

# CONSERVATION & MANAGEMENT

*M*angrove biodiversity, management and conservation have received considerable attention in recent times because of the extensive degradation of mangrove areas along the Indian coast. Restoration of mangroves has also greatly improved over the years. Today mangroves have become global concern as about 100 countries worldwide have mangrove resources.

Presently, less than one percent of all mangroves worldwide are sufficiently protected; however, mangrove destruction continues to go unchecked. Therefore, the first step towards creating a solution is educating the public at large. Creating awareness is important so that developmental activities in mangroves, dumping habits and releasing of hazardous effluents could be effectively avoided.

At the International Level, the common approach to major environmental policy issues has been to formulate conventions, treaties and agreements, which all concerned countries become signatories. Mangroves are today global issues and around 20 countries have undertaken rehabilitation initiatives, establishing nurseries and attempting afforestation and re-planting in degraded areas. More than half a dozen international agreements and various regional agreements are directly relevant to the conservation of mangroves.

Historically, the responsibility of mangrove management at the national level in many tropical mangrove countries have been assigned on a sectorial basis to executing agencies of the government institutions for example Forestry, Fishery or Agriculture Departments. The agencies responsible for administering mangroves differ between each country and even between states and districts within countries.

## MANGROVES AND THEIR BENEFITS

· Mangrove ecosystem is self-maintaining, self-repairing, renewable, self-sustaining and most

productive.

· Mangroves form very important part of the marine food chain.

· Mangroves help to recycle nutrients in coastal waters.

· Mangroves help to control pollution through a process called rhizo-filtration.

· Mangroves are a source of wood and have unexplored potential for natural products.

· Mangroves help to trap debris, silt and stabilizes the coastline.

· Mangroves protect coastland by absorbing the energy of storm-driven waves and wind action, creating an effect of a natural breakwater that helps in preventing a great deal of property damage and sometimes even human death.

· Mangroves sequester and store carbon i.e. removes carbon dioxide from atmosphere, an important component (CO<sub>2</sub>) responsible for global warming.

· Mangroves also provide opportunities for education, scientific research, eco-tourism and socio-economic studies.

## MANGROVE CONSERVATION IN INDIA

In India, mangroves occur on the West Coast, on the East Coast and in Andaman and Nicobar group of Islands, but in many places they are highly degraded. More recently, the concern of the Government of India for the conservation of forests and wildlife was clearly demonstrated by a 1976 amendment to the Indian Constitution, which states that it shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wildlife.

The Government of India had set up the National Mangrove Committee in the Ministry of Environment and Forests, New Delhi in 1976 to advise the government about mangrove conservation and development. In its first

meeting, the panel, which consists of scientists, research scholars and experts on the mangrove ecosystem, emphasized the need to conduct a survey of the existing mangrove areas along the Indian coast line. The government subsequently introduced a scheme for mangrove conservation and protection, consisting of:

- 1) Identification of selected mangrove areas for conservation.
- 2) Preparation of a management plan.
- 3) Promotion of research.
- 4) Adoption of a multidisciplinary approach involving state governments, universities, research institutions and local organizations.

In 1979, the National Mangrove Committee recommended areas for research and development and for management of the mangroves, which included the following:

- a) Nationwide mapping of the mangrove areas, preferably by remote sensing techniques coupled with land surveys and time series to assess the rate of degradation of the ecosystems.
- b) Quantitative surveys of area, climatic regime, rate of growth of forest trees and seasonal variations of environmental parameters.
- c) Assessment of suitable sites for reserve forests.
- d) Conservation programmes.
- e) Afforestation of degraded mangrove areas.
- f) Study of management methods, the ecology of mangroves, their flora and fauna, their microbiology and the biochemistry of organic matter and sediments.

The Government of India has provided guidelines and financial assistance to states and Union territories for the preparation and implementation of Management Action Plans for the conservation and development of these mangrove ecosystems. Most of these plans are now being implemented. The plans broadly cover survey and demarcation, natural regeneration in selected areas, afforestation, protection measures, fencing and awareness programmes. The Sundarbans mangroves, located in the Bay of Bengal (partly in India and partly in Bangladesh), was the first mangrove area in the world to be put under scientific management. The first management plan for Sundarbans was implemented in 1992.

#### **LEGISLATIVE FRAMEWORK**

In India, a legislative framework for the conservation and management of mangroves is already in

place. The Indian Forest Act, 1927 and the Wildlife (Protection) Act, 1972 provide protection to flora and fauna. Although, they do not specifically mention mangroves, these acts can also apply to the conservation of the flora and fauna of mangrove ecosystems. Since 1927, the Indian Forest Act has been applied to the mangrove forests of the Sundarbans, which have been declared as a reserved area.

The Environment (Protection) Act, 1986 has a crucial role in the conservation and management of the mangrove ecosystems. It declares a Coastal Regulation Zone in which industrial and other activities such as discharge of untreated water and effluents, dumping of waste, land reclamation and bunding are restricted in order to protect the coastal environment. Coastal stretches are classified into four categories, and mangroves are included in the most ecologically sensitive category – CRZ - 1(I).

#### **SITUATION IN GOA**

Of Goa's total land area of 3,70,200 ha, the mangrove area is 2,200 ha having declined sharply from a recorded 20,000 ha in 1987. Some 178 ha of the best mangrove area at Chorao, Goa was declared as Reserved Forest under the Indian Forest Act, 1927 to protect and conserve the mangrove forests. Subsequently, in 1988, this area was declared as Dr. Salim Ali Bird Sanctuary under the Wildlife (Protection) Act, 1972. Afforestation work to restore degraded mangrove areas started in Goa in 1975-1986; by the end of 1996-1997 the programme had covered 876 ha (Forest Department of Goa statistics).

In 1988, the Government of Goa formed a State Level Steering Committee to oversee the development of the mangrove forest. In 1990, the state government set up a Multi disciplinary Project Formulation Team to facilitate the preparation of a Comprehensive Action Plan for the development of the mangrove ecosystem. The same year, the government decided that no construction or development would be allowed in the area earmarked by the Forest Department for mangrove conservation, and declared that 15 mangrove species should not be felled for a period of ten years.

A five-year Mangrove Management Plan for Goa was prepared in 1991-1992 and implemented with financial assistance from the Government of India, and 100 ha of mangroves were planted each year as planned. A second five-year Management Plan is currently under

implementation.

### **MANGROVE AFFORESTATION**

More than half a dozen international agreements and various regional agreements are directly relevant to the conservation of mangrove biodiversity. The destruction and depletion of mangroves forest, pose one of the most serious social problems in the world. The problem in India is particularly observed along the west coast where the extent of the remaining mangrove forests is under constant threat. Conservation measures and afforestation are therefore, essential.

Activities sponsored by the UNDP/UNESCO Regional Mangrove Project have greatly contributed to mangrove awareness in India. It can be said that the mangrove afforestation experiments in Gujarat, Goa and Maharashtra are the results of the UNESCO project.

Furthermore, mangroves are slow to recuperate from cutting. Several species do not re-sprout after being cut. So, once they have been cut down, they will never regenerate unless replanted.

### **MANGROVE RESTORATION**

· In order to undertake restoration work, it is necessary to understand both the autecology (individual species ecology) and synecology (community ecology) of mangrove species at the particular site.

· Particular attention to be given to patterns of reproduction, propagule distribution, and successful seedling establishment.

· The attention to hydrological patterns that control the distribution, successful establishment and growth of mangrove species are required to be studied.

· Assess changes and modifications carried out of the previous mangrove environment that currently prevent natural secondary succession.

· Select an appropriate mangrove restoration site that is both hydrologically and ecologically likely to succeed in rehabilitating a healthy mangrove ecosystem.

· It should also be taken into consideration land ownership/use issues for ensuring long-term access to and

conservation and management of sites.

· Design restoration programs at appropriate sites to initially restore the appropriate hydrology and take advantage of natural recruitment of mangrove propagules for plant establishment.

· Utilize actual planting of propagules, collected seedlings, or cultivated seedlings as natural recruitment will not provide the quantity of successfully established seedlings, rate of stabilization or rate of growth of saplings established.

### **TECHNIQUES FOR MANGROVE RESTORATION**

#### **Mangrove plantation with nursery techniques,**

For high density planting, direct sowing of propagules with 0.5 x 0.5 m spacing should be adopted in open mud flats. Nursery raised seedlings can be planted with 2x2 m spacing where direct sowing of propagules are difficult. The technique of raising seedlings in nursery and plantation is given in Annexure - I.



**Nursery raised mangrove seedlings**

#### **Enrichment plantation**

The main objective of this technique is to improve biodiversity of the area and also to improve genetic resource conservation. Under this technique, threatened mangrove species are replanted at appropriate sites. The preference should be given to those species that have been exterminated from the area. If necessary seeds or propagules required for restoration should be imported from other areas to raise nursery.



**Planting with trenching**

### **Planting with trenching**

This technique is practiced in Andhra Pradesh and Tamil Nadu in saline blanks or mud flats with *Suaeda* cover, where the tidal amplitude is less than 12 inches. In hyper saline area, tidal water reaches occasionally due to the marginal elevation of land from the mud flats of mangrove area. Formation of hyper saline mudflats is a natural process which occurs as a result of deposition of silt and high evaporation rate. This process is accelerated when estuary and streams discharge high quantity of silt in the sea creating “Saline Blanks” where tidal water cannot reach and soil salinity remain high.

Digging of trenches facilitates supply of tidal water to the planted mangrove seedlings. With this method, successful plantations have been raised in some areas in Andhra Pradesh and Tamil Nadu. However, digging trenches involves disruption of natural process and may have negative impacts of activities on habit and biodiversity of the area. Excess excavation may also result into erosion of mudflats as well as addition of silt load in water. The following guideline may be followed for planting with trenching:

- Trenching should be done in restricted area, leaving enough space for the maintenance of ecology.
- Disruption and excavation of mud flats should be

minimum with careful designing of trenching.

- Trenches should not be dug far away from the main creek.

- Mudflats having very gentle slopes should be preferred.

- In main feeder canals, planting of *Rhizophora* sp. is recommended, while *Avicennia* sp. should not be planted as growth of pneumatophores trap silt and block flow of water.

### **MANGROVE CONSERVATION PLAN**

Conservation of mangrove should be linked with sustained economic benefits of the coastal community. Ultimate goal of the mangrove conservation is to provide diverse products on sustainable basis to meet diverse need including ecological security to the coastal people.

#### **Community participation**

The coastal community, especially fishermen, is main stake holder and they have maximum interaction with tidal environment. They are directly and indirectly benefited by mangroves and there is no reason why they should not be involved in mangrove development. In most of the states, fishermen work as a labourer for mangrove plantation but they do not own the programme. It is necessary to develop understanding among coastal community about economic and ecological roles of the ecosystem. It is now essential to initiate joint forest management programme in mangrove areas.

Community participation should be important component in mangrove development programme and following activities should be considered:

- Meeting and workshop of the coastal people, forest officials and local NGOs to initiate process of education and understanding.

- Selecting educated youth from coastal villages for imparting education and training so that they can work as resource persons in the villages.

- Organize local community, constitution of society as institution and their registration.

- Capacity building of local community – education, training and inter-state field visit.

- Allow flow of funds through the society for implementing activities.

- Improving capability of the society to develop mangrove conservation and village eco development plan.

- Integration of local Forest Officials, NGO and village community in an institution to develop viable and transparent organization for programme implementation.

### **Capacity building**

Training locals in mangrove propagation techniques and nursery maintenance with different species of nursery-raised mangrove seedlings has been the regular feature to rehabilitate mangroves in degraded areas. This programme can be conducted in a coastal village school, so the students will be the key players of local mangrove conservation. The students will convey the conservation message of this event to their father and mother who are daily venturing into sea and local mangrove habitat for fishing, respectively.

### **Awareness and education**

Public awareness of the importance and value of mangroves has been identified as a critical factor in the conservation and restoration of mangrove ecosystem. Awareness can be raised in younger generations particularly school children by stimulating interest and passion for the environment through art, exhibition, essay and public speaking competitions and by encouraging them to discuss the importance of mangroves with their friends, colleagues, families and communities.

The future of our society lies in the hands of aspiring young people. Young people, who can innovate, cooperate with others, and stay resilient would spare no effort in upgrading the quality of our living environment to make our home a better place to live in and work. In view of this, a project "Awareness campaign amongst the student community regarding mangrove conservation" was undertaken by MSI with the financial assistance from Department of Science, Technology and Environment, Govt. of Goa. Under this programme, students of five schools participated in various awareness activities undertaken to sensitize young minds in mangrove conservation and protection. The project successfully changed children's perceptions through awareness programmes highlighting the importance of conserving their local environment.

Current focus is on environmental awareness campaigns in schools, colleges, and general public through popular theater, leaflets, posters, picture competitions, exhibition, and celebrating Mangrove Day, Wetland day, Environment day etc. It is necessary to hold

consultations for like-minded people on important conservation issues in which people's decisions and actions are badly needed.

### **Research**

The government supports research by academic institutions for development of mangrove ecosystems on a sound ecological basis. The National Forest Policy, 1988 lists effective conservation and management of natural forest ecosystems (including the mangrove ecosystem) as a priority area for forestry research. Application of research in mangrove conservation was hardly visible and coordination between the Forest Department and other research institutes was absent in most of the states. As a result financial impact on mangrove research did not yield desirable result which needs to be reviewed.

### **Marine Protected Areas (MPA)**

There are 685 protected areas containing mangroves globally, distributed between 73 countries and territories. Countries with very large areas of mangroves have a significant number of protected areas notably Australia (180), Indonesia (64) and Brazil (63). There are many areas in India rich with mangrove formation such as Sundarbans, Andaman and Nicobar group of Islands, Maharashtra etc. These areas are under constant threat due to large scale deforestation and reclamation. It is necessary to make coordinated efforts to preserve, conserve and manage these areas and this is possible only through the establishment of Marine Protected Areas. During 1997-98, NIO, Goa has identified and recommended seven sites along the Maharashtra coast as Marine Protected Areas.

The Govt. of India has identified 16 areas as Marine Protected Areas along the Indian coast line in mangrove ecosystem based on following criteria:

- Area with different sensitive ecosystems.
- Habitats containing viable population of economic important genetic resources.
- Transition zones of all major ecosystems such as marsh, estuary, coastal zone and island ecosystems.
- Sites containing locally endemic species.
- Matrix of protected areas that ensures the survival of indicator and keystone species.
- Human use and influence on protected areas.
- Conservation and management of Marine Protected Areas and to mobilize potential benefits for

biodiversity within protected areas.

### **Ecotourism**

Many mangrove areas are potentially suitable for ecotourism. The indigenous biodiversity offers great attraction to tourists and poses as great assets in ecotourism economy. In recent years, many mangrove forests have become accessible through board walkways. Informative signage, arboretum, nature education centers, information on the biodiversity of flora and fauna will help tourists to know about mangrove in its natural environment. It is possible for tourists to spend an entire day in the mangroves looking and appreciating interesting and unique plants and animals.

The mangrove swamp is an ideal place for bird watchers as it serves as a bird sanctuary for indigenous attractive kingfishers, shrikes, dark green, yellow and migratory birds etc. Canoeing in the mangrove swamps and appreciating wild life will attract many nature tourists.

To sustain the ecotourism industry, it is necessary to understand the importance of the services mangroves offer to coastal inhabitants and unique flora and fauna it possesses. The Government on its part needs to effectively channel revenue generated from eco-tourism activities into conservation of the mangrove swamps. This can be done by promoting the mangroves ecotourism products and collaborate with big and successful tourism players to introduce and bring their clients to the site as extended visit.

## **TRADITIONAL METHODS OF CONSERVATION**

### **Crocodile worship, Odisha.**

The largest living reptile is the estuarine crocodile,



*Crocodilus porosus*, the strength of which in 1976 was merely 96 individual and now stands at 16,646 individual inhabit about 175 Sq. km of Bhitarkanika Wildlife Sanctuary, Odisha; Andaman and Nicobar group of Islands and Sundarbans. This over population of crocodiles in this sanctuary needs rehabilitation to avoid man-crocodile conflict.

Since the time immemorial the rural girls including women and widows have been worshiping crocodiles in a coastal village of Balikuda, Erasama, Kujang, Tirtol and other areas of Jagatsinghpur District in Odisha. On the occasion of auspicious month of Kartik, a holiest day in the Hindu calendar, women and girls get up early in the morning and take a holy deep in ponds, rivers, creeks and canals. They make idol of Goddess Durga near Tulasi Vrindavan called Brundabati in front of their house to perform pooja. They decorate the area and make the crocodile idol of 15 to 20 feet crocodile by sand or mud. They decorate the idol by different colours and make use of electric bulbs and other material to make eyes, teeth, tail and other features of crocodile

The reason to worship crocodile goes back to many years when the entire area of creek, rivulets, canals and ponds was infested with crocodiles. There were many incidences of crocodile attacks on fishermen and women who were attacked and killed by crocodiles. To appease the crocodile, villagers perform this ceremony which had now become tradition in these villages.

### **Mange Thapni (Crocodile worship), Goa.**

A ritual "Mange Thapni", crocodile worship is being carried out in Goa's coastal village at Durbhatwadi in Ponda. This ritual has become old tradition which is being celebrated every year on new moon day in the month of Pausha (Hindu month). It is said that this festival



coincides with the commencement of thrashing of the harvested paddy crop. The main objective of this celebration is to protect paddy fields from the natural fury (calamities) such as cyclone, flooding etc. and to get good fishery following year. It is also considered that crocodile being top predator of the environment, responsible and manages to keep marine environment clean and free of predator fishes.

As a token of gratitude to this predator “Mange Thapni” is being worshipped every year. In Goa, crocodiles are the inhabitants of mangroves that are found fringed along the Mandovi and Cumbharjuva canal. Villagers at Durbhatwadi Talauli in Ponda taluka worship Crocodile by scooping mud from mangrove and make an image (idol) of crocodile. It is decorated with the sea shells as eyes and thick plates on the back of crocodile, teeth with small and big sticks etc. The image is worshipped with variety of flowers and vermilion. A hole is scooped on the back of crocodile and live chick is kept in the hole covered with coconut shell. Puffed rice and jaggery are offered to the crocodile image and then distributed to all people present on the occasion.

### Sacred groves

There are number of forest areas in India that have

been preserved as sacred grooves, to offer protection from destruction. Mangroves are not protected as sacred grooves except Achra mangroves in Maharashtra that has been declared as the sacred mangroves of Rameshwar temple. These mangroves are protected by the temple authority, however, temple authority allow some portion of this area to meet fire wood requirement of the locals.

### Sacred Mangrove Tree

*Excoecaria agallocha* is considered a temple tree in the temple of Chidambaram, Tamil Nadu, which has medicinal value.

## MANAGEMENT AND PLANNING

### Planning principles

- Given the many types of products and services which might be obtained from forest and aquatic resources in mangroves, a multi disciplinary approach towards their management is essential.
- Wood, non-wood and aquatic resources are managed in an integrated way and used to meet local, regional or national needs.
- Managing natural resources to meet peoples' needs implies knowledge of what people want.



Students visit to mangrove nursery

- An assessment of needs and public participation is an integral part of the planning process.
- This prioritization among the management objectives should be clearly reflected in the management plan's activities.

**Plans must be objective oriented.**

- Objectives should be quantifiable targets that serve to focus management efforts and measure performance.
  - The ecological carrying capacity should never be exceeded and resource sustainability should be given high priority.
  - The need for the conservation of biological diversity and wildlife should be recognized.
- Planning is an on-going dynamic process.
- The plan must provide for improvements in data collection to reduce areas of uncertainty associated with an incomplete or weak information base.
  - The ultimate objective may be to apply a conservative approach where the uncertainty is perceived to be great.

The decision-making process must be visible and equitable.

- Involving the public in the decision-making process is necessary to get local support and acceptance for integrated management planning.

- Customary rights should be respected where possible.
- Decision-making should not marginalize the traditional incomes of local people nor their access to forest products.

**LIMITATIONS IN MANAGEMENT**

- The management of the restored site is pre-requisite for successful rehabilitation programme.
- Lack of knowledge of mangrove ecosystem, its extent, status and linkages to other ecosystems hampers efforts to conserve and manage mangroves.
- A comprehensive information database of mangrove biodiversity is critical in planning an effective management of mangroves.
- Although, true economic evaluation of mangrove diversity and natural resources is difficult to measure, it happens to be an important factor in conservation and management of mangroves.
- All development plans and policies should include economic valuations that fully reflect the sociological, ecological and environmental costs of resource use, physical developments and pollution.
- Sustainable management can only be achieved if evaluation of mangrove areas is undertaken on a site-by-site basis

