Chapter — X
Regional Development and Planning

10.0. Introduction

A greater portion of the natural resources of the Sundarban has already been lost due to overexploitation of the natural resources. Sundarban being one of the richest biodiversity reserves of mangrove vegetation, due attention is to be paid to the environmental concerns keeping in mind the interest of the rural folk as their livelihood is dependent on forestry and fishing. The problem is to strike a balance between these two ends. The forest-based economy may be developed, keeping in mind the fragility of the ecosystem. Thus planning for a region, considering a balance between conservation and utilization is not an easy job. Moreover, regional development should aim at holistic development of the region allowing adequate time for replenishment of natural resources as well as providing minimum support base for the teeming millions. Pockets of development lead to inequality, rise of discontent and social unrest which in the long run leads to a collapse of the entire socio-economic structure. Moreover, over utilization or misutilization of natural resources disturb the prevailing balance among the components of the ecosystem and make the society vulnerable to a situation when the nature strikes back. This concept cannot be shelved by the regional planners whenever they adopt policy issues and sanction any developmental project. (Mandal et al., 1989)

10.1. Role of Sundarban Development Board

Keeping in mind an integrated model of all round development of the reclaimed area, conservation of the endangered flora and fauna within the forest as well as proper utilization of the aquatic resources, Government of West Bengal, in 1950, initiated a move to form a
committee of 13 members under the chairmanship of the then secretary of Agriculture, Irrigation and Waterways Department to evaluate the feasibility of implementing certain proposals in Sundarban region. The following objectives of the committee can be highlighted:

i. The feasibilities of abolishing all rent receiving interests in the area with immediate effect and a future land system that is to be set up.

ii. Development of food resources in the area and the development of animal husbandry.

iii. Development of inland fisheries.

iv. Development of industrial resources of the area and promotion of salt preparation units to an organized industry.

v. Better utilization of forest resources.

vi. Addressing the problem of irrigation, drainage and embankments. (Mandal and Ghosh, 1989)

The main task of the Committee was thus to look into the development of the region in totality. This committee functioned till 1973 when for better development and coordination it was dissolved, only to be replaced by a Board as per recommendation of the various committees.

The Sundarban Development Board (SDB) was formed in 1973 and entrusted with the responsibility of development and planning for this region. The newly formed SDB concentrated in formulating a ten-year master plan for the future development of the area. This board also emphasized the fact, that production potential of the arable land should be fully utilized for the benefit of the small and marginal farmers. Employment oriented projects were also encouraged, keeping in mind the position of the marginal farmers as well.
However, after so many years, as observed in 2000 and 2001 the land still remains mostly under a single crop, animal husbandry, poultry and duckery projects are yet to take off. Agricultural productivity is also low.

Sources of alternative employment and services had been promised much earlier and after years of independence, the local people still continue to depend on forestry, fishing and subsistence farming with very little modernization or diversification of the production system.

Stringent forest policies have been applied but in vain because there is lack of alternative sources of employment. These rural folk, mostly living below the poverty line, have to survive and therefore exploitation of forest resources still continues thus affecting both the fragile ecosystem as well as the ecosystem people in turn.

Defective policy and adhocism coupled with lackadaisical approach of implementation and irregular monitoring are mainly responsible for such unfortunate situation.

10.2. Wildlife Conservation

Instead of the continuing ecological decline of the Indian subcontinent, the massive network of parks and sanctuaries constructed after 1947 apparently stands out to be an exception. It was found that by the tiger population, estimated 40,000 at the turn of the century, had slumped to 3000. The Cheetah was extinct in 1952. Other large mammals, such as the elephants and rhino had disappeared from areas in which they were formerly quite numerous, while the Asiatic lion survived only in the Gir forest. (Gadgil and Guha, 1992)

Taking into account the rapid loss of wild life, the Indian Board of Wildlife was set up in 1952, from when declaration of several parks and sanctuaries occurred.
It was during this period the interest of the Government was keenly entrusted upon preservation and conservation of the unique mangrove ecosystem. Then the Project Tiger (1973) was launched and consequently declaration of Sundarban Tiger Reserve took place.

10.3. Sustainable Management of Natural Resources

The need of the hour is introducing sustainable management into decision-making on natural and physical resources. Both the natural resources of the Sundarban and the human resources focus our attention mainly on the need to adequately use the earth’s resources, with particular emphasis on conserving resources for future generations. This has been emphasized in all three global conferences held in Stockholm (1972), Rio de Janeiro (1992) and Johannesburg (2002).

There is also the need to consider the environmental costs of activities and policies in the decision-making process in order to protect the biophysical resources of Sundarban. The viable solution to environmental problems can be obtained by connecting the considerations and the relationships during policy and decision-making.

Presently, it is found that the significant sustainable management issues required for: a) Sustaining the potential of natural and physical resources to meet the reasonably foreseeable needs of future generations, b) Safeguarding the life-supporting capacity of air, water, soil and ecosystems, c) Avoiding, remedying or mitigating any adverse effects of activities on the environment. (Kumar, 2001)

It is often found that the main difficulties in applying the concept of sustainable management are the interrelationships between resource use and environmental systems and the problems of identifying appropriate levels and time scales of resource use.
Sundarban requires a management programme, which depends on widening horizons of the planning scenario.

Steps undertaken within the framework of regional action for sustainable development in the Sundarban are given below:

1. Assessment and monitoring of environment and sustainable development trends.

2. Regular publication of the reports of the environment, collation and development of major environmental indicators of the Sundarban mangrove ecosystem.

3. Thorough and regular analysis of regional impacts of population growth mainly by migration from neighbouring Bangladesh.

4. Combating deforestation and land degradation not with the stringent forest policies (having their loopholes), but by promoting environmental awareness and perception.

5. Development of adequate policies supporting environmental impact assessment after assessment of each such parameters within the unique mangrove environment as soil, land, water, vegetation etc.

6. Research, development and regular accounting and auditing the land, water and forest resources is essential for the Sundarban. This done regularly could easily present a picture of the resource scenario both terrestrial and aquatic.

7. Promoting energy efficiency and energy conservation, thereby giving more stress to proper utilization and check misutilization of the conventional sources of energy — the key one being wood or timber of the rare mangrove belt. Conservation of energy could be maintained by harnessing non-conventional energy sources as solar, wind, tidal
energy — which are of abundance and could substitute the energy and fuel crisis of Sundarban.

8. There is the need of promoting environmental awareness, communication and encouraging public participation in several sustainable development activities. In Sundarban, participatory forest management is implemented in several places, but still much more has to be done. Government incentives for promoting formal and non-formal environmental education are the need of the hour.

Presently it is the time to realize that proper management of the environment is a prerequisite for development.

Sustainable development is defined primarily as the development, which needs the requirements of the present, without compromising the activity of future generations to meet their own needs. Environmental awareness should develop with the viewpoint that the present levels and methods of resource exploitation should not degrade the environment to such an extent that in future the resource availability of the rich domain of the mangrove ecosystem should decline. It should be realized that the environmental limits are finite and once it is crossed, the transformation may occur in resource productivity of the region.

10.3.1. Models for Sustainable Management of Tropical Forest

Some models have been suggested by Indian and foreign agro-botanists for sustainable management of the tropical forests, which seems to be applicable in Sundarban region also. One such model has been suggested by T. N. Khoshoo (1996). According to him it may be possible to enhance productivity by judicious application of forestry genetics, breeding, bio-technology and sound silvicultural practices. Improved and highly productive varieties of forest trees are needed
Four Main Types of Forestry and Their Ecological and Socio-Economic Implications

**CONSERVATION FORESTRY:**
Conservation of watersheds and of aquatic and terrestrial biodiversity
No exotics
Coalition with ecosystem people

**AGRO-FORESTRY:**
Agro-pastoral, silvi-pastoral, agro-silvi-cultural, agro-silvi-pastoral
Food, fuel, fodder, fertilizer, small timber, medicinals

**RESTORATION FORESTRY:**
Enhancing soil cover and productive capability, and improving aesthetics
New biodiversity regime

**INDUSTRIAL FORESTRY:**
Timber, veneer, pulpwood, fibre silvi-chemicals

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After Khosho, 1996

Fig.35
STABILITY MODEL FOR USE OF TROPICAL FOREST BY INDIVIDUAL HOUSEHOLD AND ENTERPRISES

Minimum output level to guarantee the conservation of a forest ecosystem (socio-economic stability)

Service and other values (religious, spiritual, cultural)
Profits
Work income
Subsistence production

Actual use (overexploitation)
Actual value of sustainable production

Other values

Indirect use (Climate effect)
Option values
Existence values

Compensation by international community

Other services (ecotourism)
Non-wood forest products
2nd class timber
High quality timber

Other services (ecotourism)
Non-wood forest products
2nd class timber
High quality timber

After Pretzsch, 1998
for making forestry sustainable in India. Fig. 35 suggests the goals of four main types of forestry. The four types (viz. conservation, agro, restoration and industrial) of forestry are not mutually exclusive, but mutually supportive. Such forests must be allowed to regenerate and this should go hand in hand with vigorous forest plantations of elite varieties, particularly raising high density and short rotation plantations of elite, location specific varieties. However, such species should be introduced first in the manipulation zone of Sundarban. If it becomes successful, it may be allowed to grow in further interior of the forest.

The cause of tropical forest conservation has suffered from impractical and unrealistic demands for conservation and protection; the plain fact is that destruction continues unabated from lack of will to make the necessary structural adaptations (Pretzsch, 1998).

Assessing the economic potential and possibilities sustainable primeval forestland utilization is a very difficult and complex task. In terms of timber production, the value of a growing stock (stumpage value) varies much (Fig. 37), depending on the factors being taken into account in the calculation.

The focus of current concern relating to tropical forests is the remaining natural forests whose total area is rapidly decreasing irreversibly (FAO, 1997). Happily, however, the issue of secondary forest management has started attracting interest. If judiciously controlled timber extraction can be coupled with considerably higher increments than at present, but the expenses entailed in such controlled systems, whose function would be to make reafforestation concentrate on valuable tree species and the distant time horizon for the harvest narrow down the profitability. (Figs. 36 and 37)

Figure 38 illustrates the rapid deterioration of the cost-benefit ratio resulting from the exploitative practices common today. There is a woeful paucity of the basic knowledge on the
MARKET PRICE AND STUMPAGE VALUE OF TROPICAL TIMBER WITH AND WITHOUT SILVICULTURE MANAGEMENT

Without silvicultural management

Market price f.o.b

Logging and transport cost

Stumpage Value

With silvicultural management

Market price f.o.b

Logging and transport cost

Costs of silvicultural management

Negative Stumpage Value

Fig. 37

After Pretzsch, 1998
Cost Benefit Ratio of Forest Management Alternatives

After Pretzsch, 1998
functioning, economic efficiency and complex socio-economic, ecological and cultural effects of tree-specific and general forest utilization systems in the tropics. Nobody knows how productively and efficiently these systems are really working. It may be noted that the scope for implementing sustainable forest utilizations systems is shrinking. In some cases, the rapid degradation of resource bases can only be checked by providing external production factors. The conversion of natural forest to production forest by means of homogenization involves high costs which, if the area's timber reserves have already been used and profits not reinvested (as is usually the case), can only be covered through substantial capital investment from outside. (Pretzsch, 1998). These models may be successfully implemented in Sundarban too.

10.4. Critical Appreciation of Government Policies

The government policies, policies of the Forest Department of the Sundarban region are often contradictory, with some actively promoting and others seeking to arrest the environmental degradation. Often it is found that the poor people are most vulnerable to environmental degradation associated with increasing shortages of essential natural resources and contamination of those resources.

It is found that in the Sundarban, degradation has affected the people's livelihood and the productive capacities suffer due to the misutilization of the natural resources. The Boulees (woodcutters), the Mouleys (honey collectors) and the Jeles (fishermen) are the worst sufferers.

10.5. Critical Appreciation of the Environmental Policies on Sundarban

Environmental policies tend to provide alternative sources of employment, but it is found that population growth is the most exacerbating factor in environmental degradation worldwide. Rates of resource extraction are determined by the population size, level of consumption and the
efficiency of existing methods for resource use. It is found that in Sundarban too, if the efficiency of resource use is not improved unchecked population growth is sure to lead to the degradation of resources.

In Sundarban population pressure is the major factor contributing towards environmental decline. The population pressure led to rising number of people, who obtain their living from the natural resources without changing their production techniques, thus overgrazing grass lands.

Land tenure institutions have a major impact on both the exploitation of forest resources and the social consequences of deforestation. In Sundarban, the agricultural land is saline, agricultural production too is much less. Thus instead of stringent forest policies the landless labourers, small and marginal farmers invade the forest.

Though the Forest Policy, participatory forest management schemes, local forest committees and Sundarban Development Board has been established, yet there is a lag in policy formation and its proper implementation. It is observed that the policy failure and market failure may be responsible for deforestation. Politics and socio-economic development are both interconnected; Sundarban is no exception.

Another problem is that the forest tenure systems have still to be secure, equitable and participatory for sustainable forest management, only then the forest resources will be saved from destruction.

10.6. Critical Appreciation of Development Projects

The major projects, undertaken in Sundarban, are given below, but these projects have not been implemented to the truest sense of the term. There is however, lack of coordination between the
policy makers, the local people and implementation, thus creating a complex mesh of fragile environment. And again it is the ecosystem people who have to pay the price.

1. The Sundarban Development Board was set up in 1973 with its jurisdiction of 9630 square kilometers.

2. Sundarban Tiger Reserve was set up in the same year (1973), covering an area of 2585.10 square kilometers.

3. The Sundarban Crocodile Project (Bhagabatpur) was launched in the year 1976.

4. Sajnekhali Wildlife Sanctuary covering an area of 362.40 square kilometers was established in 1976.

5. The declaration of Lothian Island Wildlife Sanctuary was made in the same year (1976) covering an area of 38 square kilometers.

6. The Halliday Island Wildlife Reserve declaration was also made in 1976 covering an area of 5.96 square kilometers.

7. Declaration of National Park followed later in 1984, covering 1330.10 square kilometers and declaration of World Heritage Site was made in 1987.

The entire inter-tidal zone of Sundarban over 9630 square kilometers, bounded in the north by Dampier-Hodges Line was declared as Sundarban Biosphere Reserve in 1989. Sundarban National Park is coterminous with the core area of Sundarban Tiger Reserve, which is a protected area for conservation and has been kept out of biotic interference for acquiring of scientific knowledge and skill as a gene pool.
10.7. Planning for Fishing

A major population of Sundarban is dependent on fishing and allied activities. There is the need for excavation of ponds with provisions for regulating the entry and drainage of saline water to raise productivity of Bagda, but of course giving due attention to aquatic diversity of species. *Panchayet* (local self-government) may take initiative to acquire land, to form cooperation of the fishermen and if necessary to subsidize such effort.

Fishing was not supported by proper infrastructure by the government earlier. However, recently the government has set up fishing port at Frazerganj and Sultanpur (Diamond Harbour). The project for setting up another fishing port at Kakdwip is under completion.

Recently greater impetus has been given to the crab culture. The crabs exported from Sundarban brought returns of 5 crores of rupees to the country. Scientific method of crab culture has brought good results. A new project has been taken up for crab culture on a cooperative basis. The cost of this project is 1 crore of rupees.

10.8. Planning for Protection of Mangrove

During 1989-1990 a programme was undertaken to protect and conserve the mangroves. Over 6000 hectares of forestland was brought under mangrove forests. Besides the mangroves, 700 hectares of land were brought under forest cover up to 1997.

In the year 1994, about 2589 hectares of land was brought under mangrove forest cover and 195 hectares were brought under other forestry schemes. The seeds of trees were distributed from the aeroplanes in dense jungles of the islands of Daya, Swan, and Sagar. In 1994, 800 hectares of land adjoining the Thakuran river was brought under forestry programme. The government forest policies have given stress to the afforestation programmes in the newly evolving islands.
10.9. Coordination amongst the Different Government Departments

It is found that the emphasis of coordination among the different government departments for protection, preservation and conservation of the mangrove forest has been stressed upon. This is a modern approach and helps to bring several disciplines together for a major task. Presently all the policies are framed by the forest department by taking valuable suggestions of different departments of the government, non-governmental organizations, individuals. These departments include that of agriculture, irrigation, forest, health, wildlife resource, education, fishing, science and technology, Sundarban Development Board etc.

The Sundarban Development Board is participating actively in the different developmental activities as forestry, conservation and preservation of land resources, socio-economic development etc.

10.10. Joint Forest Management Policy

In the villages, which are situated at the margin of the forests or its border, Forest Protection Committees have been organized at the local level. From each family a person has been selected to be a member of the forest protection committee. The women have also been involved under such a scheme. These committees are entrusted to look into the interests of the preservation of the forest resources and its proper utilization. As a reward these committees would get 25% of the total timber sold from the forests and 25% of the fuel-wood. Besides they would also be given share of the forest resources. This type of policy is aimed at raising the socio-economic status of the rural folk. (Chamber, Saxena and Shah, 1989)
Alternative sources of employment have also been suggested as fishing in the saline water, honey-bee keeping, extension of agricultural land and encouragement of orchards, giving training for several job oriented vocational courses etc. (Kanjilal, 2000)

The policy mainly aimed at upliftment of the economic status of the villagers by alternative sources of employment. This could lead to less intrusion of the villagers into the forests.

Until today, ten committees have been formed where 3226 families are entrusted with the responsibility of preserving 17,593 hectares of mangrove forest. Fifteen such committees shall be operative in a couple of years.

Thus, keeping in mind the interest of the villagers and preservation of the natural resources on the other hand, the following mode of action is considered.

a) Aquaculture of species as Bagda and Parsey. Introduction of scientific techniques and its implementation through the Panchayets (local self-government) and cooperatives.

b) Initiation of oyster and crab culture.

c) Mushroom cultivation has been started and encouraged in several parts of Sundarban.

10.11. Sustainable Land Use Planning

It is found that three most important and interconnected problems facing mankind today are those of increasing population, provision of adequate food and increasing level of waste carbon dioxide in the atmosphere. (Kumar, 2001)

It is found that in the tropical region there is lack of adequate knowledge on the functioning, economic efficiency and complex socio-economic, ecological and cultural effects of tree-specific and general forest utilization systems.
10.12. Lacunae in Management

Modern ecological and evolutionary theory suggests that the need of the hour is to prevent an environmental collapse, although they would never ensure harvests at maximum sustainable yield levels. Experts say that, prey extinction could be effectively avoided only by providing the prey a refugium, an area of the experimental area inaccessible to the predator where the prey could maintain a minimal population and from which other areas could be colonized by it.

Several days have gone since the Darwinian theory of evolution of species geographers have always brought into concern all the spatial phenomena in totality. The concern about the socio-economic wellbeing, as well as the concern about the rare flora and fauna of the fragile environment, derives due importance in every respect.

Modern ecological theory, however, stresses upon the significance of certain species, which acts as keystone resources or mobile links in maintaining the overall functioning of the community.

Today a section of the people realize that the environment can become degraded through the overuse (or gradual deterioration) of the natural resource stocks, including biodiversity, on which economic activity depends.

10.13. Coastal Zone Management

The coastal zone management in West Bengal has been suggested under both regulatory and non-regulatory system. Aquaculture should also be regulated with a total ban on conversion of mangrove area, controlled obstruction of ground water and appropriate treatment of effluents before being discharged into the surface water system. Similarly, regulatory measures should also be adopted to control dragging activities, discharge of burnt oil, leakage of oil and oil spill due to improper maintenance of vessels, limiting setback lines for coastal construction etc. It is
also emphasized that Environmental Impact Assessment (EIA) study should be made mandatory for any large coastal project.

The coastal stretches within 500 meters of the landward side of High Tide Level can be classified into the following 3 categories for West Bengal as CRZ I, CRZ II and CRZ III Coastal Regulation Zone. Sundarban falls within CRZ I.

CRZ I is identified as the zone of no construction within 500 meter of high tide line. Areas that are ecologically sensitive and important like National Parks, Marine Parks (Sagar Marine Park), Sanctuaries (Sajnekhali, Lothian, Hallyday), Reserve Forests, Wildlife habitats, mangroves (Sundarbans) areas close to breeding and spawning grounds of fish and other marine life (Sagar, Sandhead Island), areas of natural beauty (lower Long Island), historical heritages (Sagar Temple and Ganga Sagar fair site).

Coastal Zone Management Plan for Sundarban is given below. It is considered that:

i. A disaster management plan should be made to cope with frequent cyclones.

ii. Tourism is to be regulated to avoid impact due to influx of tourists, which exceeds the carrying capacity.

iii. Construction of jetties be allowed to facilitate communication of local people

For proper management, Sundarban has been divided into several zones as the Manipulation Zone and Restoration Zone.

The manipulation zone (forestry) supports activities for development of mangrove ecosystem, which will be allowed with emphasis on forestry and allied activities for the benefit of fringe area population.
The restoration zone consists of mainly degraded forest areas, saline banks, mudflats and embankments.

The manipulation zone (agriculture) mainly aims at activities as agriculture, aquaculture, animal husbandry etc.; along with the socio-economic developments.

Despite CRZ Notification and its implementation in Sundarban region defects in the monitoring system and weakness in the process of participatory management often culminate in degradation of land and forest in some places and delayed restoration in other areas.


Several risk factors are involved with the consumption of formed finfish and crustaceans, which need to be identified and controlled in view of the growing importance of formed fish as both a major export commodity and a vital source of protein in low-income food-deficit countries. Aquaculture has been stressed in Sundarban, which is one of the fastest growing food sectors in the world and an increasingly important source of sustainable food production. (Kumar, 2001)

In Sundarban, aquaculture should aim at low value staple food species for domestic markets and high value cash-crop species for export. However, presently it is found that under the influence of globalization multinational companies are encouraging shrimp culture, which is a high value aquatic species for export. The greater and easier returns from the spawns have led to culture of a single species for cheaper and easier economic gains.

The policies should be framed so that in future the environmental risks from the capital-intensive aquacultural systems are reduced. This requires stricter enforcement of environmental laws and generating consciousness amongst the rural folk who are easily purchased by the different
multinational companies extending and encouraging shrimp culture, bringing cheap and easier money.

10.15. Summary of the Work

In comparison to any other field of Geography, lesser importance has so far been attached to the issues related to Biogeography. So any attempt to go through the critical area of man's relationship with inorganic and organic components of nature requires conceptual clarity, identification of the problems and collection of information from secondary sources. Setting the objectives with well-designed methods, for working on such a vast field is essential. All these organizational areas were taken into consideration while preparing the First Chapter of this thesis.

The Sundarban region, which once supported vast stretch of primeval littoral forest, has experienced indiscriminate deforestation for the last two centuries. Much importance has therefore been given to the study of evolution of land use in the Second Chapter. Geographical personality of Sundarban region has been incorporated in the same chapter through discussion on geology, relief and drainage system, climate, soil, flora and fauna. Considering all the facets of physical environment three geo-ecological regions were delineated each of which reflects separate ecological identity.

The entire Third Chapter was devoted to appraisal of resource base in the area under study. Three main components of natural resources — forest, water and land have been discussed at length inclusive of their nature of utilization. A stock of human resource was also taken in order to assess demographic and socio-economic problems prevailing in the local community. These anthropogenic problems are in fact reflected in misutilization of natural resources in the region concerned.
Chapter Four deals with the issues related to the mangrove ecosystem. Its ecological significance, the complex food web and its relation with diversity of species have been analyzed here. Forest policy acts and their implementation in the region has been critically discussed along with identification of endangered species.

Intricate issues of fishing in fresh water, brackish estuaries and Bay of Bengal have been presented in the Fifth Chapter. Biodiversity in the aquatic ecosystem along with problems and prospects of pisciculture have been discussed here.

Chapter Six is concerned with the agricultural ecosystem of the area under study. Cropping pattern and crop calendar, problems of input supply, irrigation and salinization have also been analyzed in this chapter. However, the problems related with erection of earthen embankments and their probable solution have been given due importance here.

Chapter Seven deals with problems of infrastructure and tourism. Transport and accessibility are to main constraints of Sundarban development. Problems of linkage were studied in great detail along with the scope of tourism. Eco-tourism deserved special attention in course of study. In view of energy crisis in the region concerned, scope of non-conventional energy has been discussed in length.

Sundarban is frequented by various natural hazards. Their frequency, magnitude, and mitigation were matters of concern in the Eighth Chapter.

Ninth Chapter analyzes the nature-society interface and man-made hazards. Nature of imbalance in the ecosystem inflicted by human being has been discussed here.
The last chapter is devoted to regional development and planning for the entire Sundarban region. Critical appreciation of the various developmental projects undertaken so far has also been presented in this chapter apart from summery and conclusion.

10.16. Conclusion

Nobody would perhaps de-recognize the significance of forestry and wildlife. Plants have a mechanism of absorbing carbon dioxide, which is a green house gas. Importance of maintaining green belt and biodiversity has been emphasized in all global conferences. Sundarban, being a world heritage site, its conservation has received prime attention of the national and international organizations. Through field investigation it is clearly discernable that problems of the Sundarban region is not only related with forest-centric issues. Existence of three different ecosystems — mangrove forest, aquatic and agricultural — in the same region has complicated the situation. Since none of the systems can be withdrawn from the area under study, complete harmony among three different facets of the littoral ecosystem is the need of the hour.

Thus keeping in mind the sustainable development of the whole region of Sundarban, certain measures can be recorded as humble suggestions following a holistic approach:

1. Entry of human being in the core area of the forest should be totally prohibited through strict vigilance of the mobile forest guards maintaining strong coordination with water police and border security force.

2. Deforestation in the buffer zone should be controlled with utmost sincerity. In this belt joint forest management would be the ideal proposition. Mass awareness on the necessity of green environment would serve as the safety valve for protection of the forest resources.
3. Preservation of the endangered flora and faunal species requires top priority. Expertise of the Botanists and Zoologists can be utilized for regeneration and replenishment of these species inside the core area in the first phase followed by their introduction within the buffer zone in the second phase. This will assure smooth running of the mangrove food web, which in turn will restore biodiversity of the forest ecosystem.

4. Application of Geographical Information System and Remote Sensing Technique would render a great service for monitoring of the forest cover. It would be the task of the department of forest and environment to adopt and implement these techniques effectively.

5. In the manipulation zone just outside the buffer zone, agro-forestry would be the best alternative. Training camp for the farmers may be organized to make them aware and skill enough to implement this method. Social forestry with indigenous species combination may also be encouraged in this belt.

6. Embankments erected in the Sundarban region should be pushed back thus allowing the creeks to enhance their carrying capacity and mangroves to regenerate in the space between the embankments and the channel line. Apprehension of breach in the embankment will also be reduced thereby.

7. Crop rotation and crop diversification need to be introduced keeping in mind the history of crop failure in case of cotton and sugar beet. Over emphasis on food crop, paddy may be reduced in some areas with a record of low yield. Fodder crop, pasture of orchard would be better alternatives.
8. In view of salinity of soil, indigenous salt resisting variety of paddy (Lunisree) may provide good result. Research on development of high yielding salt resisting variety needs to be promoted.

9. Chlorinated hydrocarbon group of chemical pesticides with a record of high residue level should be totally disbanded. Thiophosphate group of pesticides, having the quality of quick degradation in the field condition may be used. But the dose and timing of application needs to be guided by the experts concerned. Biological control of pests seems to be best remedy for controlling the pests without disturbing the food chain.

10. New employment opportunities need to be explored for the people below the poverty line. Bee-keeping, poultry, duckery, sheep rearing, dairy farming, horticulture and floriculture may be encouraged with institutional incentives like introduction of easy credit system from the rural bank. This will help to minimize the exploitation of rural money lenders too.

11. Land use planning is the need of the hour in Sundarban. Conversion of wetlands for any other use needs to be totally prohibited. With a view to maintaining the pond and swamp ecosystems.

12. Fish cum paddy culture may be encouraged during the monsoon as a pragmatic eco-friendly measure with least cost involvement. But application of pesticides in such case should be totally prohibited.

13. Oil spill from the vessels needs to be controlled by imposing severe restrictions on their careless movement so that marine or estuarine species do not get affected.
14. Fishing with super fine nets needs to be controlled in order to save the small pawns on which the bigger target species survive. This will help to restore diversity of aquatic species through smooth progress of the food chain.

15. Monoculture of shrimp should be discouraged with replacement by the ideal combination either for closed or running water bodies.

16. Weather forecasting system needs technological toning up. Special warning for the fishermen should be broadcasted daily at regular intervals. Life insurance for the fishermen operating in the bay would restore social justice.

17. Safe drinking water facility should be extended with installation of tube wells. Water samples of these tube wells needs to be tested from time to time for the sake of quality control.

18. Railway network should be extended to further south thus enhancing accessibility of the isolated areas. Extension of metal roads and repair of the potholes is a precondition of transport development. Regularity and higher frequency of launch service is a requirement of the local people.

19. Rural electrification is a demand of the grass-root people. Power grid network requires to be extended here with subsidy from non-conventional sources of energy.

20. Principles of eco-tourism should be strictly implemented disbanding polythene and other non-degradable waste materials right from the manipulation zone.

21. Human resource development, gender development and gender empowerment should get top priority. Literacy campaign needs to be toned up and rural health centers must take care for reducing child and maternal mortality rates. Ecosystem people requires social
safety nets for coming out of the clutches of iron triangle of the politicians, bureaucrats and landlords/traders.

Implementation of these suggestions will bring relief to the local people and save the fragile ecosystem of Sundarban from destruction.

Reference


