

A Research study on conservation, management and development of beach and estuarine areas of the coastal Karnataka, India

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Abstract: The Government of India concern for the environment of beaches in India surfaced in the year 1981. The concern is mainly towards the quality of beaches and the disappearance of mangroves. In common with most beaches and estuarine / deltaic zones in India, those of the Coastal Karnataka have suffered from neglect, encroachment, human dwellings, and industrial activity causing pollution of air, water and soil and mining operations to a certain extent. In the context of the deep concern about the harmful effects of the above activities, an attempt is made here to suggest a few recommendations for speedy implementation of remedial action. In this attempt individual component of the major resources, namely biological, industrial, tourism, water resources, human dwellings and minerals are analysed to gather overall impact data on the coastal eco-system as a whole.

Key words: Individual component, estuarine, human dwellings, eco-system, industrial activity and biological.

I. Introduction:

Coastal zone is defined as that space in which terrestrial environments influence marine or lacustrine and vice versa. The coastal zone is of variable width and may also change in time. At any one locality the coastal zone may be characterized according to physical, biological or cultural criteria.

Following the Coastal Regulation Zone Notification issued by the Ministry of Environment Forests under the Environment (Protection) Act, 1986 has been adopted in the context of the work done so far on the coast of Karnataka. Coastal zone Management is based on optimal utilization of sources. In fact, one has to adopt administrative criterion for delineating a coastal zone. To date unchecked exploitation of coastal resources has lead to depletion of natural resources but also degradation of coastal environment.

Development and management of the coastal zone in the three coastal districts of the Karnataka State needs priority attention in view of their importance for sea trade, marine fishes, beach tourism, minerals and hinterland resources. This has to be done in different stages to safeguard natural resources and environment along the coastland.

Coastal areas selected or released for varied special purposes like tourism, afforestation, park system, fishing harbours, offshore disposal of industrial effluents should be notified to prevent their use for any other purposes than earmarked. The responsibility for the beach management and the working procedures to be co-ordinated by a committee chaired by the Deputy Commissioner and associated Government Departments, by the local environmentalists and officials of the Forest Department. The maintenance of the quality of the beaches is required for protection. On the basis of the data collected the following steps are suggested and recommended for conservation, management and development of beach and estuarine areas of the coastal Karnataka.

II. Conservation, management and development of beach and estuarine areas of the coastal Karnataka.

2.1 Biological resources and development perspectives:

Biological resources are either under used or overused or abused and exhausted in several instances. Since beach and estuarine flora and fauna have been vulnerable to changes drastically at certain segments along the Karnataka coast, they have been indicated with a view to initiate early steps to prepare a well designed plan for conservation, management and development.

2.1.1 Beaches and its vicinity:

1. A few fidelity species, namely *Spinifex littoreus*, *Cyperus pedunculatus*, *Hydrophylax maritima*, *Cyperus arenarius*, *Ipomoea pes-caprae*, *Canavalia lineata*, *Lanuaea sarmentosa* and *Scaveola persica* are the components of the natural beach flora of the Karnataka coast. Their stock should be preserved in a natural habitat and their conservation in botanical gardens and arboreta.
2. An overall bench marking throughout the length of sandy relief/beach from the high tide water level up to 200/500 mts towards the inland should be initiated.
3. A distinct provision should be made to prevent trespassing the bench marked areas. The passage to the beach area should be regulated only through selected pathways to the locals for their activities.
4. The biomass available in or near beaches needs to be conserved and regulated to maintain the environmental quality of beaches.
5. Developmental plans along the beach vicinity affecting the loss of biomass shall be compensated in protecting the surroundings by afforestation. Casuarina or other strand plantations act as a biological barrier along the sandy beach shores. This green wall controls sand erosion and to a great extent its extension to the hinterland. As a bio productive system, it provides fuel, recreational wood lands and an effective wall against wind and salt spray.
6. Beach areas selected or released for varied special purposes like tourism, afforestation, park systems, fishing harbor, offshore disposal of industrial effluents, urban sewage should be notified to prevent their use for any other purpose than earmarked.
7. Interior land in the vicinity of beaches beyond 200/500m from the high tide water level and within 1 km should be catalogued according to land use patterns to assess and monitor the possible encroachment of the locals into the activity zone.
8. To date, in addition to industrial assemblage at Mangalore and Karwar, the other possible belts are Udupi-Malpe, Coondapur- Gangolli, Bhatakai, Honnavar-Humta nad Ankola to Karwar due to the 'Sea Bird' activity. In course of time the existing and the proposed development in the above sectors will likely to affect the entire coastal environment. It is therefore imperative that comprehensive land use management project must be planned around area where developments have to be established.
9. Beaches and their vicinity were found to be lacking in infrastructural sanitary facilities. It is an open field for abuse by the locals at their own convenience. An overall sanitary facility should be established for the use of the human dwellers near the beaches and also strict regulations should be made to prevent adverse impacts of their professional activity. This could be well done by bench marking their activities along the beaches with notifications for deterrent punishment for any abuse thereof.

2.1.2 Estuarine mangroves:

Fringing mangrove formation is the dominant stable type along the estuarine of the Karnataka Coast. They are poor in species and often found in pure or mixed associations in response to soil gradients of salts. Mangroves are the products of an estuarine whole. The Karnataka coast is non-deltaic and supports mangroves only on estuarine border lands. Soils testing have revealed that they are by and large acidic to strongly alkaline, normal to strong in respect of salt contents, high in organic carbon and low in available phosphorus and potassium. The succession of the mangals is less dense woody and far taller. The existence of correlation is evident between the saline situations and the adoptive features of mangroves in a graded sequence along the estuarine border lands.

Based on recent in-depth study to evaluate the estuarine mangrove habitats for conservation and management the following action points are required:

1. The chakra Haladi-Kollur estuarine complex in the vicinity of Coondapur is being selected for afforestation programme. Concurrently a study is to be initiated to study the growth features of the existing mangroves and the afforested plants for comparison and remedial measures. If any for their improvement and enrichment of the habitat, this plan of action would be helpful to suggest methods to practice sustainable management and development of mangrove formations along the Karnataka State estuaries.
2. The Coondapur and the Mulki mangrove areas have good assemblage of mangals with heavy anthropogenic pressures. An Analysis of the girth and height of the mangroves indicate conservation potential of these areas. As such there is no plan to manage these areas so far. Therefore, there is an immediate need to recognize these areas as a protected area.
3. It has been observed that awareness among the locals for management of estuarine mangroves is disquietening and not followed scientifically. The sequence of this is the despoliation of estuarine

mangroves all along the tidal lands of the estuary, resulting in the loss of mangrove habitats. The locals have to be educated regarding the usefulness of the mangrove habitats for their welfare.

4. Estuarine farming systems as practised to date along the estuarine riverbanks have resulted in the salt intrusion into the adjacent paddy fields due to tidal water storage and this has caused sufficient damage to paddy production. It is imperative therefore to educate the locals to adopt scientific methods for prawn farming without destroying the natural habitats of mangroves.
6. There is a need for massive eco-development plan to contain the anthropogenic pressures and to sustain the requirements and improve the economic status of people in the vicinity. This can be thought of by planning mariculture both in the tidal wet land and degraded edge of the mangrove forests.
7. Lagoon water was reported to be productive at both the primary and secondary levels especially pre and post monsoon months. During that time they can be successfully utilized for brackish water culture with systematic management. Mangrove destruction is very harmful especially along the estuarine border lands, because they are the real soil conservators and protectors of the tidal river banks to a great extent. Further, the habitat is a breeding ground for marine edible animals and their nurseries to a great extent.
8. A state level Beach Development Board shall be established exclusively to deal with all round planning and development supported by coastal agency, forest department, tourism officials, naval authority and other specialized experts in the field of beach morphology.
9. How many lands are under Government or private control and their encroachment in varied forms have to be categorized for needful action.
10. Land use surveys in respect of the encroachment of local people for varied reasons have to be conducted; agricultural, plantations, domestic markets, human dwellings especially fisher folk, with respective survey number should be catalogued for ready reference and monitoring their activity to maintain the quality of life around the beaches.
11. Beach conservation implies management of the adjacent area in such a way that they are useful to humans and at the same time increase the scope for afforestation to protect the hinterland from the saline spray of sea and spread of sand to the interior.

2.1.3 Beach tourism:

Beach segments around the coastal villages have been surveyed in respect of the sea around, recreational value, human settlements, natural resources, levels of economic development, sociosphere of the locals and available infrastructural facilities with a view to incorporate into the comprehensive beach management plan. Based on the obtaining situations the beaches are classified into sea-side resorts, recreational centres and domestic/religious tourism centres and international tourism resorts. Beach inventory is recorded and a scale is outlined to evaluate their quality.

The following suggestions have been made as an indispensable part of the process of beach improvement. Their development and management in totality are considered in the regional context with a view to enhance their attraction from tourist point of view.

1. A state level beach development board should be established exclusively to deal with all round planning and development supported by coastal agency, forest department, tourism officials, naval authority and other specialized experts in the field of beach morphology.
2. Land use survey in respect of the encroachment of local people for varied reasons have to be conducted: agricultural, plantations, domestic markets, human dwellings especially fisher folk, with respective survey number should be catalogued for ready reference and monitoring their activity to maintain the quality of life around beaches.
3. A survey has to be undertaken to find new spots along the estuarine upstreams for the settlements of fisher folk or construction yards for boats or country crafts atleast 200 m away from the water front in case any attempt is made for resettlement of the encroached lands near the beaches.
4. Beach conservation implies management of the adjacent areas in such way that they are useful to humans and at the same time increase the scope for afforestation to protect the hinterland from the saline spray of sea and spread of sand to the interior. Instead of restricting the land use throughout the length of the coastline upto 200-500m from the high tidal water regime, there should be relaxed only for a few beaches selected for development or fishing harbours or recreational beaches.
5. Apart from the scenic panorama of the beaches there should be a provision for establishment of local attractive products as attractants to beach visitor market. In the plan to have a package of attractants to tourists to be created to improve tourism both domestic and international by developing complementary infrastructural facilities around the beaches beyond 500m to 1km from the high tidal water mark.
6. Necessary precaution should be taken to see that no building should raise and obstruct the scenic beauty of the sea from the restricted zone.

7. Beach resorts could be made attractant by developing infrastructural facilities in the form of coastal and riverine cruises, water sports, deep sea fishing and adventure sports.
8. The importance of availability of ground water, fresh water in the vicinity of beaches selected for domestic and international tourism cannot be undermined. In this context it is imperative to have updated information of the fresh water or ground water resources near them.
9. The contents of ground water exploitations have to be gauged and if possible the demands, limitations and impact if any of these exploitation and the source themselves have to be attempted. Salt water intrusions, if any have to be looked into before proceeding to build infrastructural facilities near the beaches for tourism.

2.1.4 FISHERIES

1. Fishing harbours and fish landing centres

There are number of fishing harbours and fish landing centres. These centres offer facility for fishing boats to unload their catch and anchor their boats. In some places there are facilities for icing the fish catch and auction.

These centres are very sensitive places where large scale activities like unloading, sorting of fishes, discarding of unwanted fishes, auction of fish, icing, loading of fish to trucks (fish in baskets or fish with ice). The landing centres unless provided with proper sanitation, it is likely to create a healthy hazard in and around the loading centre.

Therefore, for existing, landing centres as well as proposed centres, the actual facilities available and the required facilities to manage the coastal zone. Each centre is required to be studied and report has to be prepared.

2. Fishing villages and townships:

There are number of fishing villages and other townships located on the banks of the estuaries discharging domestic sewage and factory effluents into the estuary causing heavy damage to fauna and flora in the vicinity. Unless proper precautions are taken to keep the estuaries safe, it will have deleterious effect both on estuarine and marine life besides terrestrial animals and human beings.

Therefore, each estuary has to be studied with references to its condition and remedial measure has to be prepared for implementation.

3. Aquaculture

There is a large scale conversion of agricultural land into aquaculture farms for shrimp culture. These farms draw water from the estuary or sea and hold it for a considerable period in ponds and large seepage of saline water to adjoining areas. They are also discharging the used water into the estuarine or creek and the water quality has to be checked to avoid any epidemics. It is also necessary to bring suitable measures to create buffer zone between villages, agricultural land etc., to avoid salinisation of fresh water resources in the area. Indiscriminate tapping of ground fresh water or drawal of Marine water into the land has to be checked.

Aquaculture units should be prohibited for establishment in bio-diversity rich areas like mangrove and swamps, migrating bird routes and breeding grounds, sanctuaries, national parks, protected areas, forestry, place of heritage.

For monitoring and according sanctions for establishing aquaculture farms, a high level committee is required to be constituted in each district. specially with Joint Director of Agriculture, Executive Engineer of (Irrigation), Executive Engineer (Ground Water) Public Works Department. Deputy Conservator of Forest, Regional Officer, Department of Ecology and Environment, District Environmental Officer of the Karnataka State Pollution Control Board and the local officer of the Town Planning Authority as its members for proper evaluation and providing guidance for shrimp culturists to avoid any eco-damage in the locality.

III. Processing plants

There are number of ice plans, cold storages, processing plants, fish canning plants, fish meal plants located all along the coastal Karnataka. These institutions are also discharging certain quantity of effluents into the sea or estuary. The type of effluents and their quantity is required to be estimated individually and the

3.0 KEY ISSUES OF FUTURE INTEREST:

The following special projects are suggested to undertake concurrently along with the Coastal Environmental Management Plan.

1. The offshore industrial wastewater outlets surrounding and their interaction on biota, namely fishes, planktons, benthos and beaches should be studied scientifically. Similarly, the effluents in the estuaries should be monitored to gauge the quality of water for varied purposes.
2. It was been observed that pesticides and agricultural chemicals used have found their way to estuarine river waters. So far, their effects on the biota especially fishes and the chemical concentrations in the estuarine mangrove habitats have not been studied.
3. Siltation of estuarine rivers require in-depth study starting from the upstream to the mouth of the rivers concerned.
4. Near the beaches, especially those areas which are to be developed ground water resources should be assessed to safeguard the soil from salt water intrusion and the adverse impacts thereof.
5. A study to assess the effect of pollutants along the beaches have to be monitored and also studied in-depth to overcome their toxic impacts, if any. Suitable field stations in the form of full fledged laboratories have to be established.
6. Eco-system studies should be initiated as a whole. An inventory of all the components including the benthic fauna and flora around the coastline with special attention to microflora around the discharge of industrial effluents and their adverse effects on the fishes to be initiated. Necessary monitoring system to be established to warn the excess of pollution which would be harmful to fishes and thereof to fisherman's livelihood. A project to strengthen the fishery department and the pollution board and thereon infrastructural facilities to assess the environment impacts should be initiated.
7. Avifauna is very much affected along the mangrove formations due to the removal of foliage as a fodder for the domestic animals and the plant parts as fuel for routine household activities. The loss or shrinkage of the crown area of the mangroves could be the main cause for the absence of sufficient number of visiting birds which usually enrich the mangrove habitats with their nitrogen rich excreta. So far Aghanashini mangrove formations at selected segments have been studied. To make this place much more attractive to avifauna there is a need to pay sufficient protective devices to restore and increase the crown area of the mangrove taxa to help the birds to nest breed and enrich the habitats. On the obtaining situations necessary action to be taken to erect bench marks to safeguard mangrove disturbance or safety over the years. Avifauna of the mangroves around the Karnataka Coast needs immediate study.
8. Potential areas for aquaculture and the extent of water spread and their suitability for aquaculture along the estuarine mouth and banks have to be studied in the estuarine rivers of Dakshina Kannada and Udupi District. The information available to gather results on field scale is inadequate, so far. A study in this direction is useful.
9. An apprise of the prospects for aquaculture in estuarine rivers and tidal creeks of the rivers has to be done to find out the suitability of sites for aquaculture activities. Further. A detailed investigation will help to grow the proper species for cultivation on a suitable site and also helps to modify the sites to a required condition for cultural practices/ operations. It is yet to be shown or recorded that successful marine prawn fisheries depend on the health of mangroves. So far, no work is there in this aspect and a project in this direction is necessary.
10. There are very few studies to correlate the benthic standing crop along the Karnataka coast with fishery resources of the west coast of India. This needs immediate attention since there is a very good scope for work along the estuaries of the coast.
11. Lagoon water can be successfully utilized for brackish water culture with systematic management. However, it is observed that information on the ecological or environmental status of lagoon/brackish water regime is very meager. This is therefore a potential area for work In Karnataka none of the existing National Parks or Wildlife sanctuaries appears to cover coastal habitats.
12. Reclamation of estuarine zone for aquaculture should be on a selective basis. If not done so it would destroy a natural nursery of great significance. As it is, fish farming has a bright future, the only thorn in the flesh is that of the time scale of development/seasonal scale of development.
13. Estuarine mangroves have an aerial biomass in the form of trees and shrubs which are physiologically adapted to salinity stress and anaerobic water logged mud. Pollution problems of the mangroves ecosystem are many. The factors which affect the estuarine waters are domestic sewage and industrial effluents, agricultural chemicals namely herbicides and pesticides, mining activity and oil spill. Studies have to be conducted to know the actual natural stresses and the reaction of the humans thereon. The deforestation of mangroves area is one of the most serious constraints affecting tropical coastal marine eco-system. Detailed investigations on the effects of pollution of the mangrove area are yet not available. This is to be initiated in respect of coastal Karnataka.
14. The richness of flora and fauna and also highly dynamic nature of the system result in a number of microbiological processes which influence the fertility of mangroves and adjoining coastal waters.

Studies on the microbiology of mangrove swamps including qualitative and quantitative distribution in vegetation, water and sediments and with their role in the cycling of elements and compounds in respect of the fringe mangroves of the Karnataka coast is as yet not studied.

15. Mining area is found to have been left out without refilling or reshaping to a level. This would lead to degraded land formation in course of time. Reclamation of abandoned mines should be made compulsory to the mining companies with a view to develop marine parks or piscicultural ponds.
16. The existing stretches and prospective stretches for consolidation of sandy beach area have to be marked on a map. So far indepth study has not been done on the faunal and floral quality of such stretches upto 50-55 fathoms along the continental shelf.
17. Large scale sand lifting/mining activity and their impact on the coastline environment has not been studies. This is to be initiated.
18. Since, mangroves sustain estuarine marine life their needs shall be evaluated in water management practices along the coast. A study in this respect is rewarding. It is however, necessary to study environmental conditions in individual mangrove forests in detail with respect to the local rainfall, winds, temperatures, humidities, surface and underground hydrology, tidal patterns, soil salinity etc., in order to relate zonation with climate.
19. Mangrove exploitation and protection have to be kept in mind so as to maintain the ecological balance intact.
20. It is suggested that immediate steps are to be undertaken to locate suitable sites for the development of fish farms and to assess the availability and abundance of seeds of cultivable species.
21. Remote sensing techniques used so far along the Karnataka coast especially the Netravati-Gurpur estuarine area of Mangalore taluk. The Chakra-Haladi-Kollur estuarine complex of the Coodapur taluk and the Kalinadi estuarine complex of the Karwar taluk have revealed synoptic and repetitive coverage for a year. This work has to be continued for identifying as well as understanding varied geomorphic changes taking place along the entire coastal zone from Someshwar to Majali in Karwar taluk. This is to be supported by mapping based on aerial photos and ground truth survey in relation to erosion prone area, changes in land use pattern in the sub-coastal area deleterious effects of various developmental projects near the coast, such as mining, dam construction, industrial plants, reservoirs etc., over a period of time to plan premedical measures.
22. Remote sensing technique is very helpful in gathering information on environmental parameters/degradations associated with developmental activity.

23. COASTAL REGULATIONS ZONE

Under the Government of India, this notification in 2011 covers all area within 200m HTL as prohibited area whereas in CRZ-1 construction activities in areas within the 500m from HTL are forbidden. The present study has clearly indicated the over all land use activity in all most all the survey numbers coming under 200/500m HTL. In some cases, there may be encroachment further for cultural, industrial or agricultural activities and often used for urbanization and dumping industrial pollutants.

24. The detailed research study is very essential along the coastal Karnataka in view of the pressure of population, exploitation of natural resources, namely fisheries, aquaculture, seaweed harvesting increasing location of waste effluent disposal sites, development of various chemical, petro-chemical fertilizer and allied industries. Aquaculture development is another fast-growing activity mostly unauthorized along the Karnataka Coast because of its foreign exchange earning potential.

25. COASTAL PROFILE

All along the coastal zone within 500m inshore there are varied activities which are imperative for bettering living conditions of the people, it is also equally important to protect the coastal 500m inshore from further deterioration and degradation which will upset the entire eco-system irreversibly.

26. No agency exists in the Karnataka State to monitor the impact of changes of natural or anthropogenic features and to suggest methods to minimize the adverse effects of development.
27. The present survey has covered land use patterns with the survey numbers as outlined in the records of taluk offices. The data though it serves the main purpose for coastal management plan, the data are not periodically updated to reveal the exact features of the survey numbers. Further, there should be up-to-date ground truth maps in respect of varied disciplines activities which are helpful for coastal management plan of action.
28. For better assessment there is a need for satellite data which help to locate fishing areas accurately along the sea adjacent to coast line. Further, their migration pattern can be studied and thus the information can be made available to fishermen for rational development of fish landing along 500m inshore.

29. Building activities along the 500m inshore should be monitored as it is vital for coastal management plan.
30. Sea walls in certain stretches have counter productive and have either aggravated or only shifted the site of erosion. In such cases sea walls to be juxtaposed with green walls for effective protective measures.
31. Due to increased industries and urban effluents along the 500m inshore the existing survey numbers for such activity should be mapped and monitored to check the deleterious effects at a minimum.
32. Tourism along the 500m inshore is no longer just a matter of recreation but has become a major source of income earning foreign exchange. The Karnataka Coast has the vast potentialities which are yet to be tapped, as it is done in Goa and Kerala. Any thinking in the above direction there must be enough input of marine and coastal land use data. There is a scope for littoral arboretum for coastal plants and aquarium for marine fishes. For this there is a need for enough input data.
33. The above mentioned issues will be useful for evolving a comprehensive Coastal zone Environmental Management. There is immediate need for such a management policy in every existing land use pattern and also proposed developmental activity along the Dakshina Kannada, Udupi and the Uttara Kannada coastal districts of Karnataka State.

IV. Management of Action Plan and Prescriptive Solutions.

1. It is emphasized that conservation plan of beaches and adjacent area including areas within the tidal reach should have proper policy backing in the direction of protection, rehabilitation and management.
2. Beaches and mangrove formations as-a-whole are vulnerable to changes drastically at certain segments. They have been indicated with a view to take early steps for correctives to be implemented.
3. Encroachment in varied forms is not uncommon all along the coastal Karnataka. The human dwellings and their unregulated activity along the 'No Activity Zone' have reached a stage to tell upon the quality of beaches and the estuarine banks supporting mangroves.
4. Loss of biomass along the beaches and mangrove habitats should be compensated by afforestation. This will help the locals to get their fuel needs and concurrently conservation of beach and mangrove zone.
5. Unregulated human dwellings, agricultural operations, fish farming are detrimental for conservation practices and they create repercussions and lead to the impoverishment of beaches and mangrove ecosystems and their destruction.
6. Aqua farming has become a seasonal affair in the coastal Karnataka. Their dual role is in producing paddy during monsoon and prawn farming during non-monsoon months. This regular practice has created saline lands to a certain extent.
7. Publicity and awareness among the locals has to be initiated by audio-visual methods to emphasise the importance of natural settings in their day-today life and conservation of the quality of beaches and mangroves.
8. Local people must be made to understand that by protective devices they will have the chance to get assured supply of fuel or fodder, which they can plan for.
9. Coastal areas selected or released for varied special purposes like tourism, afforestation, park system, fishing harbours, offshore disposal of industrial effluents should be notified to prevent their use for any other purposes than earmarked.
10. The responsibility for the beach management be placed at village level and the working procedures to be co-ordinated by a committee chaired by the District Administration and associated by Ecology and Environment, Forest, Revenue, water resources, Rural Development and Panchayath Raj, Fisheries, Agricultural and Public Works departments, local environmentalists. The maintenance of the quality of the beaches should be the responsibility of the local authorities with close links with the officials of the zilla Parishad.
11. Shell and sand removal from the estuarine rivers are very common along the estuaries, especially the Gangolli, the Aghanashini and the Kali rivers. The shells are mainly being used in plyfibres and pulp industry and also for the other purposes. It has been established that their removal especially during the monsoon months has an adverse effect on the breeding behavior of migrating fishes and feeding habits of prawn juveniles. It is suggested that the dredging of operation to be restricted to non-rainy seasons. This regulatory managerial act is to be implemented by the coastal authority to avoid the adverse effects on shell beds due to extensive operation of shell dredge.

12. Public awareness in respect of the beaches of Karnataka coast seems to be low among the general public of the three coastal districts. To date, no attempt has been made to understand the overall impact of intense urbanization, industrial wastes, pollution of air and water, on their livelihood. The areas around the beaches seem to be of no concern to general public except for the fisher folk who are interested in their professional activity ignoring the beach environmental problems. It is imperative, therefore, to educate the locals about their professional implications without any regard to environment, as harmful.
13. It is observed that the beaches and areas around estuarine banks and islands are not notified in the existing network of conservation areas in the State. The best way to do so is to set up 'Marine coastal National Park' sanctuary. The prospective sites for the park is the estuarine complex in the Coondapur and Udupi taluks.
14. Ecosystems concept involves multi-disciplinary studies. It is imperative therefore to set up at one place near the coast an Institute to do research on all aspects of the ecosystem and their interaction. Further, it should be augmented by having in-service training programme for better research results.
15. In the proposed institute provision should be made for the participation of local people with the patronage of forest department and other related departments of the Government and also technical experts to check ecological despoliations of coastal settings.
16. District Administration staff has to be trained in integrated planning and Coastal zone environmental management.

V. Conclusion:

This research study report contains details on different disciplines involved proceed to prepare Coastal Environmental Management Plan. However, it is not an exhaustive study. Coastal Zone Environmental Management Plan is multifaceted. It is difficult define a coastal zone so as to apply to all disciplines or applications. However, in this study an attempt has been made to bring the existing situation related to physical features and land use pattern within 500m inshore from the high tide line.