ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 8, Issue, 08, pp.36430-36435, August, 2016

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

ENVIRONMENTAL STATUS OF KADALUNDI RIVER BASIN IN KERALA – A CASE STUDY OF KADALUNDI ESTUARY

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ARTICLE INFO

Article History:
Received 21st May, 2016
Received in revised form
25th June, 2016
Accepted 11th July, 2016
Published online 20th August, 2016

Key words:

Environmental Status,
Kadalundi River Basin,
Kadalundi Bird Sanctuary,
Kadalundi Estuary.

ABSTRACT

Detailed study has been carried out for understanding the environmental status of Kadalundi River Basin in Kerala using secondary data collected from various departments and field survey. This study is a preliminary investigation of the early and existing environmental condition in the river basin which is one of the hot spots of biodiversity. Based on the published information in news papers, articles, internet and a pilot field study was carried out to find out the actual environmental status of the river basin. As per the survey it is noted that environmental status of Kadalundi river basin is deteriorating day by day. The major environmental issues are the dumping of plastic wastes in open space, decrease in the annual arrival of migratory birds, reduce in area under mangrove forest, increase in pest attack over areas in mangrove forest, drudging and illegal sand mining, ecological disturbance, salt water intrusion and disappearance of local flora and fauna due to implementation of inter cropping agricultural pattern. This study can be a base for an environmental evaluation and formatting a plan for integrated river basin model for Kadalundi river basin.

Citation: Bindu, K. B. and Jaypal, G. 2016. "Environmental status of kadalundi river basin in kerala – a case study of kadalundi estuary", *International Journal of Current Research*, 8, (08), 36430-36435.

INTRODUCTION

The word Environment refers to the surrounding area which includes both biotic and abiotic factors. A natural environmental system depicts a network of interrelated biotic and abiotic factors which makes the existence of life possible on the earth. The biotic factors are man, animal, plants, microbes etc where as the abiotic factors are air, soil, water and light. The water being essential for life, both abiotic and biotic factors are highly influenced by the presence and absence of water. River being named as life line on the earth is often selected for various environmental studies. A river basin is a natural unit of land area drained by water, flowing across or under its way to a river just as a bathtub, catching all of the water that falls within its sides. A river basin sends all of the water falling within its area, towards a central river and ends up in an estuary or to an ocean. The river basin irrespective of its size, shape, pattern and volume of water carried by it, act as a source of life on earth. This is the natural environment consisting of four inter linking systems of hydrosphere, atmosphere, lithosphere and biosphere. Since these systems are not static, any change in these interlinked systems can change the equilibrium of natural environmental condition of a river basin.

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The change can be either natural or man induced changes, in both cases the result can be seen on the ecological system of a river basin. Human activities are already impairing the flow of ecosystem services on a large scale, as human societies derive many essential goods from natural ecosystem of a river basin. Hence river basin is considered as a major study area of geographers and environmentalists for proper utilization, conservation and management of a natural river basin. Kadalundi river basin is one of the medium size river basin, flowing towards Arabian sea. This basin is not yet affected by man induced changes but the detailed study of environmental parameter indicates existence of ecological fragile areas in the natural ecosystem.

General introduction of Kadalundi river basin

Kadalundi River originates from Western Ghat and the river is one among the four major rain fed rivers flowing through Malappuram District of Kerala in India. The major tributaries of Kadalundi are: Olipuzha and Veliyar. The Veliyar tributary originates from the forests of Eratakombanmala and the Olipuzha originates from the Cherakkombhanmala. The river originates in Palakkad and flow through Malappuram having total length of 130 kms, with a drainage area of 1122 sq. kms. The Fig. 1 shows the Digital Elevation Model of Kadalundi river basin. Topographically this basin exhibit undulating

terrain with steep slope. The ground elevation ranges from 0 MSL to 1200 MSL. Based on the physiographic condition, the study area falls into three well defined natural divisions – lowland, midland and highland. The drainage pattern is complex with considerable variation in the spatial arrangements, controlled by topography, slope, rock type and structural deformations. Climatically the river basin experience normal tropical climatic condition with major influence of south west monsoon season. The average annual rainfall of Kadalundi river basin is 3610 mm, of which 60 percent is received during the south west monsoon (June – September) and 30 percent during the north east monsoon and the remaining 10 percent during the summer season. The average annual surface water potential of the basin is estimated as 1829 Mm3.

The main economic activity is agriculture. There are no major irrigation schemes in the river basin. Agricultural activities are mainly dependent on rainfall or dug wells. With different agro climatic conditions experienced in different physiographic zones, a large variety of crops such as paddy, coconut, tapioca, arecanut, pepper, rubber, cashew nut etc are grown in this basin. The industrial activities are very limited only small scale industries especially coir making factories are found in this basin. Hence there is no artificial man made influence in this basin.

Environmental Importance of Kadalundi River Basin with Special Reference to Kadalundi Estuary

Kadalundi river basin is blessed with rich biodiversity in both flora and fauna.

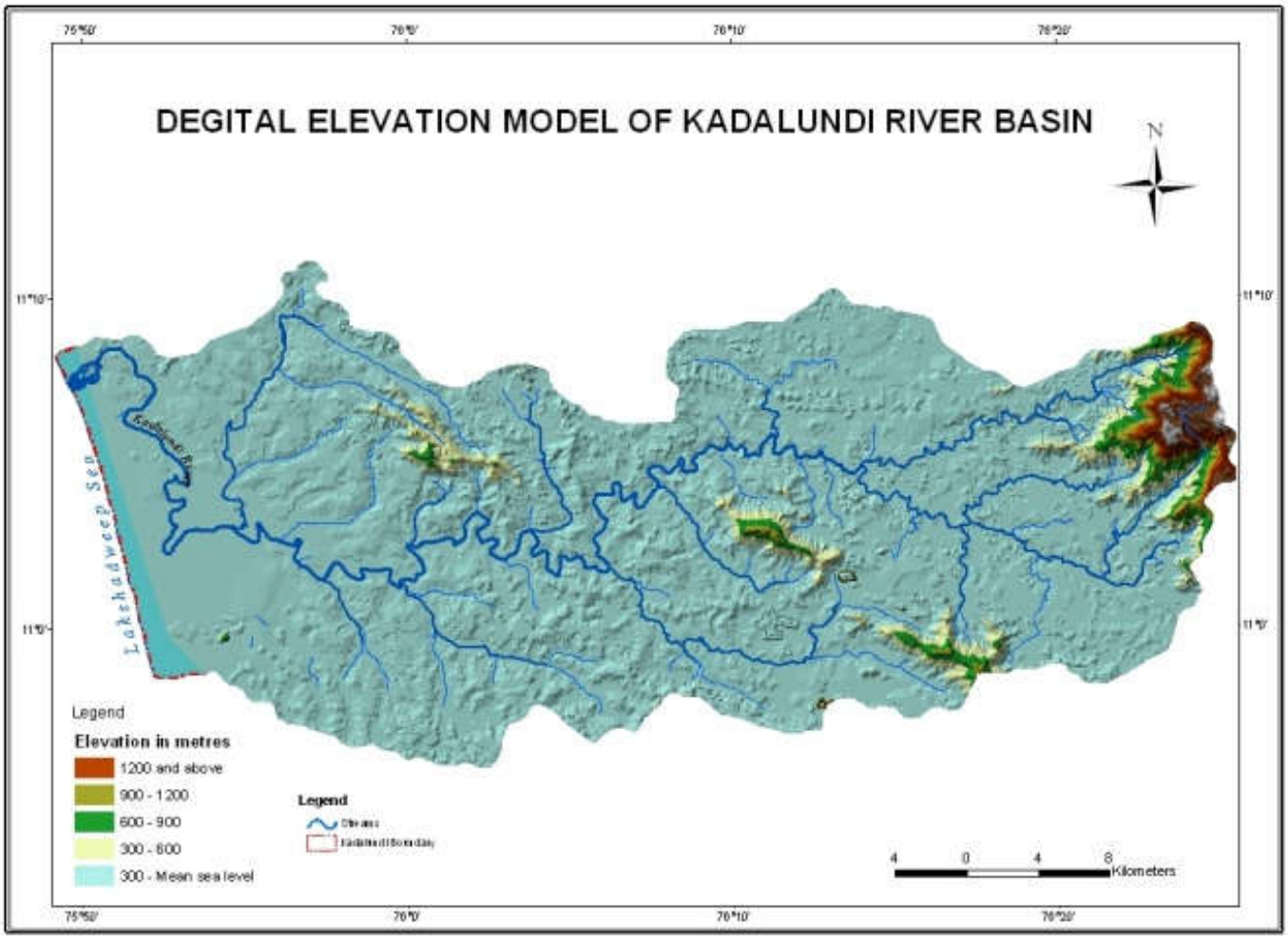

Fig. 1. Digital Elevation Model of Kadalundi river basin

The geology, soil and land use / land cover in the river basin indicate a well fertile land. Charnockite is covered by alluvial formation in the coastal belt and laterite in the midland and highland regions. The different types of soil that occurs in the basin are coastal alluvium, riverine alluvium, laterite, brown hydromorphic soil and forest loam. The various types of landuse which are seen in this river basin are water bodies, river and streams, wasteland, plantations, arable land and forestland. The river basin has less influence of urbanization.

The natural environmental condition is very much favourable for setting a natural habitat for many rare and endangered flora and fauna.

The Kadalundi Estuary

The Kadalundi estuary, a wetland of national importance is situated at the mouth of the river which is noted for thick distribution of mangrove forest, presence of migratory birds,

several rare species of flora and fauna, lime shell and coconut fibre trade. The river mouth is partly blocked by a coastal sand bar, forming a lagoon undisturbed by the turbulence of the sea. This area contains extensive mudflats of about 12ha which are exposed during low tides, which form the habitat of a large population of avifauna.

and 19 species of insects including 12 butterflies are identified. The kadalundi estuary has very large bird population of about 53 species, birds of the order Charadriform, particularly Caridae family (Gulls and Terns) dominates the estuary bird community. The other common birds are sand pipers, plovers and stints are the next most numerous forms in that order.

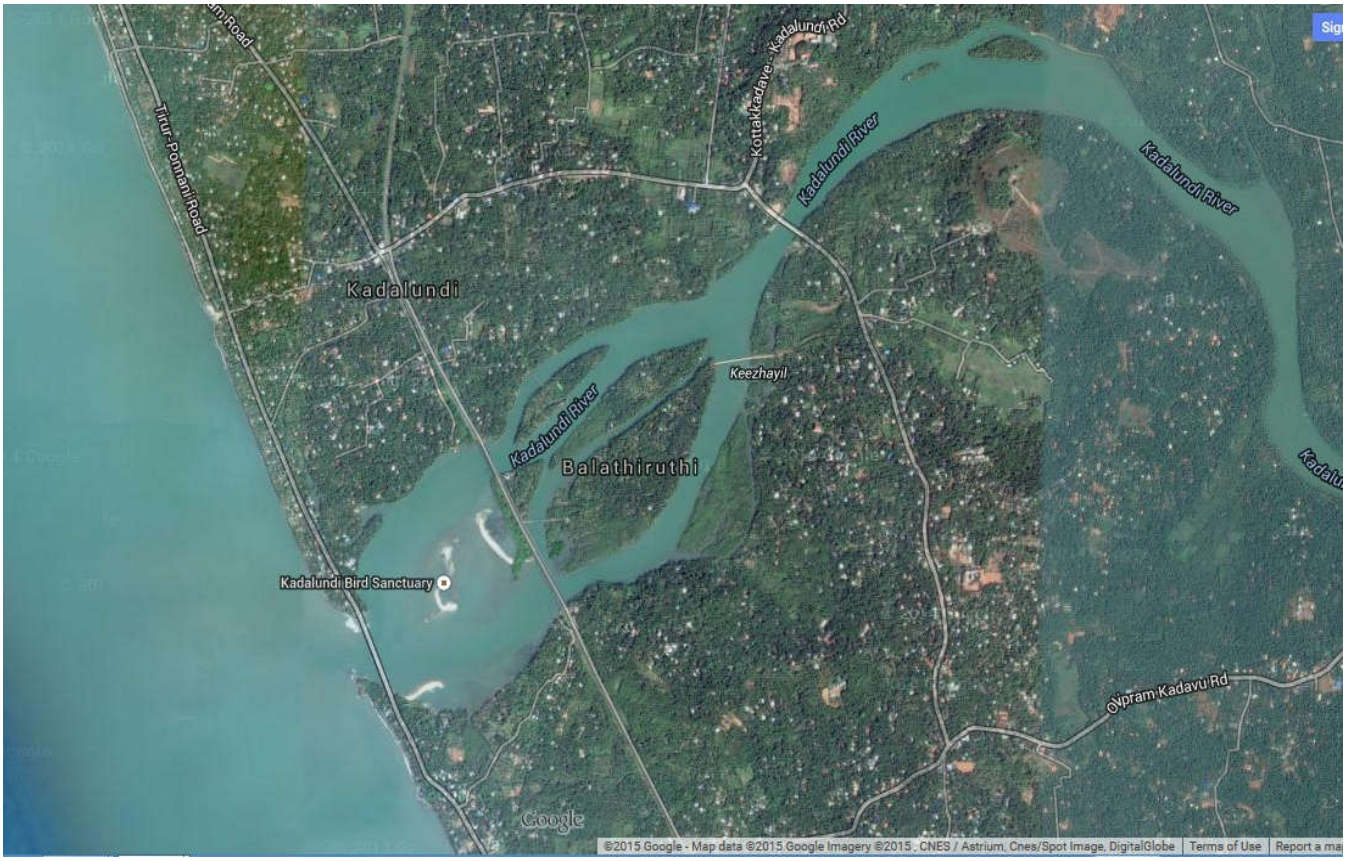

Fig. 2. Location Map of Kadalundi Bird Sanctuary in Kadalundi Estuary

The Kadalundi Bird Sanctuary

The Kadalundi Bird Sanctuary is a most popular tourism site located at the estuary spreading over cluster of islands. The Fig. 2 shows the location of Kadalundi Bird Sanctuary at Kadalundi estuary. There are around hundreds of different varieties of native birds and around sixty different types of migratory birds which reach here annually in a large number.

The Kadalundi Aquatics

The Kadalundi estuary has considerably good fish population as it is in very close to the sea and hence has both fresh and salt water species. There is a large fish worker community here depending on this resource especially species like Poozhan, Thirutha, Malan, Chameen and its different varieties.

The Biodiversity of Kadalundi Estuary

According to the survey conducted by Centre for Environment and Development in 2003, the flora in the Kadalundi Estauary consists of 19 tree species and 180 herbs, shrubs and climbers. The fauna includes 34 species of fish and 34 species of fish

These birds mainly stay on mud flats adjacent to the railway bridge, only to feed on the small organisms like worms, crabs and other tiny creatures in the mud flats.

The Kadalundi Vallikkunu Community Reserve

The Kadalundi Vallikkunu Community Reserve is established in this area which covers 1.5 $km^{2,}$ with good patches of mangrove forest. Studies carried out by Centre for Environment and Development in 2003, shows that the common mangrove species found is Acanthus illcifolius followed by Avicenalis officinalis.

Tourism in Kadalundi Estuary

The Kadalundi area is scenically very beautiful with the estuary on one side and the sea on the other and with thick luxuriant mangrove vegetation, where the later is home to a large number of migratory as well as resident birds. Hence Kadalundi hold high tourism potentiality with special thrust to bird watching, game fishing etc. Boating using pedal and row boats is possible in this area. A Biodiversity interpretation centre can be developed with special focus avaifauna, mangroves and fishes.

Major Environmental Issues in Kadalundi River Basin

The major driving forces of environmental change are fisheries, acquaculture, small industries, household, shell mining, sand mining, services like water supply and sanitation, activities of researchers and academicians and to certain extent tourism. There are about 200 persons engaged in fishing and around 50 families are involved in mussel cultivation usually in high saline waters. These issues become more severe due to lack of cooperation from local residence and government officials. Based on the secondary data collected from newspaper, journals social medias and pilot visit to the study area, the following are the major issues threatening the environmental condition of Kadalundi river basin.

Retting of Coconut Husk

Coconut husk retting is a major economic activity in area of Kadalundi Estuary. The pollution caused by the retting of husk by the traditional conventional method is threatening and adversely affects the industry based on fisheries. Above all, since the area around the retting yards is inhabited by the community people engaged in these industries, occupational hazards are reported among the target group. There are so many health diseases such as head and backache, respiratory problems, poor eye sites, skin diseases reported in this area affecting the health condition of people in Kadalundi estuary.
A study conducted by Centre for Water Resource Development and Management in 2002, reveals that the traditional method of retting results in release of large quantities of organic substances like pectin, petosan, fat and tannin liberated into water by the activity of bacteria and fungi. The decomposition of pectin results in the production of hydrogen sulphides-the basis of the nauseating smell in and around retting zones. Husks are suspended in brackish water for the period of 6 to 11 months to separate fibres. This causes pollution in water depleting the quality of water and threatens life of fishes in Kadalundi estuary.

Depletion of Mangrove Forest

The mangrove forest is a major source of ecological, environmental and socioeconomic benefits for the Kadalundi community reserve. The thick concentration of mangroves not only acts as a natural barrier protecting the Kadalundi estuary and preventing tides, it is economically of high value because of its rich biodiversity. However the biodiversity rich mangrove cover is fast declining at the Kadalundi estuary. The mangrove forest is a complex ecosystem because it represents an inter phase between two contrasting types of communities: terrestrial as represented by lowland forests and marine mangroves. The main ecological functions of mangroves are shore stabilisation, groundwater recharge, groundwater discharge. Flood and flow control, sediment and nutrient retention, habitat protection and biodiversity. But due to its over exploitation for economic benefits like recreation, tourism, hunting, fishing, shrimp and crab farming, shell and sand mining, coir retting, mussel cultivation, ferry services, water transport and dumping of plastic and human wastes results in disappearance of mangrove in the area of estuary.

Depletion of Water Quality

As per the study conducted by Centre for Environment and Development in 2003 the water quality parameters and pollution indicators shows slight variation in values. This is mainly because of the dumping of lot of pollutants in the form of domestic sewage. Also coconut husk retting done in tanks letting out its effluents in the estuary also have major role in water quality depletion. Dumping of waste directly to the estuary also lead to the depltetion of water quality. Sanitary issues especially the “hanging latrines” in the river shores, directly discharging human excreta, dumping of animal waste into water body is creating many environment and health problems.

Illegal Sand Mining

Kadalundi river consist with large deposits of black sands (containing ilmenite, monazite, rutile and zircon) glass sand (pure silica), clays, bauxite, iron – ore, lime stone, graphite, lime shell (raw material for white cement) and river sand. Even though all the above deposits are available, the mining activities are restricted to black sand, glas sand, clays, laterites, lime shell and river sand. For the construction purpose, the illegal mining of sand from the river basins, estuaries and even paddy fields are practiced in a large scale. The fig. 6 shows the illegal sand mining activity in the kadalundi river. Even though the license for shell and sand mining are given by the Local Self Government Institution, illegal mining and unscientific method of exploitation of resources makes the problem much more severe. Another risk is the collection of lime shell for industrial purposes.

Disappearance of Endangered Migratory Birds at the Kadalundi Estuaries

The Kadalundi Bird Sanctuary is spread over a cluster of islands in a scenic area surrounded by hillocks where the Kadalundi river flows into the Arabian Sea. The Kadalundi estuary is adobe of hundred species of native birds and over 60 varieties of migratory birds that flock here in large numbers seasonally. Some of the important species are terns, gulls, herons, sandpipers and cormorants. The uniqueness of Kadalundi not only as a winter station but also as a sanctuary was established with siting of dozens of migrant bird species by scientists and birdwatchers over the last three decades. Among the unique migrant bird species found in the Kadalundi – Vallikunnu Community Reserve, from Kadalundi estuary, the disappearance of Sandwich Tern over the past couple of years has raised concerns about the changes taking place to the ecology of the sanctuary. There are many migratory and residential birds listed in endangered species and are slowly migrating to some other habitats, the reason may be change in food availabity, natural habitats etc.

Landuse Changes and Salt Water Intrusion in Kadalundi Estuary

The Kadalundi estuary is currently subjected to acute pressure of rapid developmental activities. The industrial activies, urbanization, infrastructural development, unauthorized encroachment of the public areas near estuary are happening

on a large scale. Initially most of the encroachments were for agriculture purposes, later these areas were reclaimed and used for various other purposes. Encroaching mangroves areas and clearing it for tourism, recreation and other purpose causes siltation leading to vertical shrinkage and related problems like salinity intrusion, ecological disturbances and biodiversity loss. Even though salinity intrusion is checked to certain level, still salinity intrusion is a major problem in the Kadalundi estuary.

Development of Kadalundi Vallikunu Community Reserve

The Kadalundi – Vallikkunnu Community Reserve located in Kozhikode and Malappuram Districts in Kerala State is the first Community Reserve of India, declared in 2007, which spread across 1.5 Km ^{2}. This community reserve is situated at the estuary of Kadalundi river at a height of above 200 mean sea level. The management committee comprising members from both the panchayats and officers from the forest department for technical supports was formed for the management of reserve with public participation. Though a draft management plan was prepared by committee for submission to the government, the project ran into rough weather after people from the region coming out against the move, voicing various concerns. In the meanwhile the ruling government changed and as the modified action plan failed to compile with the Wildlife Institute of India, the plan was again revised. Even after it is submitted to the government, the action plan, which includes a boundary wall, approach road, public comfort stations, and other facilities for eco-tourists and ensuring the conservation of the area and its biodiversity, has many other hurdles to overcome, including final sanction from the union government. This is at present a major concern about the future of the Kadalundi - Vallikunnu Community Reserve and protection of Kadalundi estuary.

Plastics and Slaughter Waste Dumping along Roadside

Due to improper municipal waste disposal and improper slaughter waste management, the solid plastic materials loaded with slaughter houses are dumped along the road side and near the banks of the river. People living near the Kadalundi estuary in the rural stretches are also depositing wastes into the system. Hanging latrines with outlets directly to water body are common scene in the rural areas in this area. The infrastructure development along the road side also contributes to large scale dumping of debris which consists of organic and inorganic materials and toxic compounds like cement, clay, wood, oil grease, paints, insect repellent substances etc along the road and remains undecomposed as it gets mixed with plastic materials.

Tourism in Kadalundi Estuary

The Kadalundi Bird Sanctuary is the most important attractive spot for national and international tourists all over the world. The sanctuary with its natural scenic beauty and population of several varieties of migratory birds is the favorite hub for the bird watchers. The Kadalundi estuary as a whole with its rich biodiversity attracts many researchers oriented to the study of natural flora and fauna. The unimpeded tourism activities contribute to the increased pollution, eutrophication, encroachment, reclamation, mining and biodiversity loss in the Kadalundi estuary. This is the major concern of both government and non government stack holders and the local people depending on the natural resources of kadalundi estuary.

Pollution and Eutrophication at Kadalundi Estuary

The major source of pollution near the estuary are manmade including effluents, sewage and faecal disposal, pesticides and chemical fertilizers from paddy fields, retting of coconut husks, slaughter house waste, domestic waste etc. The large scale trade and commercial activity has brought with it, a large number of aquatic weeds into this area. The excessive growth of weeds like Salvina molesta, Eichornia Crassipes and Damasonium Flavum etc. disturbs the biodiversity of wetlands. These weeds are having more advantage over the local weeds and hence result in eutrophication.

Lack of Cooperation among Local People and Government Stack Holders

The major issue in conservation of the Kadalundi – Vallikunnu Community Reserve is the conflict between local residents and conservationists. Natives are afraid of growth of mangrove areas as it might affect their livelihood expose them to nuisance from the animals and snakes etc. inhabiting the mangrove and reduction of available water spread areas for coir retting. The agencies governmental and non – governmental institutions are coming forward with several useful projects for the conservation and sustainable development of the Kadalundi – Vallikunnu Community Reserve. But as they lack in alternative options for the local economic activities, the plans and not proved to be beneficial for the local people and hence they often refuse to join hand with the governmental and non governmental agencies.

Impacts of Environmental Issues on People and Ecosystem at Kadalundi Estuary

With the rising population, the unscientific use of land for agriculture, aquaculture, urban expansion etc has resulted a large scale impact on the man and ecosystem of Kadalundi estuary. As a result of denuding, polluting, draining, filling etc, this ecological sensitive area at the mouth of river Kadalundi river is under sever threat. Direct exploitation of the natural resources for reclamation for agriculture, urban expansion, housing development etc., are the major environmental threat to the ecosystem of Kadalundi estuary. The pollution of water body not only resulted in threatening the natural flora and fauna but also it has also affected the socio-economic and health status of people living in Kadalundi Vallikunnu Community Reserve. Depletion of bio-resources due to loss of mangrove vegetation and intensive aquaculture is a major threat to the environment. The reduction in fishery resources leads to many socio-economic problems. The tourism activities at Kadalundi estuary at one hand increased the economic well being and popularity of the place, on the other hand had generated so many environmental problems, loss of jobs for local fisheries etc. Besides this the dwellers working in Coir retting factories still face so many health problems as the side

effect of the unscientific coir production. All these issues gives a alarming indication for not only the government and non government stock holders, but also it makes the local people to take a joined effort in order to protect and preserve the natural ecosystem for the future. This study recommends for the speedy and unavoidable recovery measures for safeguarding the estuary.

Conclusion

Based on the above referred information and secondary data received from various government and non government institution, published articles, journals, posters and thesis, the environmental status of Kadalundi river basin with special reference to Kadalundi estuary is studied. The derived information was verified by the direct visit to the Kadalundi estuary and interviewing the people in Kadalundi Vallikunnu Community Reserve. The basin is rich in its natural resources and blessed with scenic beauty which is still not disturbed and over exploited compared to any other major river basin in Kerala. There are many natural problems like salinity intrusion, water quality problem, coconut husk retting, depletion of mangrove vegetation, plastic waste and human waste dumping, sand mining etc. Amid these problems the Kadalundi estuary has immense potentiality which has to be traced out and to be managed and attain sustainable development.

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