
- 2 *Oryza officinalis* Wall. ex Watt. ssp. *malampuzhaensis* (Krishn. et Chandr.)
Tateoka (Poaceae)
- 3 *Oryza rufipogon* Griff. (Poaceae)
- 4 *Oryza jeyporensis* (Poaceae)
- 5 *Cajanus cajanifolia* (Haines) van der Maesen (Fabaceae)
- 6 *Cajanus albicans* (Wight & Arn.) van der Maesen (Fabaceae)
- 7 *Cajanus crassus* (Prain & King) van der Maesen (Fabaceae)
- 8 *Cajanus rugosus* (Wight & Arn.) van der Maesen (Fabaceae)
- 9 *Cajanus scarabaeoides* (L.) du Petit Thou (Fabaceae)
- 10 *Cajanus sericeus* (Benth. ex Baker) van der Maesen (Fabaceae)
- 11 *Piper nigrum* Linn. (Piperaceae)
- 12 *Piper attenuatum* Buch.-Ham ex Miq. (Piperaceae)
- 13 *Piper hymenophyllum* Miq. (Piperaceae)

C. Endangered Animal species in Eastern Ghats

Butterflies and Moths (Lepidoptera)

- 1 *Discophora lepida lepida* (Moore)
The Southern Duffer, Family: Danaide
- 2 *Euploea crassa* (Butler) The Brown Crow
- 3 *Amblypedia bazaloides* (Hew) The Tamil Oak Blue
- 4 *Catapoecilma elegans myositina* (Fruh.) The Common Thisel
- 5 *Charana athora* (Hew) The Orchid Tit
- 6 *Horaga viola* (Moor). Brown Oryx, Family: Nymphalidae
- 7 *Doleschallia bisaltide andamana* (Fruhstroefler) Family: Satyridae
- 8 *Zipoetis saitis* (Hew) The Tamil Catseye

Mammals

- 9 *Antelope cervicarpe* (Linnaeus) Black Buck
- 10 *Bos gaurus gaurus* (Smith) Indian Bison
- 11 *Tragulus meminna* Mouse deer
- 12 *Bubalus bubalis* (Linnaeus) Wild Buffalo
- 13 *Cervus unicolor* (Kerr.) Sambar
- 14 *Coun alpinus* (Palas) Wild Dog
- 15 *Elephas maximus* (Linnaeus) Indian Elephant
- 16 *Felis bengalensis* (Kerr.) Leopard cat
- 17 *Gazelle bennitti* Chinkara or Indian Gazelle
- 18 *Loris tardigradus* (Linnaeus) Slender Loris
- 19 *Macaca arctoides* (Geoffray) Slump tailed Macaque
- 20 *Macaca fascicularis* (Ragflers) Crab eating Monkey
- 21 *Macaca nemestrina* (Linnaeus) Fig tailed Macaque

22 *Macaca radiata* Bonnet Macaque

23 *Panthera tigris* Tiger

Birds

24 *Buceros bicornis homrai* Great Pied Hornbill

25 *Cairina setulata* (S. Muller) White winged Wood duck

26 *Choriotis nigriceps* (Vigers) Great Indian Bustard

27 *Cursorius bitorquatus* (Blyth) Jerdon's Courser

28 *Falco peregrinus* (Tunstall) Falcon

29 *Falco biarmious* (Tamminck) Falcon

30 *Haliacetus leucogaster* (Gmelin) White bellied Sea Eagle

31 *Pelecanus phillippensis* Grey Pelicans

32 *Ardea cinera* Grey Herons

33 *Leptoptilos dubius* Adjudant Storks

34 *Anastorus oscitans* Open Billed Stork

35 *Ibis leucocephalus* Painted Storks

36 *Phenicopterus rosens* Lesser Flamingoes

37 *Haliastur indus* Brahming Kite

38 *Pavo cristatus* Peacock, Pea fowl

39 *Gallus sonneratii* Grey jungle Fowl

40 *Gallus gallus* - Red jungle Fowl

41 *Sypheotides indica* - Lesser Florican

42 *Laurus brunnicephalus* Brown headed quail.

43 *Tockus birostris* - Grey Hornbill

44 *Anthra coceros coronatlis* Pied Hornbill

45 *Dinopium benghalense* Golden backed Woodpecker

- 46 *Picoides manus* Pigmy Woodpecker

Reptiles

- 47 *Crocoylus porosus* (Schneider) Estuarine Crocodile
48 *Croylus palustris* (Lesson) Fresh water Crocodile
49 *Vipera russeli* (Shaw) Russels Viper
50 *Naja naja naja* (Linnaeus) Common Cobra
51 *Bungarus caeruleus* (Schneider) Common Krait
52 *Eryz johni johni* (Russel) Sand Boa
53 *Python molurus* (Linnaeus) Python
54 *Veranus bengalensis* (Boulenger) (Monitor lizard)
55 *Barkudia insularis* (Annandale) Limbless lizard
56 *Chamaelon zeylanicus* (Laurenti) Chamaeleon
57 *Calodactylodes aureus* (Beddome) Golden lizard or Gecko
58 *Geochelone elegans* (Schospff) Starred Tortoise
59 *Kachuga tectum tectorica* Fresh water Tortoise
60 *Lissemys punctata granosa* (Schospff) Flapshell Turtle

Amphibians

- 61 *Rana tigrina* (Daudin) Common Frog
62 *Microphyla ornata* (Dum. & Bibr.) Flying Frog
63 *Rhacophorus leucomystax* (Gravanherst) Tree Frog.

Annexure V**Environmental Protection and Conservation Laws in India****Central Enactments****5.1. Water Pollution**

The River Boards Act 1956

The Merchant Shipping (Amendment) Act 1987

The water (Prevention and control of Pollution) Act 1974, amended in 1988

The Water (Prevention and control of Pollution) Cess Act 1977

The North India Canal and Drainage Act, 1873

The Indian Fisheries Act, 1897

The Damodar Valley Corporation (Prevention of Pollution of Water) Regulation Act
1948

The Environment (Protection) Act 1986

5.2. Air Pollution

The Air (Prevention and control of Pollution) Act, 1981, amended in 1987

The Indian Boiler's Act 1923

The Factories Act 1948, amended in 1987

The Industries (Development and Regulation) Act, 1951

The Mines and Minerals (Regulation and Development) Act 1947

The Oriental Gas Company Act, 1857

The Indian Explosives Act, 1884

The Explosives substances Act, 1908

The Motor Vehicles Act, 1938, amemdedin 1988and rules in 1989

The inflammable substances Act, 1952

The Petroleum Act, 1934 and Rules, 1979

The Environment (Protection) Act, 1986

5.3. Noise Pollution

The Environment (Protection) Act, 1986

5.4. Marine Pollution

The Share Nuisance (Bombay and Colaba) Act, 1953

The Obstruction of Fairways Act, 1891

The Indian Fisheries Act, 1987

The Indian Ports Act, 1908

The Major Ports Trust Act, 1963

The Merchant Shipping (Amendment) Act, 1987

The Territorial waters, Continental Shelf Exclusive Economic Zone and other
Maritime Zone Act, 1976

The Coast Guards Act, 1978

5.5. Hazardous Substances

The Poison Act, 1919

Dangerous Drugs Act, 1930

The Drugs and Cosmetics Act, 1940

The Factories Act, 1948, amended in 1987

The Prevention of Food Adulteration Act, 1954

The Industries (Development and Regulation) Act, 1951

The Insecticides Act, 1968

The Environment (Protection) Act, 1986

The Consumer (Protection) Act, 1986

5.6 Radiation

The Atomic Energy Act, 1962

Radiation Protection Rules, 1971

5.7 Pesticides

The Insecticides Act, 1968

The Factories Act, 1948, amended 1987

The Poison Act, 1919

5.8. Forest and Wild Life conservation

The Indian Arms Act, 1978

The Wild Life (Protection) Act, 1972

The Indian Forest Act, 1927

The Forest (Conservation) Act, 1980 as amended 1988

5.9 Others

The Urban Land (Ceiling and Regulation) Act, 1976

The Prevention of Food Adulteration Act, 1954

The Ancient Monuments and Archaeological Sites and Remains Act, 1958

The Slum Areas (Improvement and Clearance) Act, 1956

State Enactments

5.10. Water pollution

The Orissa River Pollution Prevention Act, 1953

The Maharashtra Prevention of Water Pollution Act, 1969

5.11. Smoke Control

The Bengal Smoke Nuisance Act, 1905

The Gujarat Smoke Nuisance Act, 1963

The Bombay Smoke Nuisance Act, 1912

5.12. Pest Control

The Andhra Pradesh Agricultural Pest and Diseases Act 1999

The Assam Agricultural Pests and Diseases Act, 1954

The U.P. Agricultural Diseases and Pests Act, 1917

The Kerala Agricultural Pests and Diseases Act, 1958

5.13. Land Utilization and Land Improvement

The Andhra Pradesh Improvement Schemes Act, 1949

The Acquisition of Land for Flood Control and Prevention of Erosion Act, 1955

The Bihar Waste Lands (Reclamation) Cultivation and Improvement Act, 1946

The Delhi Restriction Use of Land Act, 1964

The Madhya Pradesh Nagar Tatha Gram Nivesh Adhiniyam. 1973

The Madhya Pradesh Gandhi Basti Kshetra (Sudhar tatha Nirmulan) Adhiniyam,
1976

The Madhya Pradesh Town (Periphery) Control Act, 1960

The Madhya Pradesh Regulation of Uses of Land Act, 1948

5.14. Forest and Wild Life Conservation

The Madras Elephants Preservation Acts, 1873 and 1879

The Nilgiris Game and Fish Preservation Act, 1879

The Indian Arms Act, 1878

The Wild Birds and Game Protection Act, 1887

Notifications in 1902 under Sea Customs Act 1878

The Wild Birds and Animal Protection Act, 1912

The Bengal Rhinoceros Prevention Act, 1932

The Punjab Wild Birds and Wild Animals Protection Act, 1933

Andhra Pradesh Forest Act, 1967

Arunachal Pradesh Forest Reserve (Constitution and Maintenance) Act, 1975

Karnataka Forest Rules 1969

Kerala Forest Act, 1961

Meghalaya Forest (Removal of Timber) Regulation Act, 1981

Nagaland Forest Act, 1968

Orissa Forest Act, 1972

Punjab (Sale of Timber) Act, 1913

Rajasthan Forest Act, 1953

U.P. Protection of Trees in Rural and Hill Areas Act, 1976

Indian Forest (West Bental Amendment) Act, 1988

(Source: Government of India/Ministry of Environment and Forests (1990)

'National Strategy for Conservation and Sustainable Development).