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GEOGRAPHERS' PERSPECTIVE OF SUSTAINABLE DEVELOPMENT

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Environmental components and development processes are closely interrelated. Sustainable development can be achieved primarily by conserving and managing natural resources which are the bases of development.

In Sri Lanka major development projects have been launched since gaining independence. The Gal Oya development project in 1952 marks the beginning of such large scale multipurpose development projects in the country. In development planning the increase of population[1] and demand for employment opportunities were the basic factors which motivated consecutive governments to undertake such large scale projects. Some of these development projects have made a commendable contribution to economic development by alleviating poverty and providing employment opportunities. Population projections[2] for Sri Lanka show that many more development projects should be launched to provide solutions to some of the pressing problems in the country.

However, economic development activities invariably lead to adverse environmental problems. These issues have local, regional, and national dimensions. Some environmental problems cause irreparable damages to human health and physical environment. It is vital to have development oriented environmental management to minimise the impact of human activities on the physical and biological environment. It is apparent that many of these environmental problems have been caused due to inadequate attention paid to the balance of nature and ecosystem during planning stages.

1.

Year	Population ('000)	Density (per Sq.k.m.)	Average Annual Growth rate (%)
1901	3,566	55	1.7
1953	8,098	125	2.8
1963	10,582	164	2.7
1971	12,690	196	2.2
1981	14,847	230	1.7
1991	17,261	267	1.5

Source: **Census Reports, Department of Census and Statistics, Statistical Unit, Registrar General's Department, Population Division, Ministry of Health and Women's Affairs - 1992.**

2.

1991 - 17,261,000
2000 - 19,090,000
2010 - 21,017,000
2020 - 22,568,000
2030 - 23,576,000
2040 - 24,048,000

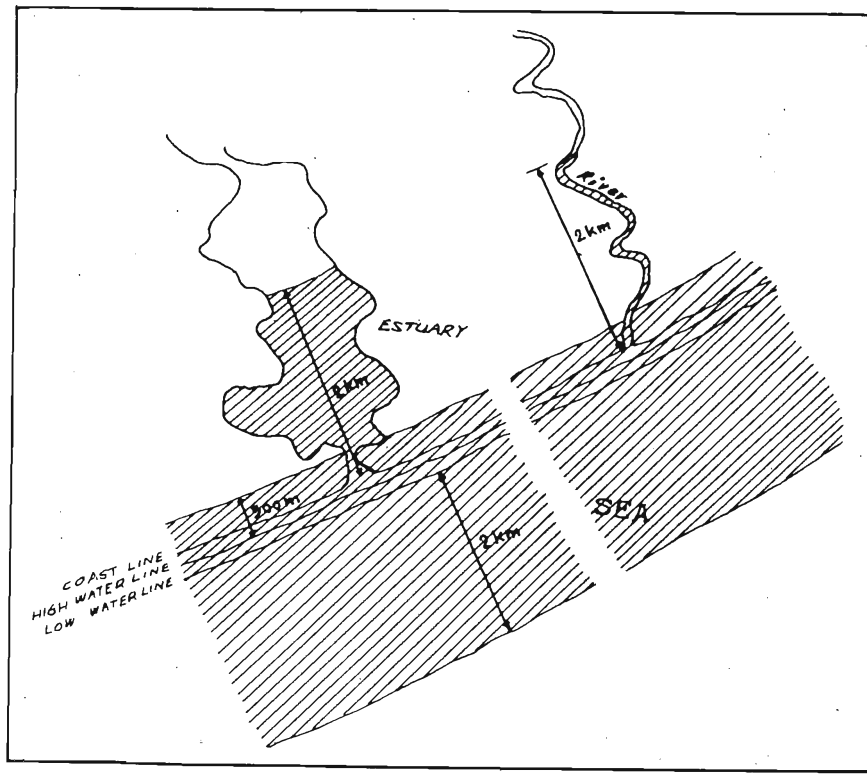
Source: **Census Reports, Department of Census and Statistics, Statistical Unit, Registrar General's Department, Population Division, Ministry of Health and Women's Affairs - 1992.**

The objective of this paper is to highlight some of the environmental problems caused by development activities. From a Geographer's point of view, these problems can be illustrated as changes that have taken place due to faulty planning particularly during the past 30 years.

It is evident that development activities have caused adverse effects on topography, soils land forms, river regimes and climatic elements. Since an analysis of development oriented environmental problems in the entire country is not possible in this paper, the coastal zone has been selected to highlight the environmental problems that have emerged particularly during the past three decades in Sri Lanka.

Coastal Zone

The coastal zone may be defined as "that area lying within a limit of 300 metres landwards of the mean high waterline and of 2 Kilometres seawards of the mean low waterline in the case of rivers, streams, lagoons or any other body of water connected to the sea either permanently or periodically, the landward boundary shall extend to a limit of 2 Kilometres inland along the body of water".(Map 1)



Map 1: Diagramatic presentation of the coastal zone

(Source: Sri Lanka coastal zone management plan-coast Conservation Department, January, 1987.)

The coastal zone defined above is an economically active, and environmentally polluted zone in the country. It contains 34 percent of the island's total population and represents 24 percent of the land area. The coastal zone contains the highly populated townships of which the city of Colombo is the primate city, six of the twelve municipal councils and 19 of the 39 urban councils. Over 80 percent of the industrial units of the country are located in and around the city of Colombo and a high proportion of the remaining industries are also located in the coastal zone. The location of major townships have attracted a high proportion of available infrastructural facilities to the coastal zone.

Sri Lanka's coastal zone contains a diversity of critical habitats such as coral reefs, mangroves, estuaries, lagoons, salt marshes, sand bars and sea-grass beds. These critical habitats being highly vulnerable to pollution and degradation, provide shelter to aquatic flora and fauna. In their natural state, they act as buffer zones in protecting land area from the sea's erosive forces.

The development processes that have made indelible changes in these critical habitats have been identified as;

a) development projects located within the coastal zone and
b) development projects located outside the coastal zone such as river diversion schemes, agricultural development projects. These activities have a long term impact on coastal habitats.

Development Projects and Sustainability of Coastal Resources

The sustainability of coastal resources has been threatened to a great extent by the development projects, that have been highly active during the past 30 years. Of these, attention should be focused on the activities that have, brought in physical changes in the environment. ie: Tourist Industry

1. Tourist Industry

Tourist Industry is one of the oldest development ventures that have been launched in the coastal zone due to its attractive physical environment.

According to the Tourism Act of No. 10 of 1966, six important zones have been identified for tourist development activities. ie.

(i) Colombo resort region-(Area from Mount Lavinia to Negombo)
(ii) West coast resort region-(From Beruwela to Hambantota)
(iii) Ancient cities resort region-(Area including Anuradhapura, Polonnaruwa, Dambulla and Sigiriya).
(iv) The East coast resort region (Kuchcheveli to Batticoloa).
(v) Hill country resort region-(Nuwera Eliya).
(vi) Northern resort region.

The 1968-1978 comprehensive plan for the development of tourism included the above six resort regions. This further indicates that from the inception of the tourist industry great emphasis has been paid to the development of coastal tourist resources.

Today, the widely expanded tourist industry clearly indicates that 75 percent of hotels, beach resorts and rest houses are located along the coastal zone and 85 percent of revenue derived from the tourist industry come from facilities available in the coastal zone. This phenomenon is likely to increase in the future.

The period from 1978-1982 has been designated as the "maximum development period in tourist industry". Some of the factors responsible for haphazard location of tourist hotels are lack of planning and inadequate regulatory measures for monitoring. The concentration of tourist resorts in Hikkaduwa and Negombo provide excellent examples. A glaring example in Negombo is that 50% of the hotels have sea reservations less than 15 metres. Today due to progressive sea erosion these reservations have shrunken causing damage to buildings and changing coastal land forms.

The high competition for coastal resources have created an unprecedented stress on resources. This would undoubtedly destabilize existing economic activities in the coastal zone thus adversely affecting the sustainable economic growth.

2. Extraction Activities

(a) Coral mining:

Coral and sand are two natural deposits which have been subjected to over exploitation during the past three decades. Coral and sand mining have created severe coastal erosion problems as the methods adopted have exceeded sustainable levels of extraction.

Coral mining was active in many parts of the island and particularly intensive in Akurela, Seenigama, Kahawa, Warallana, Totagamuwa, Mirissa, Talpe, Ahangama, Madihe, and Rekawa. Mining of inland coral deposits take place mainly in the south-western sector. During the past three decades the construction industry recorded significantly rapid development.

These activities have placed an unprecedented demand on the sand and coral resources. All types of corals, for instance coral reefs, sandstone reefs boulder reefs, have been destroyed.

Coral reefs have a growth rate of only 10 c.m. per annum. According to an ESCAP survey in 1985, seven thousand tons of corals are removed from reefs annually. The ESCAP report further shows that, the annual requirement of lime has been estimated as 27,000 tons, of which 50 percent is obtained from corals and the balance from miocene limestone and dolomite from the hill country.

The development of the tourist industry and population expansion have had an adverse impact on coral reefs. The excessive use of glass bottom boats, clearing of coral reefs for boat passage, trampling of coral at low tide, collection as souvenirs, and for commercial activities, extraction of coral for aquarium or exportation of fish, and fishing with rough nets, use of explosives have largely contributed to the destruction of coral resources. In addition, water pollution from use of agro-chemicals, industrial activities hotel complex and wetting of coconut husks cause irreparable damage to coral reefs.

The existence of a high percentage of dead corals is a good indication of the destruction caused to valuable resources. In Polhena 80 percent, Weligama 50 percent and from Hikkaduwa to Akurala 25 percent of the corals are believed to be dead corals (Natural Aquatic Resources Agency - 1989).

(b) Sand mining

Sand mining from river banks, estuaries, and beaches has risen sharply as a result of the development of the construction industry. Some of these activities are road development programmes, large scale land filling projects, and for the usage of water supply and sewerage projects.

It has been reported that from Puttalam to Dondra Head 500,000 cubes (1415,000 cubic feet) of sand were removed annually (Coast Conservation Department 1984). Some of the river deltas where sand mining has caused severe damage are Kelani, Kalu, Gin Nilwala, Maha Oya, Walawe, Kirindi, Yan Oya and Deduru Oya.

3. Destruction of Coastal Vegetation

Mangroves have become severely reduced by over use, abuse and conversion for other uses. Increasing population, expansion of development projects widespread urbanization and the awareness of multiple usage of mangroves have created drastic reduction of mangroves in the coastal zone. Some of these uses are as a source of fuel wood, raw material for house construction, basic wood for making masks, source of obtaining tannin, source of manure, as fodder for goats and cattle, and leaves as a source of vegetable for human beings.

Mangrove eco-systems provide food and shelter to fish and other species such as reptiles, mud-lobsters, crabs, prawns and quadrupeds. These species help to maintain the equilibrium within an eco-system. Sri Lanka has approximately 12,200 hectares of

mangroves. (Coast Conservation Department 1990) They occur mainly around lagoons lakes and estuaries. Of the coastal Districts a high proportion of mangroves are found in Puttalam (3200 ha) Jaffna(2400 ha) Trincomalee(1900 ha) Batticaloa(1400 ha) Mannar(900 ha) Kilinochchi(870 ha) Hambantota(600 ha) Mullaitivu (475 ha) Gampaha (150 ha) Galle(100 ha). In addition, insignificant extents are found in the districts of Colombo Matara and Kalutara. During the past 2 decades conversion of land under mangroves to other uses have become a widespread activity due to the population increase. Construction of hotel projects and housing development programmes have reclaimed a considerable extent of mangroves on the coastal areas. eg: In 1984, fifty hectares of mangroves have been used for national housing projects. Similar changes have occurred in Chilaw, Puttalam, areas where large scale aqua-prawn culture projects are in operation.

4. Aqua Prawn Culture Projects

The coastal landscape around Chilaw and Puttalam, have been drastically changed due to aqua-prawn culture projects during the past decade. An ideal example is the area around the Dutch canal which leads from Deduru Oya to Mundel Lake. The striking changes in land use and topography can be seen in areas such as Bandadeniya, Karukkupone, Kottapitiya, Kusala, Virankattuwe, Suruwila, Battalu Oya, Senegal Oya Grama Niladari divisions.

The expansion of aqua-prawn culture projects have created several changes in natural vegetation and cultivated crops. The removal of mangroves, uprooting of coconut trees, changes in paddy lands are some examples. The expansion of prawn culture also has completely changed the home gardening pattern and increased the dryness of the area. In the Arachchikattuwa Divisional Secretary Division alone 1100 acres have been converted to artificial ponds and many more additional land will be brought under aqua-prawn culture in the future.

The productivity of these ponds and prawn yields depend on the usage of chemical inputs. It was revealed that large quantities of lime. Urea, Endrine, dolomite, Tobacco dust Gusathione are added to enrich waters in artificial ponds. During the harvesting season it is essential to empty these ponds and it is inevitable that additional chemicals get deposited in lagoons as well as in agricultural lands. Mangroves which play a dominant role in protecting coastal areas are removed for the construction of artificial ponds. The destruction caused by private companies engaged in aqua-prawn culture is much more serious than the damage done by local residents. Large scale earth moving equipment such as bulldozers are used to construct artificial ponds. There had been instances where temporary filling of lagoon was necessary to pave way for bulldozers to get across the lagoon.

In the district of Putttalam aqua-prawn culture is done by both legal and illegal operators. A general phenomenon with regard to environmental destruction is that more damage is done by illegal cultivators and large scale project owners.

5. Industrial Activities

The river system that exists in Sri Lanka is known as a "radial system" where rivers originate from the central highlands and flow almost in all directions to the ocean.

It is inevitable that industries that are located in close proximity to water bodies have a high tendency of polluting both inland and coastal water bodies. The paper factory in Valachchenai discharges large quantities of waste into the Batticaloa lagoon. On the other hand, Walawe Ganaga Estuary is highly polluted with discharged effluent from Embilipitiya paper factory. Similar occurrences are found on Lunawa Lagoon. Industrial affluent are discharged to Lunawa Lagoon and nearby water ways. Kelani Ganga estuary is polluted from industrial plants located in close proximity to the water ways. The problem of industrial pollution is aggravated as these industrial units are generally located in highly congested urban centres. Therefore in addition to industrial pollution faecal pollution, garbage and solid waste disposal have become a serious threat. Kelaniya, Moratuwa and Lunawa areas are a few examples.

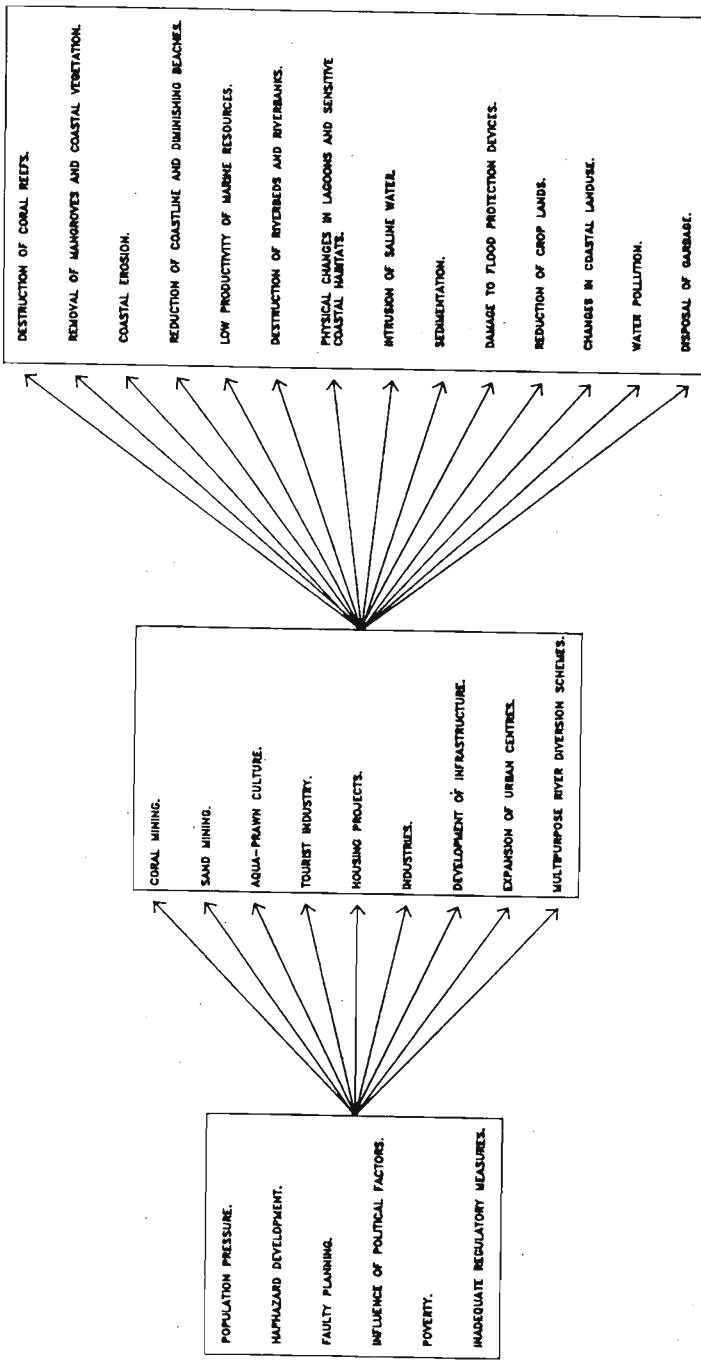
The major port facilities that are located in Sri Lanka are in Colombo, Galle and Trincomalee. Cleaning of fuel tanks around ports, oil pollution from shipping and fishing crafts are other contributory factors in polluting coastal water.

6. Siltation and Sedimentation Problem

Some of the development activities that exist inland lead to changes in landuse. Cultivation of sloping lands and land clearance for development projects cause soil erosion and siltation. It has been reported that during the 25 year period from 1956-1981 the water holding capacity of the Negombo lagoon has diminished by 790 hectares due to siltation problem. Similar occurrences have taken place in Lunawa and Kalamatiya lagoons.

There are several examples to show that adverse changes are taking place in the coastal area, and it is likely that these adverse effects will be aggravated in the future. Old maps, survey plans in the south and southwestern sector of Sri Lanka indicate that considerable land has been lost due to continuous sea erosion. The island where Seenigama Devalaya is located to day, has been attached to the main island several years ago. Another example is the coastal segment of 685 kilometres extending from Kalpitiya to Yala National Park the loss of coastal land annually by erosion is about 175,000 - 285,000 square metres. Of this about 145,000 square metres are lost annually from the 137 kilometre coastal segment that extends from the mouth of the Kelani river to Talawila in Kalpitiya Penninsula.

Diagram 1 further depicts the interrelationship between population increase development activities and their impact on the coastal environment.



Digram 1: Major issues related to environmental degradation in the coastal zone of Sri Lanka

Coastal erosion is aggravated particularly in the Southwestern and Southern sectors of the coastal zone. This sector is considered as the highly populated coastal area in Sri Lanka. This may further bring disastrous effects as the southern railway and the southern highway run along the Western and Southwestern coastline.

Sustainable Management of Coastal Resources

Development and efficient resource management are interdependent functions. Sustainable development lies primarily on proper resource utilization. Proper management of the coastal zone has become a national concern and considerable attention has been paid in the National conservation strategy. (1988). It is desirable to adopt suitable measures to conserve coastal resources so that the total extent of the island will not be reduced in the future. Some of the measures that should be adopted are as follows:

(a) Detailed information of coastal habitats should be made available for planning and management of coastal zones. Lack of data is a severe constraint today.

(b) Where necessary coastal zone development projects must be accompanied by Environmental Impact Assessment by the appropriate authorities.

(c) The inland activities that have the potential to alter or degrade the coastal environment should be regulated.

(d) Environmental carrying capacity must be evaluated particularly with regard to new tourist development activities.

(e) One of the weakest areas in the planning process in Sri Lanka has been the lack of strong cross linkages between the different government agencies managing different development sectors. Therefore steps should be taken to improve co-ordination among relevant government agencies.

(f) Where appropriate amendments should be made in the existing legislation related to coastal zone in Sri Lanka.

(g) Decentralization of development projects is one of the ways of preventing population being over- crowded in coastal zones. This would minimize pressure on existing resources.

(h) Adequate funds should be allocated in the annual budget for protection and conservation of coastal zones.

(i) Mass media should be made use of to intensify public awareness on the importance of sustaining and conserving critical coastal habitats.

(j) The recommendations of the coastal zone management plan should be implemented with immediate effect.

(k) The demand for sand and coral are likely to grow in the future. The development of alternative sources should be taken up as a matter of urgency.

(l) Identification of construction practices that require minimal quantities of sand and lime would alleviate the pressure on coastal resources to a great extent.

Some possible alternate sources are:

(i) The use of dolomite for lime production and;
(ii) The exploitation of off-shore sand resources and inland sources such as drowned river valleys.

(m) Provision of alternate employment avenues to families who are directly employed in coral mining and preparation of lime.

(n) Illegal mining should be further prevented by intensifying police action and encouraging people's participation in protecting coastal environment.

It is evident that the coastal zone of Sri Lanka has undergone several Geographical changes due to resource deterioration, biological pollution, Chemical pollution, social disruption, physical disruption and visual disruption.

Environmental quality management necessitates a wide range of regulatory strategies at the state and local levels. They may be preventive, curative, and punitive. Sustainable development of coastal resources should be considered as an important component in the overall land use planning system.

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