

FLORA OF ANDAMAN-NICOBAR ISLANDS

VOL. I : RANUNCULACEAE TO COMBRETACEAE



BOTANICAL SURVEY OF INDIA
Ministry of Environment and Forests

Mangrove Vegetation

Xylocarpus moluccensis (Lam.) M. Roemer

FLORA OF ANDAMAN & NICOBAR ISLANDS

VOLUME I
(RANUNCULACEAE TO COMBRETACEAE)

Editors:

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FOREWORD


I am glad to know that the Botanical Survey of India, Andaman & Nicobar Circle, Port Blair is bringing out a book on Flora of Andaman and Nicobar Islands (Vol. I).

The isles, endowed with a rich heritage of varied Flora and Fauna, are often described as a 'natural garden' or 'green emeralds' in the lap of Bay of Bengal. As the verdure in the form of forests occupies over eighty five per cent of the total geographical area in this biogeographical zone, the islands are fascinating and becoming a cynosure for many of the nature lovers. With their pristine glory and historical background the islands have been getting transformed into a botanical as well as tourist paradise in our country.

The plant wealth, a part of which is portrayed in this publication, it is hoped, will certainly be of much use for the islanders as a source of food, shelter and medicine. While 'A Forest Flora of Andaman Islands' published by Parkinson (1923) had dealt with the plants of Andaman islands, the present volume has been devoted to Nicobar Islands also besides Andaman Islands so that the plant resources are utilised on sustainable basis. This endeavour is likely to supplement our efforts in conserving the rare and endangered insular species especially in the protected areas, thus enabling us to pass over this heritage to the posterity.

The editors deserve all praise for making the volume available at a time when environmental issues are of major concern to the mankind.

Raj Niwas,
30-09-98.


(I.P. Gupta)
Lieutenant Governor
A & N Islands.

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Thanks are also extended to the scientists and staff who happened to work in these remote islands and in making available the present volume.

They are highly indebted to the former Directors of Botanical Survey of India in initiating this project and for their guidance in various ways. The technical assistance extended by the staff and officers of the Publication Section of BSI at Calcutta deserve special mention.



Saddle Peak National Park in North Andaman



Pterocarpus dalbergioides Roxb.
(Padauk)



A panoramic view of the Andaman coast



Littoral forest in Rutland



Orophea katschallica Kurz -
Flower with the inner petals clawed and vaulted



Orophea katschallica Kurz
(Fruiting)



Cyathostemma viridiflorum Griff.



Goniiothalamus sp.



Garcinia andamanica King



Garcinia sp.



Dillenia indica L.



Goniothalamus macranthus (Kurz) Boerl.



Casearia andamanica King



Calophyllum inophyllum L. - Inset: Flowering & Fruiting



Dipterocarpus alatus Roxb.



Thespesia populnea Correa



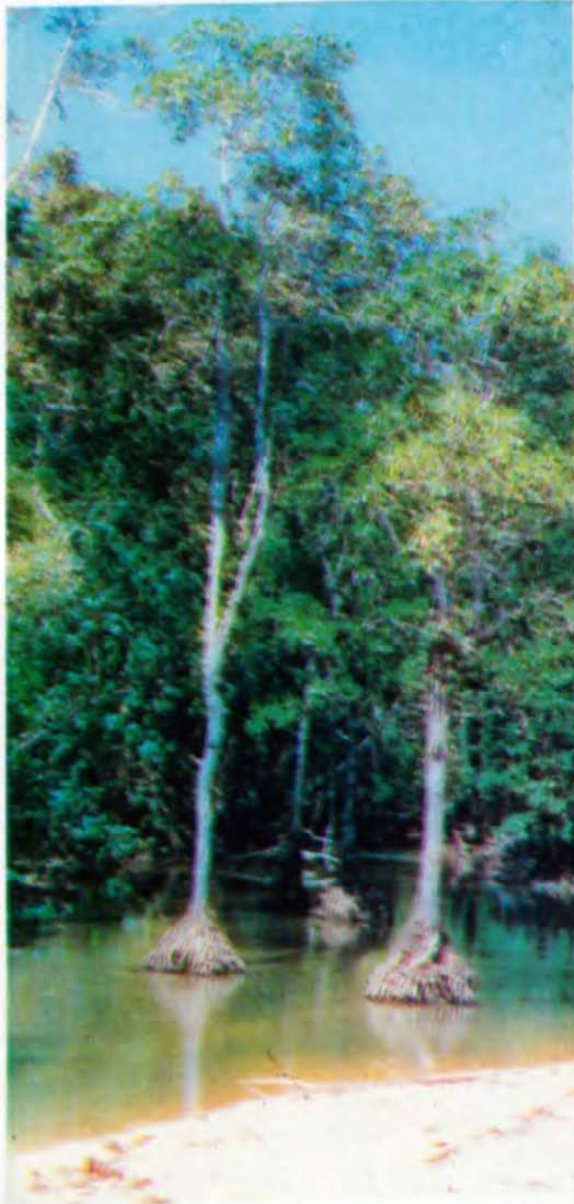
Sterculia villosa Roxb.



Heritiera littoralis Dryander



Heritiera littoralis Dryander - (curving buttresses)



Bruguiera gymnorhiza Lam.



Rhizophora mucronata Lam.



Xylocarpus moluccensis (Lam.) M. Roemer



Micromelum minutum (Forst. f.) W. & A.



Byttneria andamanensis Kurz



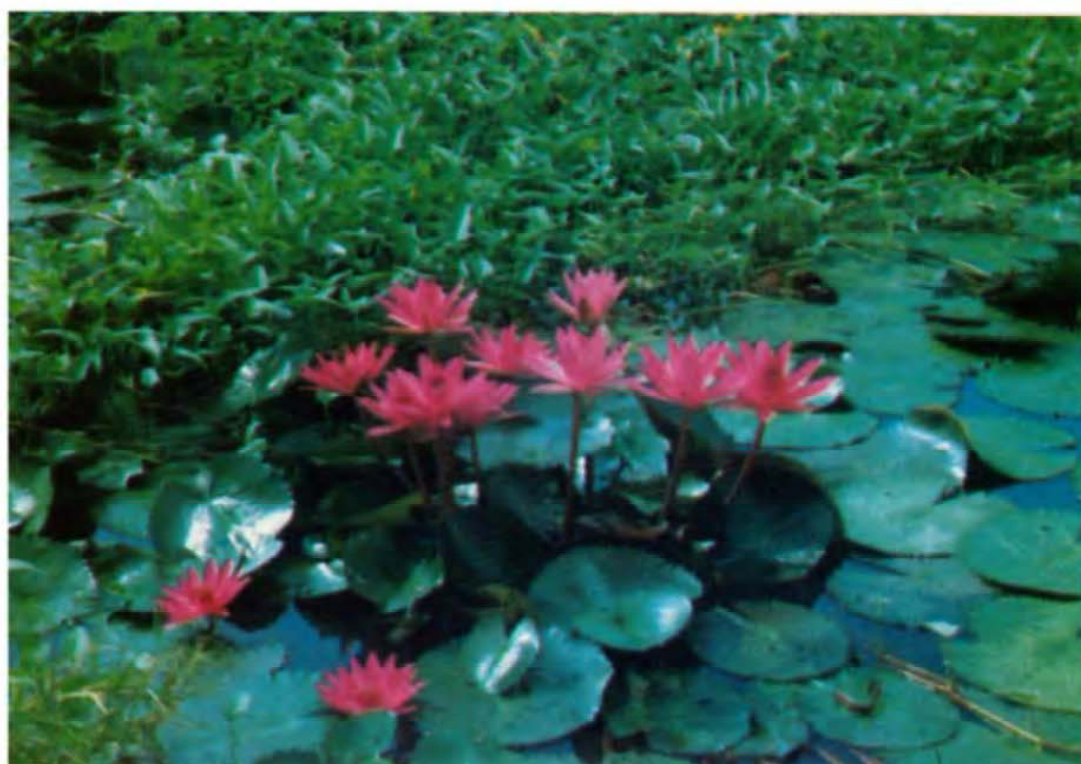
Leea indica (Burm. f.) Merr.



Strongylodon lucidus (Forst.) Seemann



Combretum extensum Roxb.



Nymphaea nouchali Burm.

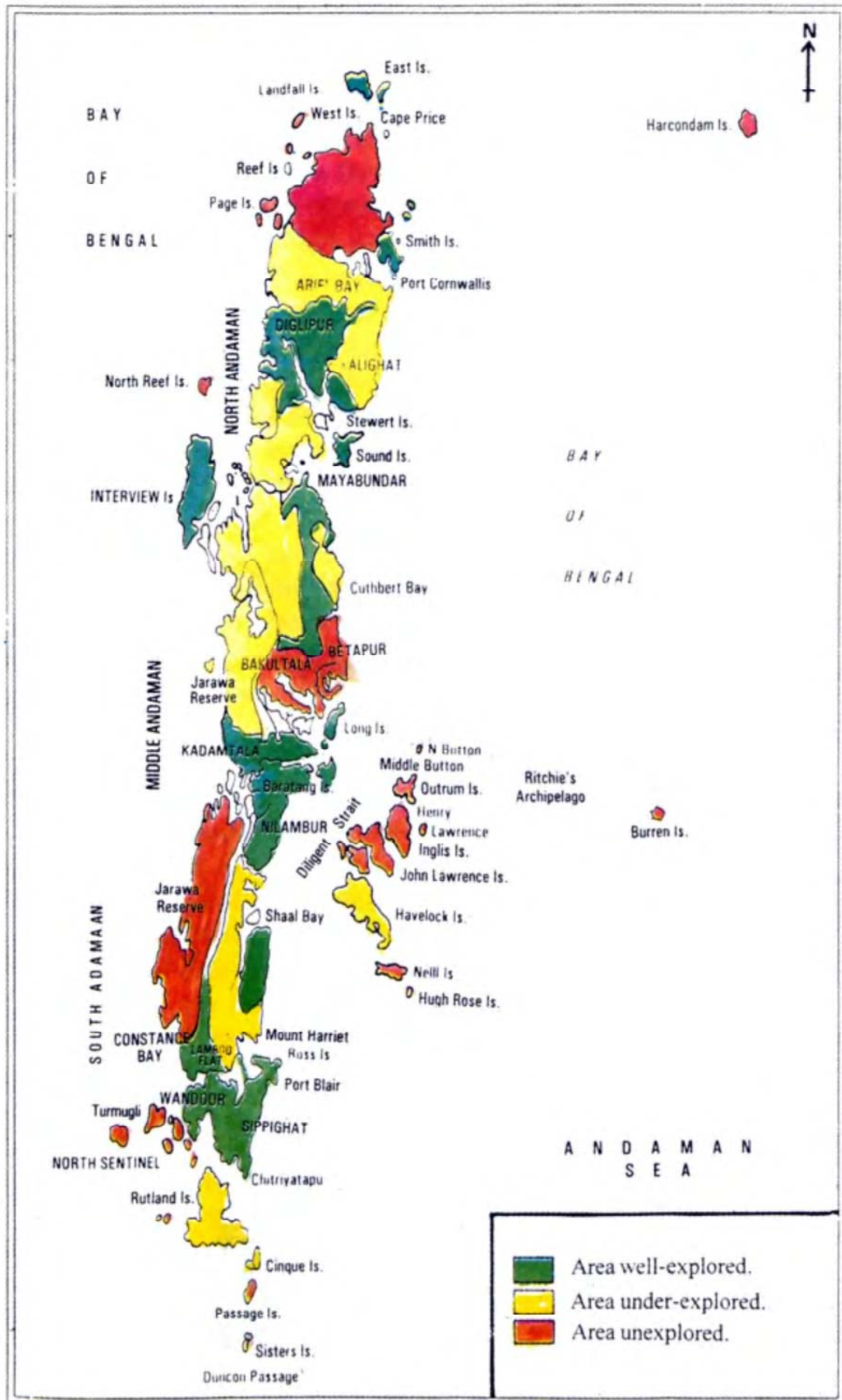


Mangrove Vegetation

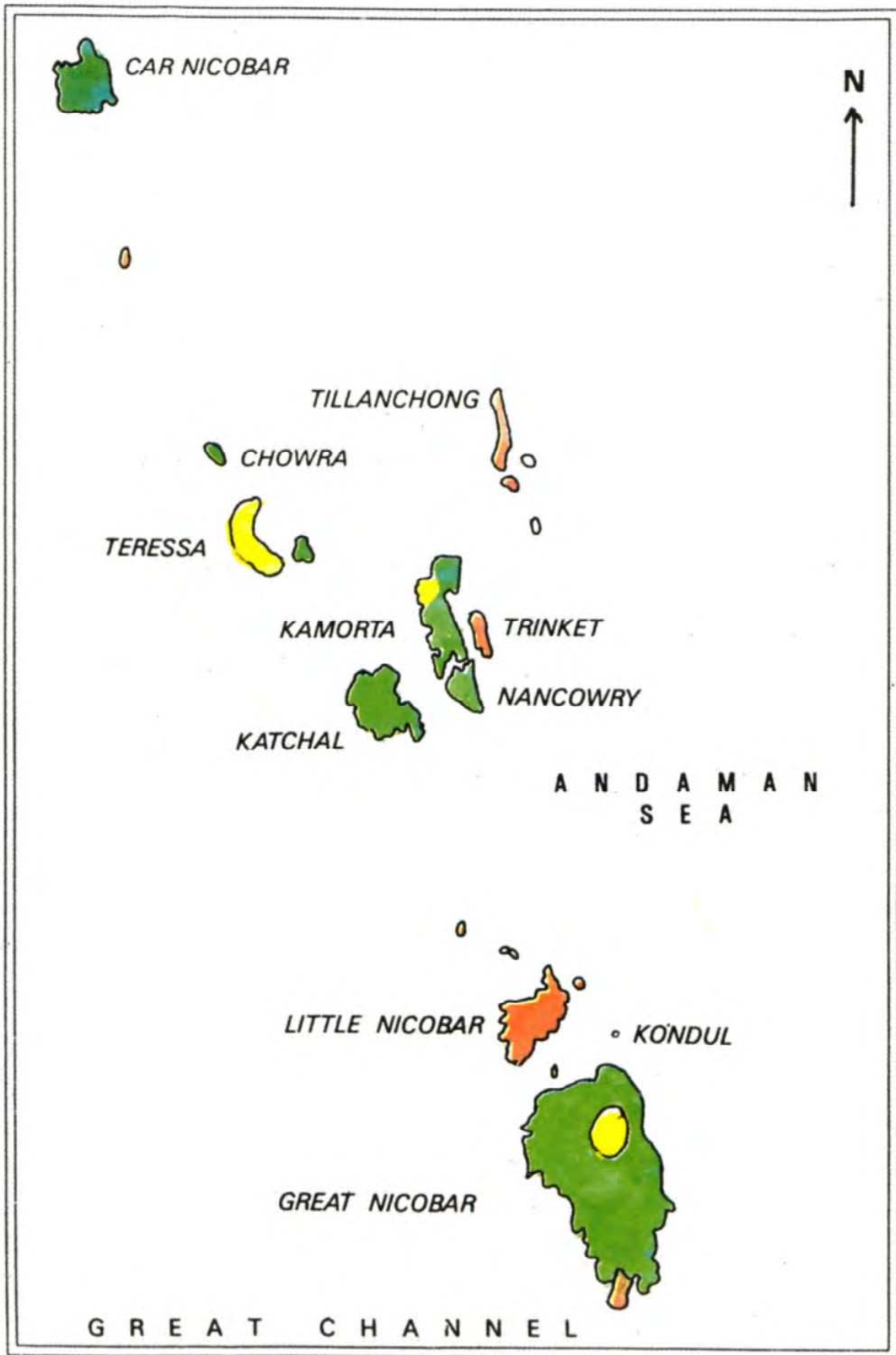
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MAP OF ANDAMAN ISLANDS



MAP OF NICOBAR ISLANDS

INTRODUCTION

(P.S.N. Rao)

The Andaman & Nicobar Archipelago consisting of about 572 islands and islets lies in the lap of the Bay of Bengal (6-14° N. Lat. and 92-94° E. Long.). Often described as islands of the marigold sun, they were known throughout the country as KALAPANI because of their having been a penal settlement under British rule, a reputation fast shedding since independence. Oriented in a north-south direction and simulating an arc stretching over a length of about 912 km the islands have a maximum width of 57 km. The northernmost Landfall island is separated by sea of about 190 km from the mainland of Myanmar and the southernmost Great Nicobar island is about 150 km away from Sumatra. The Andaman group of islands is separated from the Nicobar group by a 150 km wide under sea deep channel situated at 10° N latitude, also called Ten degree channel. The islands have a total land area of 8249 sq km with a coastline of 1962 km which is highly indented and several creeks penetrate into the island from inland bays. The highest hill in the Andaman group is Saddle Peak reaching a height of about 720 m and in the Nicobar group is Mt. Thullier with an altitude of about 670 m above msl.

Among all the States and Union Territories of India, the Union Territory of Andaman & Nicobar Islands is unique because of the tropical humid climate and insular nature with no contiguity of land with rest of the country. Classified to be one of the 12 biogeographical zones in India, the Andaman & Nicobar Islands have a biodiversity profile of over 5500 animal species, 2000 indigenous and several non-indigenous angiospermic species besides many cryptogamic species in three important natural ecosystems viz., the forest ecosystem, the marine ecosystem and the interface between the two, the mangrove ecosystem. The topographical features, the climatic regime and the soil characteristics are the foundations on which these interconnected systems are built up and the linkages between these natural ecosystems are governed by geological and physiographic conditions. Within each of these natural systems there are several interlinked subsystems constituting cycles of energy, matter and nutrients. The rich heritage of the biological wealth is directly and indirectly dependent on these cycles for sustenance.

GEOLOGY

The islands are mainly of thick Eocene sediments deposited on pretertiary fine grey sandstone, shales and silt stones in which basic and

ultrabasic igneous rocks are found to be intrusive. The calcareous sandstones and sand rocks are interspersed with conglomerates and intercalated clays. Higher elevations are characterised by serpentine and gabbro- formations while coral reef formations of recent origin are important geological formations in the intertidal belt. The rock formations of southernmost Great Nicobar island are said to be of younger tertiary age and are geologically similar to the south-west coast of Sumatra and younger in origin than that of the Andaman group of islands. The soils are immature, loose in texture, poor in drainage and low in moisture retaining capacity. As the soils are poor in nutrient content, the entire nutrient capital necessary for the continuous growth of lush green tropical vegetation is tied up in the living plant itself. Sandy alluvial soil is generally found in the creeks and sheltered coasts. The richer grey, brown and red soils are found in the inland forests and humus is not able to accumulate much as it is washed away by torrential rains.

CLIMATE

The monsoonal regime of South-East Asia governs the climate of the islands. The general climatic condition of the islands is that of warm and humid tropics with the temperature ranging between 22°C and 30°C. The islands receive heavy rainfall from both the south-west and north-east monsoon, the former from May to September and the latter from October to December with the average annual rainfall ranging from 3000 to 3500 mm. Cyclone winds accompanied by thunder and lightning are frequent in the islands. January to March show fairly dry weather with scanty rainfall. The mean relative humidity is rather high and usually remains between 82 to 85% throughout the year.

PEOPLE

The A. & N. islands were inhabited only by a little over 5000 native aboriginals till the end of the 18th century. In the late 18th century the seafaring nations of the West made their contact with these islands so as to replenish their supply of the drinking water. The British who might have appreciated the strategic importance of the islands made a first attempt at establishing a settlement at Port Cornwallis in 1788 at Port Blair and the land was cleared for a prison and a penal colony established. Nearby Chatham island became the headquarters of the forest department and Ross island was reserved for the British residents. In the subsequent

years a number of convicts were permitted to settle in small villages so that they could be self-supporting by agriculture and cattle rearing but in a primitive way. The Bantu, Mopla and other settlements came up but lived in harmony with the nature. The post -1950 period witnessed a large scale increase in the population although there was a decrease in 1942 with the occupation of islands in 1942 by the Japanese. The population increased from 30,971 to 1,88,741 between 1951 and 1981. As per the 1991 census the total population of A. & N. islands is 2,80,661 which may be much less than the unofficial figures.

TRIBALS

There are six aboriginal groups viz. Andamanese, Onges, Jarawas and Sentineles who are negrito hunter-gatherers in some of the Andaman islands while Nicobarese and Shompens belong to Mongoloid race and live in Nicobar islands. But many of the Nicobarese are now inhabiting even in Andaman islands due to more literacy and employment.

Andamanese and Onges

The Andamanese and Onge populations have dwindled to such low figures that their long-term survival is doubtful. As per the 1981 census they are only 26 and 97 respectively and it is doubted that their contact with settler population from mainland has caused their quasi extinction.

Sentinelese

They are putting up a last ditch stand in their island hideout in South Andaman. In 1961 they were about 50 but no figures are available as per 1981 census. They are said to be most ferocious and never spare the trespassers. Attempts made by the local administration to befriend them have not been successful.

Jarawas

The Jarawas segregated in their reserves in South and Middle Andaman are anywhere between 100 and 300 but no exact figures are available. They mostly engage in hunting-gathering and consume wild pigs and yams available in the interiors of the forest.

Shompens

The Great Nicobar forests are the home of this semi-nomadic, monogamous aboriginal tribe with mongoloid features. They now number 223 and live in groups and move from place to place in the forests of the central uplands where probably they were pushed into inaccessible area by the Nicobarese who have several settlements along the coast. Their home, their food, their medicine are all from within the forest and they have also been known to fish.

Nicobarese

The Nicobarese constitute the largest tribal group in A. & N. islands and most of them live in all the inhabited islands of Nicobar district. Numbering around 22,000 their greatest concentration being in Car Nicobar they have good coconut plantations and also grow tuber and fruit crops. They rear pigs, fowl, and some cattle. Physically sturdy they augment their resources by fishing in the sea with harpoons or nets cast from their traditional boats. Influenced by Christianity under the leadership of late Bishop Richardson, they are able to cope up with some of the development of an external civilisation while retaining their tribal traditional and social culture. Encouraged by the Church and Civil administration, about 18 per cent of them are literate. Several studies are available on the life, customs, habits, house construction and boat making skills of the peace loving Nicobarese.

Settlers

There are different types of settlers in the Bay islands. In Andaman group of islands it is mostly the people from Ranchi and Chotanagpur from mainland, the privileged settlers who are the refugees from Bangladesh and other groups of people from Tamilnadu, Andhra Pradesh and Kerala who have settled by being in service organisations. There are three types of settlers viz., 337 families of ex-servicemen in southern islands of Nicobar, Sri Lankan repatriates or Bangladesh refugees settled in Little Andaman and Katchal island, and the labourers with their families who have settled for long having been engaged by local contractors for work in ALHW, FPDC and GREF etc.

VEGETATION

The insular nature of the territory, physical isolation between the islands and also from the neighbouring mainlands through millions of years has resulted in the evolution of a rare and distinct flora, which though related to the mainland Indian flora, shows much closer affinity with the Myanmar, Malaysian and Indonesian floras. The rich natural vegetation of the Andaman and Nicobar Islands can be broadly classified as tropical evergreen. Balakrishnan (1989) has dealt with the vegetation and floristics and based on the proximity of the sea and salinity of the soil, the vegetation is placed into two types as Littoral and Inland types.

ANDAMAN ISLANDS : The forests are further classified as follows:

- | | | |
|-------------|---|--|
| A. LITTORAL | : | <ol style="list-style-type: none"> 1. Mangrove forests. 2. Strand (or Beach) vegetation. 3. Tidal or Swamp forests. |
| B. INLAND | : | <ol style="list-style-type: none"> 1. Evergreen forests. 2. Deciduous forests. 3. Grasslands. 4. Hydrophytic vegetation. |

A. LITTORAL :

1. Mangrove forests

The irregular and deeply indented coastline of these islands results in innumerable creeks, bays and estuaries which facilitate the development of rich and extensive mangrove forests. The mangroves develop well in areas which are covered with brackish water during high tides, protected against heavy wave action and somewhat sheltered from high winds. They prefer clayey soil. They are found in large areas in Austin, Strait (North Andamans), Bomlungta and Charulungta (Middle Andamans), Baratang, Havelock and Wrafter creeks (South Andamans) and Little Andaman.

The mangrove vegetation is evergreen and simple in structure varying from 6 to 24 m in height. In some places like Baratang, Austin and Strait Islands the species *Rhizophora apiculata* and *Bruguiera gymnorrhiza* may attain size of 50 cm in diameter and 50 m in height. With light green foliage

and almost uniformly sized, the mangroves form an easily discernible transitional zone between the forests on land and the open sea. Considered to be one of the most important surviving formations in the world, mangroves in Andaman & Nicobar islands are estimated to occupy 1,15,000 h i.e. 11.5 per cent of the territory of which 50,000 h are in the Andaman group. Their stilt roots anchoring the plants and the upwardly turned breathing roots enable them to thrive the pull and push of the tides, the limitations of the waterlogged slush and the salinity gradients of the creeks. Seedlings are nurtured on parent trees until they are capable of securing independent existence. The mangrove creeks are plentiful of organic detritus which nourishes a wide variety of marine fauna viz. fishes, prawns and marsh crocodiles.

The most common trees are *Rhizophora mucronata*, *R. conjugata*, *Bruguiera gymnorrhiza*, *B. parviflora* and *Ceriops tagal*. *Avicennia marina* is frequent forming small patches. Some of the less common species are *Lumnitzera littorea*, *L. racemosa*, *Aegiceras corniculatum*, *Excoecaria agallocha* and *Xylocarpus granatum*. *Nypa fruitcans* is a palm found in the mangrove forests. The mangrove fern *Acrostichum aureum* is associated with *Acanthus ilicifolius*.

2. Strand vegetation

The vegetation occupying the sandy coastal belt exhibits several species of plants. These include herbaceous dune formations on the open beach and wooded beach forests towards the interior. In the sandy beach, found along the coast, the foreground is marked by *Ipomoea pes-caprae*, *Cassytha filiformis*, *Vigna marina* and *Phyla nodiflora*. Immediately behind these plants are a number of littoral shrubs. *Scaevola sericea* is seen fringing the coast as a green hedge, especially in Little Andamans. Behind the dense growth of *Scaevola sericea* are other shrubby plants like *Ximena americana*, *Hibiscus tiliaceus*, *Colubrina asiatica*, *Caesalpinia crista*, *Desmodium umbellatum* and *Crinum asiaticum*. *Mucuna gigantea* is a common climber.

Along retreating coasts, the dominant tree is *Barringtonia asiatica* which is often associated with trees like *Guettarda speciosa*, *Calophyllum inophyllum* and *Pongamia pinnata* and shrubs like *Pemphis acidula*, *Messerschmidia argentea*, *Vitex trifolia*, *Pandanus andamanensium* and *P. tectorius*.

The beach forests occur behind the sand dune zone and *Barringtonia* formations are comprised of trees like *Hernandia peltata*, *Thespesia populnea*, *Pandanus* spp., *Manilkara littoralis*, *Intsia bijuga*, *Syzygium samarangense*, *Sophora tomentosa* and *Glochidion calocarpum*. *Cycas rumphii* occurs in the beach forests in large populations in North Andamans. The herbaceous plants include *Ischaemum muticum*, *Acalypha indica*, *Euphorbia hirta*, *Centotheca lappacea*, *Ophiorrhiza mungos*, *Aerva lanata* and *Cyperus kyllinga*. Climbers found on the trunks of many trees include *Dischidia bengalensis*, *D. nummularia*, *Pothos scandens*, and *Hoya*. Epiphytic orchids like *Dendrobium crumenatum*, *Luisia teretifolia*, *Bulbophyllum lepidum*, *Cybidium aloifolium*, *Eria andamanica* and ferns like *Polypodium phymatodes* and *Drynaria quercifolia* are also common.

3. Tidal or Swamp forests

It is typically a closed evergreen forest of medium sized trees which have adapted in various ways to live on tidal mud which is permanently wet with salt water and submerged at every tide. A peculiarity of the tidal forest trees is the occurrence of special root formations, stilt roots supporting stem base, plank buttress root formations, conically thickened stem bases of small erect aerial roots emerging from the mud. These help to improve the air supply to the root system or to support and protect the trees against strong winds. Trees like *Cerbera odollam*, *Heritiera littoralis* and *Barringtonia racemosa* are common in association with *Ficus retusa*, *Cynometra ramiflora*, *Scyphiphora hydrophyllacea*, *Excoecaria agallocha*, *Lumnitzera racemosa*, *Xylocarpus granatum*, *Sonneratia acida* and *Dolichandrone rheedii*. *Phoenix paludosa* a slender erect palm is also common. *Caesalpinia crista*, *Derris scandens*, *D. heterophylla* and *Flagellaria indica* are the common woody climbers and stragglers. *Sarcolobus carinatus*, *Hoya parasitica* and *Dischidia bengalensis* are other climbers. Epiphytic orchids like *Dendrobium*, *Bulbophyllum*, *Eria*, etc. and ferns like *Drymoglossum*, *Lepisorus* and *Asplenium* grow on trunks and branches of the trees.

B. INLAND

1. Evergreen forests

These represent the climax vegetation with a close compact community of diverse tropical plants. The canopy is closed and consists

of three storeys. There is little sunlight penetrating to the forest floor. The soil is composed of clayey loam with micaceous sandstones below.

The vegetation is mainly composed of tall trees laden with lianas and other epiphytes. *Dipterocarpus griffithii*, *D. turbinatus*, *Sideroxylon longipetiolatum*, *Hopea odorata*, *Endospermum malaccense*, *Planchonia andamanica* occur in the upper storey. The second storey consists of smaller trees like *Baccaurea sapida*, *Myristica* sp., *Buchanania splendense*, *Randia pulcherrima*, *Pometia pinnata*, etc. Shrubs like *Clerodendrum viscosum*, *Leea indica*, *Dinochloa andamanica*, *Maesa andamanica*, etc., occur. Amongst the climbers the common ones include *Calamus longisetus*, *Daemonorops manii*, *D. kurzianus*, *Entada pursaetha*, *Mezoneuron cucullatum* etc. *Phragmites karka* and *Saccharum spontaneum* occur sometimes in open places and edges of forests. *Asplenium nidus* and *Drymoglossum piloselloides* are the epiphytic ferns. *Dendrobium aphyllum* and *D. secundum* are the epiphytic orchids commonly seen.

2. Deciduous forests

Such forests occur in undulating ground on hills where the soil is comparatively dry as compared to evergreen forests. They are found in North, Middle and some parts of South Andamans. *Pterocarpus dalbergioides* is associated with *Terminalia procera*, *T. bialata*, *T. manii*, *Canarium euphyllum*, *Parishia insignis*, *Albizia lebbeck* etc. The second storey consists of small trees like *Lannea coromandelica*, *Sageraea elliptica*, *Sterculia villosa*, *Semecarpus kurzii* etc. The third storey is represented by *Licuala spinosa*, *Grewia disperma*, *Cordia grandis*, etc. Among the shrubs *Actephila exelsa*, *Ixora grandifolia*, *Bridelia griffithii* and *Rinorea bengalensis* occur. Canes are sparsely distributed. *Sphenodesma unguiculata* and *Dinochloa andamanica* are common climbers. Herbaceous vegetation is represented by *Paspalum conjugatum*, *Echinochloa crus-galli*, *Dichanthium annulatum* and also the fern *Pteris quadriaurita*. Epiphytic plants are less which include *Dendrobium aphyllum*, *Cymbidium aloifolium* and *Pholidota imbricata*.

3. Grasslands

Several disturbed, deforested and denuded hillocks exhibit grasslands with *Imperata cylindrica* and *Saccharum spontaneum* as dominant

species. Grasses like *Heteropogon contortus*, *Chrysopogon aciculatus* and *Eragrostis unioides* are found associated with sedges like *Scleria cochinchinensis* and the ferns *Dicranopteris linearis* and *Lygodium flexuosum*. The herbs and undershrubs include *Uraria lagopodioides*, *Desmodium heterocarpon*, *Triumfetta rhomboidea* and *Urena lobata*. Large shrubby plants are rare and comprise *Melastoma malabathricum* and *Erycibe paniculata*.

4. Hydrophytic vegetation

The scarcity of natural stagnant pools, lakes, etc. results in a rather poor fresh water flora in these islands. In the few ponds and paddy fields plants like *Ipomoea aquatica*, *Lemna perpusilla*, *Najas indica*, *Hydrilla verticillata*, *Nymphaea nouchali* are seen. Among the fresh water marshy plants, notable ones are *Ludwigia perennis*, *Blyxa roxburghii*, *Monochoria vaginalis*, *Polygonum barbatum*, *Fuirena glomerata*, *Hydrophila erecta* and various species of sedges.

NICOBAR ISLANDS : The nature of vegetation and floristic composition differ from north to south. In Car Nicobar, there is a well defined beach forest followed by inland vegetation comprising shrubs, trees and grasslands. The island being more or less flat and the soil consisting of sandy alluvium with rocks beneath, evergreen forests are absent. Mangrove forests, common in the Central and Southern group do not find a place here.

The mangrove forests in the Central and Southern group are followed by Beach forest at the coast and evergreen forest in the interior. The vegetation can be classified into the following:

- A. LITTORAL :
 1. Strand or Beach forests.
 2. Mangrove forests.

- B. INLAND :
 1. Evergreen forests.
 2. Deciduous forests.
 3. Grasslands.

A. LITTORAL

1. Strand or Beach forests

These are restricted to the beaches of fine calcareous sand which stretch along the shores. It is pronounced in Car Nicobar. Creepers like *Ipomoea pes-caprae*, *Vigna marina*, *Ischaemum muticum*, *Phyla nudiflora*, etc. are found along the coast. Immediately behind these occur *Scaevola sericea*. Associated with it are *Clerodendrum viscosum* and *Desmodium umbellatum*. *Tournefortia argentia* is common in Katchal, Kamorta and Great Nicobar Islands. *Pandanus leram*, *P. tectorius*, and *P. fruticans* grow in this forest. *Ixora brunnescens* and *Glochidion calocarpum* flourish well. The shrubby layer is followed by a few trees like *Barringtonia asiatica*, *Calophyllum inophyllum*, *Hernandia peltata*, *Heritiera littoralis*, *Syzygium samarangense* etc. *Cycas rumphii*, *Cerbera manghas* and *C. odollam* occur in the shade of these trees. *Casuarina equisetifolia* is found in Casuarina Bay in Great Nicobar. Climbers like *Cyclea peltata*, *Entada pursaetha*, etc., are not uncommon. The ground cover consists of *Centothacea lappacea*, *Oplismenus compositus* etc. intermingled with *Aerva lanata*, *Ophiorrhiza mungos* etc. The tree trunks are clothed with *Dischidia bengalensis*, *D. nummularis* and *Pothos scandens*. *Aerides emericii*, *Dendrobium anceps* and *Luisia teretifolia* are the common epiphytic orchids. *Asplenium nidus* and *Vittaria elongata* are the common epiphytic ferns.

2. Mangrove forests

They are found in West Katchal Bay, the harbours of Kamorta and Nancowrie islands, Little Nicobar and Ganges harbour, mouths of Galathea, Dogmar and Alexandra rivers in Great Nicobar. The dominant species are *Rhizophora mucronata*, *Bruguiera gymnorrhiza*, *Excoecaria agallocha*, *Carallia brachiata*, *Sonneratia acida*, *Timonius jambosella* and *Nipa fruticans*.

B. INLAND

1. Evergreen forests

They are common in Great Nicobar, Kamorta and Katchal islands. The most common and dominant tree species in Great Nicobar are

Callophyllum soulattri, *Sideroxylon longipetiolatum*, *Garcinia xanthochymus*, *Pisonia excelsa*, *Mangifera sylvatica*, etc. In moist valleys and along rivers *Anthocephalus cadamba*, *Pometia pinnata*, *Elaeocarpus tuberculatus* etc. occur. *Cyathea albo-setacea*, a tree fern, is common. *Dinochloa andamanica* is a most extensive climbing bamboo on the high hills.

The evergreen forests of Kamorta and Katchal islands include lofty trees like *Artocarpus peduncularis*, *Radermachera lobbi*, *Symplocos leiostachya*, *Bentinckia nicobarica*, *Callophyllum soulattri*, etc. Growing well under the cover of these trees are *Maesa ramentacea*, *Barringtonia racemosa*, *Syzygium claviflorum*, etc. *Cyathea albo-setacea* is common tree fern. Important climbers are *Derris thyrsoiflora*, *Dinochloa andamanica*, *Dioscorea glabra*, etc. The forest floor is covered with *Blumea myriocephala*, *Adenostemma viscosum* etc. A few grasses and sedges like *Sclera sumatrensis*, *Oplismenus compositus* also grow. Ferns like *Nephrodium molle*, *Asplenium nidus* and *Vittaria elongata* are plentiful. *Pholidota imbricata*, *Oberonia* sp., *Lycopodium phlegmeria* grow on branches of trees.

2. Deciduous forests

Terminalia procera and *T. bialata* occur at low elevations in Great Nicobar. They grow in association with *Pterocymbium tinctorium* and *Albizia* sp.

3. Grasslands

These are peculiar to Nicobars and are situated on hilly plateau areas of Kamorta, Katchal, Nancowrie and open areas of Car Nicobar. *Imperata cylindrica* occurs with *Saccharum spontaneum*, *Heteropogon contortus*, *Chloris barbata*, *Chrysopogon aciculatus*, *Scleria cochinchinensis*, etc. Often *Dicranopteris linearis*, and *Lycopodium cernuum* grow amidst these grasses. *Urena lobata*, *Desmodium heterocarpon* etc. are the herbs and undershrubs. The common shrubs are *Erycibe paniculata*, *Helicteres angustifolia* var. *obtusata* etc.

BOTANICAL HISTORY OF ANDAMAN & NICOBAR ISLANDS

A knowledge of the botanical history of any geographical area is of paramount importance for understanding its phytogeography. As known from the literature, the botanical history of the Andaman and Nicobar Islands dates back to 1791 when Colonel Kyd visited the island and introduced to the Royal Botanic Gardens, Calcutta, some Andaman plants which were later described in Roxburgh's Flora of India. In 1839, Helfer, a Russian scientist and geologist visited the islands with a view to ascertaining their mineral resources and also made extensive botanical collections but these, after his murder by aborigines on the North Andaman, were unfortunately mixed up with his Tenasserim plants and all were labelled 'Tenasserim and Andaman' which resulted in a great deal of confusion. In the year 1866 Kurz, a German botanist and then Curator of the herbarium of the Royal Botanic Gardens, Calcutta, was sent by the Government of India to collect materials for a flora of the Andaman Islands. He made extensive collections and published a report in 1870 on the vegetation of the South Andaman Islands. Subsequently, several botanists like Parish, Prain, King and Rogers made extensive botanical studies between 1870 and 1903, which together with his own efforts enabled Parkinson (1923) to bring out a flora of the Andaman Islands dealing mainly with the woody elements. Since then, vegetational accounts of the Nicobar Islands, especially Great Nicobar island, published by Sahni (1953), Thothathri (1962), Balakrishnan (1987), the preliminary and supplementary lists of angiosperms of Andaman and Nicobar islands by Vasudeva Rao (1986) and Lakshminarasimhan and P.S.N. Rao (1996) respectively and the phytogeographical account by P.S.N. Rao (1996) have greatly contributed towards understanding the floristic composition of the archipelago and in knowing their phytogeographical significance.

FLORISTIC DIVERSITY AND PHYTOGEOGRAPHY

The presence of over 2000 indigenous and 500 non-indigenous angiospermic species within a land area of 8290 sq km is a significant feature of the Andaman and Nicobar Islands, making them a cynosure not only for plant taxonomists but also for conservationists. The rare and distinct flora which evolved through millions of years due to the insular nature of the territory, physical isolation between the islands and also from

the neighbouring continental landmasses, is unique to India. Though related to the mainland Indian flora, the flora of the Andaman group shows much closer affinity with the Myanmar flora while that of Nicobars have affinity towards the Sunda biogeographical zone. Representing 700 genera and belonging to 140 families, about 14% of the angiosperm species are endemic to the islands (Table 1.) At the generic level endemism is rather less with only two genera viz. *Sphyranthera* (Euphorbiaceae) with two species and *Pubistylis* (Rubiaceae) with one species. The islands also have a rich fern flora with a little over 100 species represented, of which the tree fern *Cyathea* is the most interesting with significant population density in Great Nicobar.

Among the non-endemic angiosperm species about 40% are not found in mainland India but extend their distribution to South East Asia including Burma, Thailand, Malaya and Sumatra (Table 2). As the flora of the Nicobar Islands is essentially Malesian it is also called a subcontinental island flora (Balakrishnan, 1989). The flora of the Andaman group of islands is distinctly different from that of the Nicobars which is evident from the fact that the genera *Pterocarpus* and *Dipterocarpus*, while common in the Andaman islands, are not found in the Nicobar islands while the Melastomaceous genera *Otanthera* and *Astronia*, the Gesnariaceous genus *Cyrtandra*, *Stemonurus* of the Icacinaceae, *Bentinckia* and *Rhopaloblaste* of the Arecaceae, *Spathoglottis* of the Orchidaceae and many more species occurring in the Nicobar islands are totally absent in the Andaman islands. The striking dissimilarities between the flora of the Andaman group and Nicobar group are owing to the reason that the Andaman islands have more species common to Northeast India, Myanmar and Thailand while Nicobar islands have more species common with Malaysia in the east and Indonesian in the south. To cite a few, some rare orchids of Northeast India such as *Porpax merix* and *Ascocentrum ampullaceum* find a place on the Saddle Peak in North Andaman. Other species which share their distribution between Northeast India, Myanmar, Thailand and the Andaman islands are *Coelogyne trinervis*, *C. thailandica*, *Thunia alba* and *Hopea helferi*.

The climatic conditions of the Western Ghats of peninsular India and Sri Lanka are similar to that of the Andaman and Nicobar Islands as all these areas lie in the tropical zone and experience heavy rainfall from the south-west and north-east monsoons. Although the two zones are not

contiguous and are separated from each other by the Bay of Bengal, they show striking resemblance in their floristic composition. Several rare plants especially orchids common to peninsular India and the Bay islands are *Calanthe triplicata*, *Corymborchis veratrifolia*, *Geodorum densiflorum*, *Eulophia graminifolia*, *Nervilia aragona*, *Porpax reticulata* and *Thrixspermum album*. Other species which are common between the two areas are *Burmannia chamiensis*, *Christisonia alba*, *Floscopa scandens*, *Myxospermum smilacifolium*, *Phylloclamis spinosa*, *Osbeckia tenera* and several other species. For example, the palm genus *Bentinckia* has two species in the world, one of them *B. condapanna* is found in the Western Ghats of peninsular India while the other *B. nicobarica* occurs in the Nicobar Islands. Thus, the Andaman and Nicobar Islands stretching from Arakkan-Yoma in Myanmar to Sumatra in Indonesia are characterised by a rare and distinct flora although exhibiting phytogeographical affinity with the neighbouring biogeographic zones of South - East Asian countries and North-East, Western Ghats and Deccan peninsular biogeographic zones of mainland India by virtue of which the islands constitute a transition zone phytogeographically. More interestingly the southernmost Great Nicobar island with a mixture of Malaysian and Indonesian species and northernmost Andaman islands with several Myanmar elements exhibit a striking resemblance to that of neighbouring biogeographical zones rendering them truly transitional from a floristic point of view. The floristic analysis also indicates that while 14% of angiosperm species are endemic to the islands about 54% also occur in mainland India. The remaining 32% extend to the South-east Asian countries and Malesia but are not recorded in mainland India. The phytogeographical distinction between the Andaman islands and the Nicobar group of islands is evident from the fact that only 28% of the angiosperm plants reportedly have a common distribution on both the Andaman group and the Nicobar group, whereas the remaining 72% occur either on the Andaman islands or on the Nicobars, that is, 47% on the former and 25% on the latter.

Among the 137 families representing the angiospermic flora of the islands, the families Annonaceae, Rubiaceae, Euphorbiaceae, Moraceae, Cyperaceae and Poaceae are more predominant in terms of density as well as number of species followed by Orchidaceae in terms of number of species only with smaller populations. Besides, the plant group which contributes to a great extent to the plant diversity and richness of the flora in the transition zones like Great Nicobar island, a place rich in species

with Sundaic affinity, is the pteridophytic flora comprising of about 100 species of which the populations of tree-fern constitute a major fraction of the vegetation at certain places along the hilly slopes of the interior forests. Another aspect of the vegetation of the Andaman and Nicobar Islands is that over 11% of the total geographical area is constituted by the mangrove forests with more than twenty species which are perhaps the best formations in the entire South-East Asia providing natural habitats for a varied aquatic life offshore and climbing and epiphytic plants on shore.

During the last few decades several exotic species of rattans, bamboos, teak and rubber have been introduced by clearing the virgin forests in view of the settlements. Even though the aboriginals viz. Shompens and Nicobarese have raised coconut plantations in deforested areas, a few weeds such as *Chloronema*, *Mikania cordata*, *Cyperus*, *Fimbristylis* and *Chrysopogon* have also come up very fast as secondary formations due to deforestation in the cleared areas of the islands.

Paleobotanical studies

The only fossil record known to date is that of *Larinoxylon felix* (Lauraceae) from flyschoid gritty sandstone of Baratang island in South Andaman (Awasthi and Jafar, 1990) while undertaking paleobotanical studies on the carbonised wood fragments collected from the Nayagarh mud volcano.

Forestry

About 86 per cent of the geographical area is under forest cover, that is, 7,144 sq km out of a total area of 8,249 sq km out of which 41 per cent of the area constitutes tribal reserves. Out of the remaining 4,115 sq km, small wooded islands occupy a considerable area and the timber available here is not commercially exploitable. Owing to this realistic picture only around 30 per cent forest area can be earmarked for timber extraction although there is 86 per cent of area is under forest canopy.

The number of commercially exploitable species has gone up from 4 in 1952 to 40 today as the post-1950 period was characterised by an increasing demand for timber within the islands and also for consumption

in mainland India. In 1986 the extractions have touched 1,45,000 cu m/annum while it was only 49,000 cu m/annum in 1950. The logs of *Pterocarpus dalbergioides* (Padauk), *Dipterocarpaceae alatus* (Gurjan) and *Terminalia bialata* (White chuglam) have a ready market. Presently, there are as many as 34 wood-based industries in A. & N. Islands of which 3 plywood, 24 saw mills and 7 are match and pencil wood industries. The Government Saw Mill at Chatham is considered to be largest in the South East Asia employing thousands of people.

Natural regeneration of indigenous timber species and Andaman Canopy Lifting System have been regarded as the most suitable ways of restocking the island forests. The Working Plan by Chengappa in 1952 regarding the post-harvest regeneration operations had two main objectives (a) to convert the irregular natural forests into uniform forests of native timber species (b) to realise maximum yield of timber. This entailed a series of clearing, girdling and canopy lifting operations spread over several years. The rotation period prescribed by him was 150 years but reduced to 75 years subsequently, the exploitable girth now being 150 cm of gbh.

As the wood of mangrove trees is of high calorific value, it has been used both in industrial and domestic sectors until recently. Consequent upon this, apprehensions of imminent ecological damage have been expressed because of the depletion of mangroves necessitating a total ban by the administration in 1986. The local plywood industries have been encouraged to use wood shavings and sawdust for their boilers instead of mangrove fuel.

Plantations

The Andaman Forest Department initiated work on Red Oil Palm (*Elaeis guineensis*) plantations in Little Andaman which was taken over by the Forest Plantation Development Corporation in 1980. FPDC also developed Rubber Plantations in Katchal island and there are several other proposals for more plantations in the islands. Today, the important issue is whether a unique type of vegetation that now covers the island should be destroyed for the sake of a commercial crop for improving the island economy.

Agriculture

Agriculture has not been a mainstay in A. & N. Islands as it could be only at the expense of forest land. The area under cultivation in 1981 was 16,544 hectares. However, according to the Agriculture Department the area cleared for agriculture, plantations and horticulture in all the islands stands at 48,000 hectares. The main categories of agricultural crops are (a) Non-vegetable field crops (b) Vegetable field crops and (3) Plantation and fruit crops. Since rice is staple food of many of the settlers, the largest area is set apart for paddy cultivation. North Andaman, Little Andaman and Neil and Havelock islands are main centres of vegetable growing. The giant African snail (*Acantina fulica*) a harmful introduction into the islands, is a serious pest on all vegetables. Mango, Citrus, Sapota and Papaya have been tried. Cinnamon, Clove, Nutmeg and Pepper are grown in about 560 hectares in the islands. Oilseed crops and pulses planted in rotation with rice have been remunerative. Areca and coconut are more economical and popular. A track record of over two decades conveys that the land which could support the giant evergreen forest has not been able to support worthwhile agriculture.

Fisheries

The Exclusive Economic Zone (EEZ) of the islands extending to 200 nautical miles from the shoreline is approximately 6 lakh sq km. The economic potential of this enormous real estate comprising 30 per cent of the EEZ of India is realised, of late, for the expansion of Fisheries sector. Although estimates place the annual available catch at 50,000 to 4,74,000 tonnes, the actual catch in 1986 was 10,638 tonnes. There are many other marine products such as shell fish viz. *Trochus*, *Turbo* and *Tridacna*. However, steps should be taken not to encourage mining of corals from the coastline as this destabilises the substratum for varied marine fauna. Prawns, lobsters, mussels and crabs are being fished in limited quantities.

Tourism

Tourism industry is most ideal for these islands in case it is in the form of 'ecotourism' An IUCN study *Ecological Guidelines for Island Development* by McEachern and Towle has given guidelines for the

development of tourism in island settings. Upmarket tourism, of late, has been considered more beneficial for improving the island economy. This has to be environment friendly and not to the detriment of island ecology.

CONSERVATION

The insular species are generally characterised by a small gene pool, reduced interspecific competition, inbreeding and small population size by virtue of which they are more vulnerable to extinction due to habitat destruction. With the Bay islands being no exception to this, conservation of rare and threatened endemic species as well as the species common for the islands and the nearby mainlands has become inevitable for ensuring the preservation of species diversity. The establishment of national parks and biosphere reserves in Great Nicobar (Mt. Thullier) and North Andaman (Saddle Peak) is under the active consideration of the Government of India for habitat conservation in the centres of speciation. So far, the conservation strategies have been species oriented. As this may lead to overplaying the role of that particular species in the ecosystem causing certain imbalances, it has become imperative to give due weightage to all the components of environment to cover the total ecosystem. With the increasing population beyond carrying capacity and recent spurt in developmental activities in the inhabited islands several measures are suggested by Saldanha (1989) to strike a balance between development and conservation so that wild germplasm resources such as canes, rattans, bamboos, orchids and timber yielding tree species are well taken care of. The Botanical Survey of India on its part has already brought out a list of rare and threatened plants of Andaman and Nicobar Islands as a part of Red Data Books for conservation purposes in its Botanic Garden at Port Blair where economically important endemic species such as *Myristica andamanica*, *Knema andamanica*, *Vanilla andamanica* etc., are also successfully propagated and grown while the local Forest Department has been concentrating on *in situ* conservation of rattans, palms, tree-ferns etc., by setting aside more than 50% of the forests as tribal reserves, wild life sanctuaries, national parks and biosphere reserves (Table 1) which are 'in-violate'. Efforts are also afoot to grow several plant species of phytogeographical significance and aesthetically important endemic orchid species which are threatened in their natural habitats owing to habitat deterioration.

Table 1
Sanctuaries, National Parks and Biosphere Reserves in
Andaman and Nicobar Islands

Wild Life Sanctuaries	
1. Bingham Island	35. West Island
2. Sir Hugh Rose Island	36. Peacock Island
3. Pitman Island	37. White Cliff
4. Jame Island	38. Reef Island
5. Potanma Island	39. Mayo Island
6. Kyd Island	40. Pagat Island
7. Patnic Island	41. Shearme Island
8. Defence Island	42. Point Island
9. Montgomery Island	43. Ox Island
10. Clyde Island	44. Shark Island
11. Sandy Island	45. North Island
12. Snake Island	46. Kwangtang Island
13. Cinque Island	47. Rowe Island
14. Passage Island	48. Latouche Island
15. Sister Island	49. Jungle Island
16. North Brother Island	50. Trilby Island
17. South Brother Island	51. Table (Excelsior. Island
18. Loha Barrack	52. Table (Delgasno. Island
19. Bluff Island	53. Temple Island
20. Spike Island	54. Turtle Island
21. Talai Kacha Island	55. Ross Island
22. South Sentinel Island	56. Brush Island
23. Mangrove Island	57. Bamboo Island
24. Stoat Island	58. Blister Island
25. Belle Island	59. Dot Island
26. Ariel Island	60. Curie Island
27. East or English Island	61. Oliva Island
28. Dunnean Island	62. Orchid Island
29. Oyster Island	63. Curku (BPP. Island
30. Perkinson Island	64. Egg Island
31. Barren Island	65. Swamp Island
32. Cane Island	66. Dottrel Island
33. Land Fall Island	67. Gurjan Island
34. East Island	68. Sea Serpent Island
	69. Snake Island
	70. Bondeville Island

71. Buchanan Island	Nicobar District Wildlife Sanctuaries
72. Surat Island	
73. Entrance Island	91. Batti Mally Island
74. Bennet Island	92. Tillangchang Island
75. Roper Island	93. Megapode Island
76. South Reef Island	
77. Mark Island	National Parks
78. Tuft Island	1. Mahatma Gandhi Marine National Park
79. Hump Island	2. Rani Jhansi Marine National Park
80. Gander Island	3. Mount Harriet
81. Goose Island	4. Saddle Peak
82. Flat Island	
83. Spike Island	Biosphere Reserves
84. Ranger Island	1. Great Nicobar Biosphere Reserve
85. Wharaf Island	
86. Tree Island	
87. Channel Island	Zoological Garden
88. Narcondum Island	1. Mini Zoo
89. North reef Island	
90. Interview Island	

Table 2
Ten dominant families according to the number of species in decreasing order

S.N	Families	Genera	Species
1.	POACEAE	70	150
2.	RUBIACEAE	40	115
3.	EUPHORBIACEAE	40	110
4.	ORCHIDACEAE	50	98
5.	CYPERACEAE	12	80
6.	FABACEAE	29	60
7.	MORACEAE	7	52
8.	ANNONACEAE	18	50
9.	ARECACEAE	20	37
10.	MELIACEAE	11	31

Table 3
A comparison between ten largest families of Andaman & Nicobar Islands with those in Hooker (1904) Flora of British India

S.N. Flora of British India	Flora of A. & N. Islands
1. ORCHIDACEAE	POACEAE
2. LEGUMINOSAE	RUBIACEAE
3. POACEAE	EUPHORBIACEAE
4. RUBIACEAE	ORCHIDACEAE
5. EUPHORBIACEAE	CYPERACEAE
6. ACANTHACEAE	FABACEAE
7. ASTERACEAE	MORACEAE
8. CYPERACEAE	ANNONACEAE
9. LAMIACEAE	ARECACEAE
10. URTICACEAE	MELIACEAE

Table 4
Important Timber Yielding Plants

Botanical Name	Local Name
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Hard wood :

<i>Pterocarpus dalbergioides</i>	Padauk
<i>Manilkara littoralis</i>	Khari Mahua
<i>Albizia lebbeck</i>	Koko
<i>Calophyllum soulattri</i>	Lalchini
<i>Terminalia procera</i>	White Bombway
<i>T. bialata</i>	White chuglam
<i>T. manii</i>	Black chuglam
<i>Artocarpus chaplasha</i>	Toungpeinne

Soft wood :

<i>Dipterocarpus spp.</i>	Gurjan
<i>Pterocymbium tinctorium</i>	Papita

<i>Pterygota alata</i>	
<i>Bombax insigne</i>	Didu
<i>Canarium euphyllum</i>	Dhup
<i>Planchonia andamanica</i>	Red Bombway
<i>Sideroxylon longipetiolatum</i>	Lamba pathi

Table 5
Less Known Timber Yielding Plants

Botnaical Name	Families
<i>Sageraea elliptica</i>	Annonaceae
<i>Scolopia crenata</i>	Flacourtiaceae
<i>Xanthophyllum andamanicum</i>	Xanthophyllaceae
<i>Cratoxylum formosum</i>	Hypericaceae
<i>Sterculia macrophylla</i>	Sterculiaceae
<i>Ailanthus kurzii</i>	Simaroubaceae
<i>Garuga pinnata</i>	Burseraceae
<i>Amoora rohituka</i>	Meliaceae
<i>Dracontomelon mangiferum</i>	Anacardiaceae
<i>Mangifera camptosperma</i>	Anacardiaceae
<i>Adenanthera pavonina</i>	Mimosaceae
<i>Chydenanthus excelsus</i>	Baringtoniaceae
<i>Duabanga grandiflora</i>	Sonneratiaceae
<i>Tetrameles nudiflora</i>	Tetramelaceae

Table 6
Wild Food Plants Used by the Tribals of Bay Islands

Part used	Plants	Ni.	Sh.	On.
Bulbs	<i>Dioscorea glabra</i>	+	+	+
Tubers	<i>Tacca leontopetaloides</i>	+	+	
	<i>Colocasia esculenta</i>		+	

Fruits	<i>Morinda citrifolia</i>	+	+		
	<i>Nypa fruticans</i>	+			
	<i>Sterculia rubiginosa</i>	+			
	<i>Syzygium samarangense</i>	+			
	<i>Annona squamosa</i>	+			
	<i>Pandanus leram</i>	+	+	+	
	<i>Artocarpus incisa</i>	+	+		
	<i>A. integrifolia</i>	+	+		
	<i>Baccaurea sapida</i>			+	
	<i>Careya valida</i>			+	
	<i>Champereia griffithiana</i>			+	
	<i>Cyclea peltata</i>			+	
	<i>Hunteria zeylanica</i>			+	
	<i>Manilkara litoralis</i>			+	
	<i>Pometia pinnata</i>			+	
	<i>Salacia chinensis</i>			+	
	<i>Semicarpus kurzii</i>			+	
	<i>Ximenia americana</i>			+	
	<i>Ardisia solanacea</i>		+		
	<i>Calamus spp.</i>		+		
	<i>Citrus spp.</i>		+		
	<i>Terminalia catappa</i>		+		
	<i>T. manii</i>		+		
	Stem/Leaf	<i>Flagellaria indica</i>		+	
		<i>Celosia argentea</i>		+	
<i>Ipomoea aquatica</i>			+		

Ni : Nicobarese Sh : Shompens On : Onges.

Table 7
List of Medicinal Plants Used by the Tribals of
Andaman & Nicobar Islands

Plants	Plant part	Diseases
<i>Adenia penangiana</i>	lf	Body & chest pain
<i>Adenostemma lavenia</i>	lf	Chest pain
<i>Aerva lanata</i>	lf	Fever
<i>Ageratum conyzoides</i>	lf	Piles, wounds, eye pain