

## **Over Utilization of Coastal Resources and its Impact: The case of Sri Lanka**

**H.A.S. Arunashantha**

Assistant Lecturer, Department of Geography

samathkln2015@gmail.com

---

### **Abstract**

The coastal zone is the interface where the land meets the ocean or sea, encompassing shoreline environments as well as adjacent coastal water. Its components include river deltas, coastal plains, wetlands, beaches and dunes, reefs, mangrove forests, lagoons, and other coastal features. It is a geomorphologic area either side of the seashore in which the interaction between the marine and land parts occurs in the form of complex ecological and resource systems made up of biotic and a biotic components coexisting and interacting with human communities and relevant socio-economic activities. It has no definite boundary, it varies from one coastal nation to another nation as they defined it. In Sri Lanka, Coastal Zone is defined as the area lying within a limit of 300 m landward of the Mean High Water Line (MHWL) and a limit of 2 km seaward of the Mean Low Water Line (MLWL); in the case of estuaries, streams and river outfalls, lagoons, or any other body of water connected to the sea either permanently or periodically, the landward boundary extends up to a limit of 2 km measured perpendicular to the straight base line drawn between the natural entrance points thereof and includes the waters of such rivers, streams and lagoons or any other body of water so connected to the sea.

Coastal zone has several definitions. Ketchum has given a definition in (1972) as “The band of dry land and adjacent ocean space in which terrestrial processes and land uses directly affect oceanic processes and uses and vice versa.” However this definition also has some problem since it has not considered the all coastal ecosystems. Coastal zone is commonly referred to as the interface or transition space between two environmental domains, the land and the sea. Coastal area consists only 8% of the world surface area but it provides 25% of the global productivity. In addition to the above 70% of the world’s population is living within the coastal areas. The coastal area in the world also consists of very valuable resources such as fish, mineral corals, mangroves, lagoon and estuaries, gas and mineral (ICRMP). About 90% world’s fish harvest comes from the coastal area. Therefore coastal area is very important to the world economy and the population. However coastal zone or coast is not a well-defined resource. Coast is physically dynamic edges between land and sea and comprised of numerous physiographic forms: dunes, deltas, beaches, wetland etc. it also has a wide range of ecosystems such as coral reefs, mangroves, sand dunes, sea grass beds, estuaries and lagoons. The coastal area serves as habitats for countless flora and fauna. More importantly coastal areas are the locus of an incredibly diverse range of human uses and activities.

Sri Lanka is an island covering a land area of 65610 square Kilometers, with a coastline of 1561 Kilometers. It is located off the southern tip of India and is separated from by the shallow Plak Strait. As a result of the elongated nature of its configuration, no place in the island is more than 120 kilometers from the sea (Swan, 1983). The coastline itself consists wide range of geomorphologic features such as headlands, bays, lagoons, peninsulas, spits, bars, islets and a variety of ecologically rich coastal habitats. Coastal regions, which are home for a large and growing proportion of the world's population, are undergoing very serious environmental degradations. The issue is particularly acute in the developing countries. The reasons for environmental degradation are complex, but human and climatic factors are playing a significant role. Today, approximately 3 billion people – about half of the world's population – live within 200 kilometers of a coastline. By 2025, that figure is likely to double. The high concentration of population in coastal regions has produced many economic benefits, including improved transportation links, industrial and urban development, revenue from tourism, and food production. But the combined effects of booming population growth and economic and technological development are threatening to the coastal ecosystems and resources that provide economic benefits to the communities. Unless Coastal managers and coastal resource users take proper action to mitigate the negative impacts, population pressures and the associated levels of economic activity will further degrade many coastal ecosystems.

The challenge for policymakers and coastal resource managers is to figure out how to reap the economic benefits of coastal resources while preserving them for future generations. Addressing population expansion and infrastructure development issues are key to achieving such balance. This paper will discuss the historical changes of the coastal issues, population growth, urbanization, and other factors created to coastal resources management issues, how coastal issues influences people's lives and livelihoods; and how policymakers can integrate coastal development activities and resource management issues.

### **Coastal Resource Impact in Sri Lanka**

Pollution is the introduction of contaminants into the natural environment that causes adverse change. Pollution can take the form of chemical substances or energy, such as noise, heat or light. It could be point source or non-point sources. Point, refers to the pollutants that belong to a single source. e.g. Direct discharge of effluents from factories into the coastal water.

Non-point means pollutants emitted from multiple sources. e.g., contaminated water after rains that has traveled through several regions, (acidification of ocean water). The World Health Organization (WHO) considers waters to be polluted when they are altered in composition or condition, directly or indirectly, as a result of human activities so that they become unsuitable, or less suitable, for any or all of the functions or purposes for which they would be suitable in their natural state. Coastal pollution is a global phenomenon, mainly anthropogenic. However, it can be either land base, oceanic or atmospheric in origin. Global warming may also be a causative factor of coastal pollution. Unlike inland aquatic ecosystems, because of the complexity of coastal habitats and the magnitude of

human association with them it is extremely difficult to discuss the coastal pollution in a single array of order. However, it can be categorized into three major components, viz., and land base oceanic and atmospheric.

Climate change could affect our society through impacts on a number of different social, cultural, and natural resources. For example, climate change could affect human health, infrastructure, and transportation systems, as well as energy, food, and water supplies. Coastal areas as a whole, and small coastal river basins across the world and specially in south Asia particular, are especially vulnerable since they directly suffer the influences of phenomena such as heavy precipitation and flash floods, the frequency of which has been increasing over the last few years, as well as rising sea levels. Throughout the 20th century, the global rise in sea level has contributed to increased coastal inundation, erosion, and ecosystem losses. Rising temperatures have led to loss of sea ice, thawing of permafrost and associated coastal retreat, and more frequent coral bleaching and mortality. This has consequently led to an increase in sea level, displacement of people, loss of livelihoods, and submergence of low-lying areas.

### **Linkages between Climate Change and coastal areas**

Resources Changes in climate occur as a result of internal variability of the climate system and external factors (both natural factors such as solar radiation, cloud formation, and rainfall and those resulting from human activities, including increased concentrations of greenhouse gases) in the atmosphere. Since the industrial revolution in Europe in the mid 18th century, human activities (e.g., burning fossil fuel and land use/land cover change) have increased the atmospheric greenhouse gases (e.g., water vapor, carbon dioxide, methane, nitrous oxides, and sulfur dioxide). Increase in these greenhouse gases, especially carbon dioxide, has and will continue to increase the mean global temperature, alter the precipitation patterns, and raise sea level. This will result in an enhanced global hydrological cycle and more extreme and heavier precipitation events in many areas. Atmospheric concentrations of carbon dioxide have increased by about 30% and methane by about 150% during the last one and a half century (IPCC 2001). Other greenhouse gases and the associated biogeochemical cycles have also been affected. For example, Nitrogen production, due largely to chemical fertilizer production, has doubled in the 20th century (Walker et al 1999), and atmospheric concentrations of Nitrous oxide have increased by about 16% (IPCC 2001). Changes in anthropogenic sulfur dioxide emissions have been large, but regionally variable, and the gas is generally short-lived. In the late 1990s, the anthropogenic sulfur dioxide emissions decreased compared to the mid-1980s, due to structural changes in the energy system as well as concerns about local and regional air pollution (Albritton & Filho et al 2001). These emissions, or aerosols, cool the atmosphere (unlike the other greenhouse gases), but are still important in explaining the changes in climate observed in the 20th century and those projected for the 21st century and beyond.

**Possible impacts of these on estuaries and lagoons**

Lead to higher relative coastal water levels and increasing salinity, thereby tending to displace existing coastal plant and animal communities. But plant and animal communities may still persist, if migration is not blocked and if the rate of change does not exceed the capacity of natural communities to adapt or migrate. If estuaries and lagoons are unable to migrate to keep pace with sea level rise, net loss of physical area is possible. This is a very common occurrence in many countries as the estuaries and lagoons are unable to migrate because of development activities around them. A globally intensified hydrologic cycle and regional changes in runoff all warn of changes in coastal water quality. Freshwater inflows into estuaries/lagoons influence water residence time, nutrient delivery, vertical stratification, salinity and control of phytoplankton growth rates. Increased freshwater inflows decrease water residence time and increase vertical stratification, and vice versa.

**What are the impacts of mangrove decrease**

Reduced mangrove area and health will increase the threat to human safety and shoreline development from coastal hazards such as erosion, flooding, storm waves and surges, and tsunami, as most recently observed following the 2004 Indian Ocean tsunami. Mangrove loss will also reduce coastal water quality, reduce biodiversity, eliminate fish and crustacean nursery habitat, adversely affect adjacent coastal habitats, and eliminate a major resource for human communities that rely on mangroves for numerous products and services. Mangrove destruction can also release large quantities of stored carbon and exacerbate global warming and other climate change trends. Sustainable management and conservation of the existing fisheries and aquatic resources require control of aquatic pollution which affects mangroves negatively. Moreover, degradation of mangroves could have negative consequences for transfer of materials including trapped heavy metals into the coastal systems.

Obviously small changes in mangrove habitat might have profound impacts on alteration of species density and diversity of marine fish resources. Climate change has emerged as one of the main threats to mangroves in recent years compared to conventional threats such as habitat destruction and deterioration, pollution, change of water quality due to catchment management. Climate change components that affect mangroves include changes in sea-level, high water events, precipitation, temperature, atmospheric CO<sub>2</sub> concentration, ocean circulation patterns, health of functionally linked neighboring ecosystems, as well as human responses to climate change. Of all the outcomes from changes in the atmosphere's composition and alterations to land surfaces, relative sea-level rise may be the greatest threat. Although, to date, it has likely been a smaller threat than anthropogenic activities such as conversion for aquaculture and filling, relative sea-level rise is a substantial cause of recent and predicted future reductions in the area and health of mangroves and other tidal wetlands.

Issues related to fisheries management

In Sri Lanka, following are the main issues the coastal fisheries sector is facing.

- Lack of reliable information on catch, effort and stock sizes.

- Lack of sufficient awareness among fishers on conservation and sustainable use of resources.
- Insufficient community participation in decision making and resource management.
- Severe environmental degradation taking place in coastal areas.
- Growth and recruitment overfishing.
- Illegal fishing.
- Use of destructive fishing gear types
- Open access nature of coastal fisheries.
- Difficulties in controlling fishing effort.
- Poor law enforcement.
- Lack of integrated management approaches.
- Different fisher groups using several fishing gear types for harvesting the same resource

### **Sand Dunes Management Issues**

Issues relevant to sand dune management can be grouped into two as the formation and existence issues. Formations issues of sand dunes involves mainly with the sediment budget of the shoreline. Reduction the sand supply into the coast and influences in disturbing the long-shore drift can be regarded as main factors that cause to negative impacts for the sediment budget. Rivers, process of coastal erosion and continental self are the key sources that supply the sand into the coast. The extractions of sand from rivers are extensive. Sand mining from the beaches is in considerable level. And also, as the protection walls along the coast are constructed all along many coastal segments, shoreline erosion is no longer a source for supplying sand for the sediment load of the many coasts. Therefore, the sand supplying sources are not in a favorable situation to form sand dunes in particularly the coastal zones where the population density is high. On the other hand the existing sand dunes are in danger or facing severe problems to secure their existence. Removing vegetation cover that withholds the sand, mining dune sand, and commencement of new erosion cycle in the coast due to sea level rise or changing morphology of the coast are the main factors that influence to destruct the existing coastal sand dunes.

### **Impacts on coastal societies from diminishing sand dunes**

Impacts of diminishing sand dunes on coastal societies can be listed as follows,

- a. Increasing shoreline erosion
- b. Reduction of private and public land area
- c. Destroying near shore infrastructure facilities
- d. Disappearance of sand dune related human activities such as anchoring fishing boats.
- e. Vanishing the wetlands and other vegetation cover from the coast.
- f. Salt water intrusion into fresh water bodies
- g. Collapsing the economy of the coastal community

Other many facets of unfavorable situation can be emerge and impacts on coastal community negatively due to destruction of sand dunes.

### **The Impact Management Strategies and process**

The interest in coastal management in Sri Lanka dates as far back as the 1920's, such efforts were mainly focused on seeking engineering solutions to control coastal erosion problems by construction of coastal protection structures. During this period there were several agencies were carrying out coastal protection structures to meet their individual agencies requirements. However, the lack of understanding of the dynamic nature and complex inter relationship among ecosystems and human activities in the coastal zone resulted in an escalation of coastal problems and considerable degradation of the coastal environment.

The realization that a comprehensive approach to coastal resource management was required led to the establishment of a Coast protection Unit in the Colombo Port Commission in 1963. In 1978, a Coast Conservation Division was established in the Ministry of Fisheries. This division was upgraded to a department in 1984.

In 1981 Parliament enacted the Coast Conservation Act No. 57 of 1981 and this act came into operation since October 1983. The Act required Director General to have a survey made of the Coastal Zone and on the basis of the result of the survey to prepare a comprehensive Coastal Zone Management Plan (CZMP) for Sri Lanka.

In Sri Lanka, Coast Conservation Act No. 57 of 1981 and its 1988 amendment provide the legal foundation for activities in the Coastal Zone. In addition, there are many other statutes that support the conservation and sustainable use of coastal and marine habitats and species through other institutional mandates as given below.

- Marine Pollution Prevention Act No. 59 of 1981
- The Fisheries and Aquatic Resources Act No. 2 of 1996
- The National Aquaculture Development Authority of Sri Lanka Act. No.53 of 1998
- The Fauna and Flora Protection Ordinance No. 2 of 1937,
- The National Environmental Act No. 47 of 1980,

### **Coastal Erosion Management Measures**

- Protection of the coastline: Seawalls, Revetments
- Controlling longshore sediment transport: Groynes, Offshore breakwaters
- Sand supply to the coastline: Artificial sand nourishment, Reduction in river sand mining
- Accommodation of erosion: Maintaining setbacks, restricted areas
- Combination of the above methods

Many of the erosion management measures are expensive and are associated with comparative advantages and disadvantages. Also, a protection method implemented in one

locality may lead to adverse impacts associated with erosion in other locations. Proper coastal development planning is thus required to mitigate adverse impacts coastal erosion. And also if we want to mitigate impact to the Lagoons and Estuaries below objective can be use under two main policies

01. Strategies for minimising degradation

- Minimising the discharge of untreated industrial effluents and sewage through monitoring and enforcing compliance with existing regulations and guidelines
- Minimising adverse impacts of water diversion and irrigation schemes
- Minimising reduction of functional areas due to encroachment, reclamation and sand bar formation
- Minimising pollution from adverse agricultural practices in the coastal zone and inland through collaborative efforts
- Minimising threats from solid waste disposal

02. Strategy for enhancing economic ecological and social values

- Promoting sustainable management with community participation

The other hand in Sri Lanka fish resources and their environment represent an ongoing challenge. Sri Lankan coastal fisheries are characterized by a wide range of fishing gear and target species. It is multi- gear, multi-craft and multi- species in nature. Fish landing points are distributed widely along the shoreline and data collection on resources and crafts are not taking place in a scientific manner. Hence, collaborative efforts will be useful to strengthen institutional capabilities to strengthen the data collection system of the coastal fisheries sector.

Monitoring sediment budget of the shoreline through managing human activities are the main step that can be taken to protect sand dunes and secure the general public who rest on their livelihood on sand dune coastal environment.

### **Coastal Resources Management**

Many coastal resources managers are trying to stop or completely ban certain human activities to conserve the coastal resources and habitats in the coastal zone. This is basically a regulatory approach. However Sri Lanka has enough experiences in relation to the regulation approach and it was very clearly proved that the hard legal and punishment actions are not a very appropriate approach to coastal resources management. Therefore coastal manager's duty is to manage the human activities than banning of human activities for managing the coastal resources. There are two ways of reducing the negative human impacts on ecosystems. They are environmental management and demand management of human resources. Environmental management approach is based largely on information gained from earth science, environmental science, and conservation biology. Demand management of human resources approach is based largely on information gained from economics.

Integration

The term “Integration” can be adopted for many different purposes and therefore it is important to define the term in the context of the management of the coastal zone to appreciate the ICZM. Integration is central concerns in management of natural resources due to resources are significantly affected by cumulative impact of the decision and action taken by users and authorities. It is also very important to indicate that the management of complex resource system and the resources exist in different but inter connected. Integration within ICZM occurs in and between many different levels. They are;

- Integration among sectors
- Integration between land and water elements of the Coastal Zone
- Integration among levels of government
- Integration between nations
- Integration among disciplines

### **Carrying Capacity**

Another important definition for the ICRM is carrying capacity. Many scientific data indicated that the humans are living beyond the carrying capacity of planet earth. This situation is presented in detail in the millennium ecosystem assessment and the planetary boundaries framework. The ecological footprint measures the human consumption in terms of biologically productive land needed to provide the resources, and absorbed the wastes of the average global citizen. In 2008 it was estimated that it is required 2.7 global hectares per person, 30% more than the natural biological capacity of 2.1 global hectares. Therefore this ecological deficit must be met from unsustainable extra sources. These balance are obtained by the users in three ways; embedded in the goods and services of world trade, taken from past (e.g. fossil fuels), Borrowed from the future (e.g. over exploiting). Therefore carrying capacity is capability of one ecological system to maintain its productivity without borrowing from extra sources such as past or future.

### **Sustainability**

Sustainability is another important term to define for the Integrated Coastal Resources Management (ICRM). Sustainability is the capacity to endure. This word is derived from the Latin “sustainer”. Dictionaries provides more than ten meanings for sustain such as “maintain” “support” “endure” etc. The sustainable goal is to raise the global standard of living without increasing the use of resources beyond globally sustainable. The Brundtland Commission of the United Nations on March 20, 1987 defined the sustainability as “Sustainable development is development that means the needs of the present without compromising the ability of future generations to meet their own needs”

Sustainability does not compromise future generations’ use of the same resource. Therefore Management must be done to maintain the carrying capacity of the



resources. Thus management objectives should be guided by an ecosystem focus that allows economic and social development rather than by rigged environment standards and regulations. At the 2005 World summit on Social Development indicated that Sustainable Development requires the reconciliation of environmental, social equity and economic demand the three fillers of sustainability. The simple definition base on all of the above definitions can be stated as “Sustainability is improving the quality of human life while living within the carrying capacity of supporting eco-systems”.

### **Management Strategies used by the Sri Lanka CZMP**

The management strategies used by the National Coastal Zone Management Plan for coastal resources management in Sri Lanka are several types. These several type strategies can be organized into four groups namely; Environment type policies (Coastal Habitat management such as Estuaries, lagoons, Corals, mangroves and sand dunes), Resources management policies (Archaeologies, historical, scenic sites), Issue oriented policies (coastal erosion), Administrative procedure policies.

Under the above four categories following strategies have been implemented by the Sri Lankan authorities to manage the coastal resources in Sri Lanka. They are; Land use planning, Direct Development, Regulations, Shoreline exclusion or setbacks, Special area planning, EIA procedure, Education and Awareness, Planning , Policy and Guideline Development, Coastal Research studies and data base development, Coordination monitoring and evaluation

Coastal resources management strategies impacts on to the coastal societies

There are no proper scientific studies available to evaluate the implementation outcomes of the coastal management strategies in Sri Lanka and their impacts to the coastal communities and the coastal resources. Therefore it is very difficult to indicate the effectiveness of the Strategies. However certain studies and the CCD's implementation experiences reports and permit complacence reports has indicted certain amount of information in relation to the management strategies.

### **Regulation**

The regulatory appraisal process involves an assessment of the probable impacts of the proposed development activity. This was done with permit procedure and after the preliminary process the CCD issue or denies the permit application. If the CCD appraisal stage the developer fulfills the entire requirement, then the CCD will issue a permit with conditions for proposed development activities. However there is no proper monitoring system to evaluate the permit conditions.

According to the CCD permit procedure the developer needs to submit three building plans and three survey plans for even for small house constructions. The poor coastal communities are not is a position to provide this information and therefore they are normally not submitting the applications and construct their houses without permit.

Therefore poor coastal communities are considering this regulation procedure as barriers for their livelihoods.

#### Land use Planning

This strategy is implementing by the local authorities using UDA regulations and municipals by laws. However due to various sectoral development activities and area wise political involvements many land use plans are not implementable. The land fragmentations patterns, and land ownership pattern in Sri Lanka also negatively affected to the implementation of land use plan.

#### Direct Development

This includes coast protection structures to mitigate the coastal erosion, flood protection structures, salt water intrusion structures. As by nature these strategy has positive and negative impacts to the coastal communities. For example, coast protection structure will protect certain coastal communities' houses while preventing fishing communities livelihoods. It is also will affect to the adjoining coastal areas increasing the coastal erosion thereby destroying houses and other properties.

#### Shoreline exclusion or setbacks

Shoreline exclusion or setbacks are another type of the regulations. In Sri Lanka, country divided into 70 segments of setbacks under the 1997 CZMP and indicated multiple setbacks standard as 35m lowest and 125m as highest. These setbacks has decided base on erosion rate, level of user conflicts, exposure to the natural events, geomorphologic characteristics, vulnerability to the coastal habitats, level of development, significant of cultural and natural sites etc. However it was found that the setback segment distance are not appropriate with the above criteria. In Sri Lanka, individual land parcel size of the coastal communities are very small and therefore maintain the stipulated setbacks are very difficult. Therefore they tend to violate the setback or ignore the setback and constructing the structures without a permit. Therefore many of the small structures in the coastal areas are illegal or unauthorized constructions. This situation negatively affect to the coastal communities in many ways.

#### Education and Awareness

The CCD and other agencies have conducted many education and awareness programs to manage the coastal resources and evaluations of the education and awareness program of the CCD prove that this strategy is very useful to change the behaviors of the coastal resources users.

#### Conclusion

The CCD implementation experiences of the Coastal resources management strategies are very from one to another. One strategy will affect one area but no other area. In many cases single management strategy is not achieving the appropriate objective of

the ICRM. Therefore implementation of the multiple management strategies is the best for the ICRM. Coastal resources and their impact are very familiar for Sri Lankans. And also coastal resource management strategies were implemented by various agencies. But now we have to review and implement new methods for protect and sustainable use our coastal resources.

## References

- Bayliss, B. Benman, K. Elliot, I. Finlayson, M. Hall, R. House, T. Pidgeon, B. Walden, D. and waterman, P. (1997) Vulnerability Assessment of predicted climate change and sea level rise in the Alligator rivers region, northern territory Australia, Supervising scientist report 123, Supervising scientist, Canberra,1334pp.
- Central Environment Authority (1988), Sri Lanka National Conservation Strategy.
- Coast Conservation Department (2003), revised coastal zone management plan, Sri Lanka.
- Coorary, P.G. (1984) An Introduction to the Geology of Sri Lanka National museums Department, Colombo.
- Integrated coastal resources management plan (1990, 1992, and 1997).
- IPCC Third Assessment Report (2001): Climate Change, Impact, Adaptation, and vulnerability.
- Jayakody D.S. and Dahanayaka D.D.G.L. (2005) Diversity of Fishing practices and resources conservation in Negombo Lagoon, Sri Lanka Naturalist Vo I, Vo II: 29-31.
- Maldeniya, R. (1997) the coastal fisheries of Sri Lanka, Resources exploitation and management in “States and management of tropical coastal fisheries in Asia”.
- Sri Lanka Coast Conservation Act No 57 of 1981 and its 1988 amendment.
- Sri Lanka Coastal Zone Management Plan (2004) Amended under the Section 12(5) of the Coast Conservation Act No. 57 of 1981.
- Workshop on Coastal Resource Management (2015) Coastal pollution: Issues, Impact on society and management, Carolina Beach Hotel, Chilaw, Sri Lanka.
- Workshop on Coastal Resource Management (2015) Coastal Resource Management Plans in Sri Lanka, Management Guidelines and their impact, Carolina Beach Hotel, Chilaw, Sri Lanka.
- Workshop on Coastal Resource Management (2015) integrated coastal resource management strategies used in Sri Lanka and their impacts on to the coastal societies, Carolina Beach Hotel, Chilaw, Sri Lanka.