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**ECONOMIC INCENTIVES FOR
THE CONSERVATION OF BHARATHAPUZHA RIVER:
FOCUS ON SAND MINING**

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Abstract

Rivers in Kerala are assailed by pollution, sedimentation, sand mining, and constriction of flows. The indiscriminate and unscientific sand mining, even in the midst of many regulatory and protective measures for their conservation, have made the condition of these rivers pathetic. Bharathapuzha basin is the largest among all the 44 river basins of Kerala and the second longest river of the State. The drying up of Bharathapuzha River has become a matter of grave concern to the scientists and environmentalists. This paper tries to establish that implementing economic incentives is a possible method which can be adopted in the conservation practices of Bharathapuzha River.

Keywords: *Conservation, Economics incentives, River Bharathapuzha, Sand mining*

JEL Codes: *Q250, Q260, Q290, Q570*

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INTRODUCTION

Conservation of biodiversity is essential for the maintenance of life on earth, because biodiversity provides resilience in the face of changing global conditions, and plays an important role in the overall functioning of ecosystems. However, it is not often considered a factor in decisions regarding the use of natural resources because the direct market benefits that biodiversity sometimes provides are usually not considered sufficient to justify the cost of its protection, and the consequences of its loss do not become apparent until it is too late. Much of this biodiversity is disproportionately concentrated in aquatic systems and adjacent riparian areas and wetlands, which are affected by the cumulative impacts of land use activities throughout the entire upstream catchment area.

Management of river basins and the catchment areas nested within, also provide ecosystem services that have direct market values and which can provide an economic incentive for specific management activities. These services include protection of water supplies, reduction of flooding that can have great damage costs, providing a more even flow of water that is necessary for hydropower facilities, and sustaining freshwater fisheries and recreational values.

REVIEW OF LITERATURE

Tognetti (2000) provided an overview of existing initiatives to create economic incentives for river basin management as a strategy for protecting biodiversity. It also identified factors that have contributed to their success as a conservation strategy, obstacles to their implementation, emerging issues that are likely to impact on the success of this strategy in the future, and recommendations for follow-up assessment and actions in eco-regions. Emphasis was given on the development of direct economic incentives in the context of institutional arrangements needed to support them.

Bulte *et. al.* (2003) examined the scope of economic incentives in the conservation of wildlife. The main results are as follows: the best way to conserve wildlife and their habitat is to encourage efficient and sustainable use of the resources, the scope of economic incentives in such conservation efforts as an 'extra measure' to regulate harvesting pressure may in some cases be limited. Whether or not such gains materialize depends on the specific characteristics of a species and the parties involved in its harvesting. If both the habitat and the harvesters are "homogenous" (in the sense that there is little variation in the area in which the species is harvested and the skills/technologies of those harvesting the species), then the gains from economic incentives are small.

Kumar and Sukumar (2012) explored the evidences for the consequential impacts of the excessive sand mining continuing in Bharathapuzha. Extraction of sand from the riverbeds and banks is being carried on by mankind since a long period of time. River sand mining is warranted to prevent floods but when it becomes excessive it starts to signal danger. Traditional modes of sand mining using manual methods do not exert excessive damage on the earth. However, for the purpose of profiteering, people use harmful mechanical methods to scoop out sand. Absence of concerted conservation efforts by the authorities aggravated the issue paving ways for irresponsible sand mining causing permanent damage to the source and the related eco system.

Types of Economic Incentives

Market-based economic incentives for river basin management fall into two broad categories: direct and indirect. Examples of indirect incentives are those that seek to encourage development activities that rely on biodiversity, such as ecotourism, marketing of non-timber forest products, or biological prospecting, and thus create some incentive to protect them. However, the revenue that can be generated from these activities is small relative to the amount of area that requires protection.

For example, the value of any single hectare of endangered habitat for purposes of biodiversity or genetic prospecting is generally small – most of what is paid for samples may reflect the cost of collection and processing as well as taxonomic expertise rather than the value of the material collected. Similarly, only a limited number of areas with high value for biodiversity protection will be able to attract sufficient ecotourism to justify the development of tourism facilities. While such incentives can help to protect biodiversity, they are generally not considered sufficient to protect large areas. As a result, direct incentives are likely to be more effective as a conservation strategy.

Examples of direct economic incentives, which provide a direct link between services (i.e., maintaining forest cover) and compensation (i.e., payment for those services) include:

- *Direct payments or subsidies*, which may include any form of contractual arrangements in which parties agree to implement conservation practices in exchange for some benefit. An example of this is the U.S. Conservation Reserve Program, which pays farmers to retire sensitive croplands and to implement conservation practices, which include protection of wildlife habitat.
- *Acquisition of land or of development rights*, which are then sold separately from the land parcel, or of conservation easements that restrict uses of the land. Transferable development rights allow those who own land in priority conservation areas to receive compensation for not developing the land by selling the rights to someone wishing to develop in a non-priority area. For these rights to have value and thus to provide an economic incentive for conservation, there must be effective controls on total development as well as clearly specified objectives for resource protection.

- *Taxes or other fees* on resource users that can be used to finance conservation incentives. For example, the municipality of Quito, Ecuador, finances the maintenance of protected areas in its upper catchment with a small increase in the water rates charged, which previously had only reflected the costs of water delivery.
- *Marketable permits or trading under a regulatory cap*, which refers to an arrangement in which those polluters who can reduce emissions relatively cheaply, may sell the right to emit the difference between their emissions and the regulatory limit to other polluters, as a way to reduce costs of compliance.

To review the policy incentives that has been adopted, different criteria are used: ecological efficiency, economic efficiency, social impact, flexibility, accountability and community involvement. Regardless of how economically efficient it may be for the local community to adopt conservation practices, the decision to adopt such practices depends on whether or not those who pay their costs will have access to the benefits of their actions. This, in turn, depends on institutional arrangements, particularly on forms of property rights.

Bharathapuzha – Current Scenario

Kerala owes its biodiversity and cultural richness to a great extent to an eco-system nourished by a massive network of its forty four rivers. The Bharathapuzha, also known as Nila is the second longest river in Kerala with a total length of 209 Km. with a large basin of 6186 Sq. Km. It originates from Aana Malai Hills at Tamil Nadu in the Western Ghats and flows through Coimbatore district of Tamil Nadu, and Palakkad, Malappuram and Thrissur districts of Kerala and finally empties into the Arabian Sea at Ponnani. The river basin covers 90 panchayaths and 4 municipalities in the above three districts of Kerala. Palakkad, Chittur–Thathamangalam, Shoranur, and Ottappalam are the four municipal

towns within the basin. The major land utilization of Bharathapuzha basin includes forest (26 percent), cultivated area (52 percent), fallow (8 percent) and barren and cultivable land (5 percent). Rice accounts for the major portion of net cropped area of the basin followed by coconut and rubber. It is popular for its geo-physical value as well as its cultural and historical significance. The river valley is considered the cradle of civilization in Kerala and the influence of Nila on the cultural formation of Keralites is invaluable. However, the perennial river which was muse to writers, dancers and musicians; and lively hood to agriculturists and laborers is now a dead river with vast dry stretches which fills up for a few days during the periodical June-August Monsoon in the state.

The population growth, urbanization, agriculture growth and industrial development have increased the water demand in the basin. Some of the grave causes for the degradation of the river are;

- *Dams and impoundments:* There are eight dams built across various tributaries of Bharathapuzha in Kerala. Dams across the rivers, may often adversely affect the flow pattern, extent and nature of sediment formation and deposition, riverine biodiversity and the quality of water. It has been found that there is reduction in river flow after the construction of the dams in various tributaries of Bharathapuzha. No flow in the downstream of these dams resulted to the drying up of the lower reaches of these tributaries especially during the summer months. The reduction in flow in the downstream reaches will increase the intrusion length of salinity from estuary and deteriorate the quality status of the river water.
- *Deforestation:* The catchment of Bharathapuzha in the Western Ghats has a long history of deforestation that took place in several phases over the last two centuries; massive deforestation of the rich climax evergreen, deforestation of midland hillock

forests for cultivation, submergence and cutting down of forests for dams and State induced deforestation for raising forest plantations. Heavy deforestation have left their trail of impact affecting the river flow, river ecology, water table and water quality across the length and breadth of the river.

- *Over exploitation of ground water:* High water demanding crops like sugarcane and paddy are being cultivated in the area using the bore well water. Unscientific groundwater development for industrial and agriculture purposes in certain blocks lead to high stage of groundwater development (critical and over exploitation). The stage of ground water development with regard to the entire basin is 50.62 percent.
- *Climate change:* The analysis of the trend of temperature in the basin shows an overall upward trend in mean annual and daily temperature. The temperature during winter and the southwest and northeast monsoon periods also showed significant increase. The increase in the annual mean temperature in the basin presumably would have an impact on rainfall and local climate. It was found that the annual rainfall in the basin shows a decreasing trend. The climate change also shows a negative impact on water resources and land use of the basin.

Amongst these causes for the degradation of the river, sand mining is the gravest and dominant one.

Indiscriminate Sand Mining

Bharathapuzha is one of the rivers in Kerala heavily utilised for sand mining. Illegal sand mining in the river is quite regular and usual devoid of protective laws against mining, intervention of authorities and courts. Loopholes in the laws governing illegal mining, scope for influencing the authorities, and the financial strength of the sand mafia to fight up to the sky limit have transformed the situation into a dangerous level. The

impacts of unsystematic sand mining on environment and other physical conditions are indisputably severe. Though the general impacts are same, specific negative impacts are diverse. Demand for sand from this river has increased due to the following reasons.

- Growth in construction and infrastructure projects in last five years as NRIs of Kerala in gulf are investing their money in these projects. Real estate boom is supported by increasing number of nuclear families in Palakkad District.
- Brick building industry in Kerala has huge requirement of Alluvial Sand from Bharathapuzha River owing to its high silicone content.

An expert committee appointed by the Government of Kerala to investigate into the problems of Bharathapuzha (1997) reports, "the Bharathapuzha system is seriously affected by unsustainable exploitation of its resources and over utilisation of its surface and ground water resources, particularly in the lean period. The indiscriminate sand removal has almost killed the river (The Hindu, 2003). The first bio diversity study on the Bharathapuzha conducted with the sponsorship of University Grants Commission (UGC) also points out the primary role of sand mining in the destruction of the river. The uncontrolled sand-mining has damaged the river's ecosystem as well, destroying the habitat of organisms living on the river bed. Fish breeding and migration have been affected because of the sand-mining (The Hindu, 2012). Dinesan (2012) observed that the river shrank into rivulets and these are meandering through some portions of the river bed. As the river bed is dry for most of the period, the farmers grow vegetables on the bed. Research studies have been reporting about the pathetic condition of the river which in turn causes damages to the ecosystem in and around the river, agricultural activities dependent on the river, physical structures over the river and the river based tradition and culture built around the state. In

short, the present state of the river has become a matter of serious concern to the people, authorities, scientist, environmentalist and other stake holders.

In Bharathapuzha River, Sand mining is made legal by the government through Auctioning and Permit System. Auctioning is done at 48 Kadavus by village panchayats and permit is given by 10 Government Centers. Average legal mining allowed through auctioning at 48 Kadavus is 33570 loads. However, it is done 10 times of its permitted level. Studies show that average allowed loads as 132000 and illegal mining as 109500 loads. Hence, Average Sand mining done through both legal and illegal system is 2,88,000 loads which is equivalent to Rs.13 Cr. However, illegal mining amounts for Rs.200 Crore government revenue. Sand mining is legal in Bharathapuzha River as it has high prospects for government revenue and is a source of employment for local people. Sand mining is allowed within some prescribed zones with time limits and within selective period of the year. However, Sand Mining is done indiscriminately and legal allowance is exploited. It has become a day and night activity along the down course of the river. As a result, replacement rate of Sand in the River Basin is lower than the rate of sand mining.

Consequences of Sand Mining

Exploitation of Sand Mining in the River Basin has following repercussions on the living standards of the locals, ecosystem, and water resources.

- *Hampering the Riverine Ecosystem:* Numerous studies have reported about the severe destruction or total destruction of riparian vegetation along the Bharathapuzha river channel due to unsystematic sand mining and also the growth of exotic plants all along the basin. Excessive sand mining has also impacted the fish fauna in the river. As the eggs of majority of fishes hatch in the soil substratum, human made barriers in the river movement

prevent migration of fishes which move between fresh water and marine habitats while spawning.

- *Lowering River Beds and Water Holding Capacity:* Excessive sand mining has lowered the river bed in the downstream areas even below the sea level. Studies on the environmental issues of the river have come up with the finding that the sand layers holding considerable quantity of water in the spaces between them are disturbed due to mining. Moreover, sand mining has caused declining percolation of water through the river beds and its subsequent recharge into the ground water supply.
- *River Bank Erosion:* Indiscriminate sand mining has resulted in large scale river bank erosion. Deepening of the river bed and widening of the river ensuing in land loss and depletion of ground water level are reported by many studies. As sand mining causes the removal of top soil and vegetation cover along the river side, soil erosion is all throughout on the banks of the river.
- *Intrusion of Saline Water and Drinking Water Scarcity:* While the river is getting deeper by sand removal, there is saline water intrusion even in the upper reaches of the river and this is further compounded during high tides. Many pump houses along the river basin supplying water for agricultural and other purposes are now deserted. Further, the lowering of water tables has resulted in the drying up of nearby ponds and wells. The dwellers along the river basin are now facing severe problem of drinking water shortage and have to depend on the unhygienic water supplied by the private water suppliers. The water scarcity as well as salinity of water also has adversely affected the agriculture in the nearby areas. The agricultural activities of the Palakkad district, once known as the rice bowl of Kerala, were to a major extent depending on Bharathapuzha for its irrigation

needs. Now the district is no longer worthy of the title due to lower level agricultural activities resulted from periodical draught.

- *Damage to Bridges:* There are many bridges across the Bharathapuzha River. Indiscriminate sand mining has already made severe damages to the bridges. The basements of the pillars of many bridges have cracked indicating disastrous situation.
- *Increased Sedimentation:* Sand mining has diminished the recreational potential of the Bharathapuzha River. Deep pits are formed in the river beds which are filled with gravel and other sediments. This is highly risky for those who use the rivers for washing, bathing and also for varied forms of recreation. Lower part of the river has been completely filled by the deposits and now it is flowing very slowly. Therefore, taking this deposit from the river-bed is necessary to protect the river from the side erosion and widening through the floods in future.
- *Chemical and Fuel Spillage and Other Pollutants:* The quality of water is also adversely affected due to chemical and fuel spills from machinery used for dredging and sand mining activities and by the vehicles used for transportation of sand. The water at the mining site is disturbed and the polluted water is carried downstream causing inconveniences to people who extract water for domestic use. Now the quantity of water in the river is almost a trickle in many places and the available water is concentrated with pollutants.

Policy Suggestions

Sand is an important aggregate in the construction sector. Hence its mining causes a major positive impact in the socio-economic sector. Through mining activities, jobs and opportunities are created, and significant contributions are made to the State's economy. Mining can

provide a significant source of revenue through profit related royalty payments and fixed taxation. However, these benefits are not without direct and indirect costs to the environment. Short term benefits are only counted. This is one side of the problem. On the other side, there is a heavy environmental cost together with economic and social costs for those residing on banks of rivers. Activities which provide socioeconomic gains from the use of aggregate resources often result in the impairment of ecosystem functioning. Despite its positive phase, negative impacts dominate in the hazards, land holdings, infrastructure etc. Loss of human lives in the rivers has been increased nowadays due to creation of deep pits, channel incision etc. Channel incision causes undermining of bridge piers and other infrastructural facilities associated with river channels. Problems faced by small landholders residing on either side of the riverbanks are numerous. Limited land resources and houses of such landholders are always under threat of collapse, once mining proceeds unmindful of these issues. As a result, the poor riparian land owners are often forced to sell their property at throwaway prices. The access road to the mining site should be designed for safe entry and exit of vehicles in order to minimize the accidents. Several people and children has lost their lives in the river due to drowning in the water filled open pits left after mining. The rapid movement of vehicles for the collection of floodplain sand causes damage to roads, groundwater, surface water, flora and fauna, land stability, reduces air quality and increases noise levels.

Sand extraction from river channels and overbank areas causes local disruptions which can be anticipated and prevented through appropriate Environmental Impact Assessments (EIAs). So, an attempt should be made to assess the environmental impact of sand mining from the river Bharathapuzha. The river environments in all the three physiographic zones such as highlands, midlands and lowlands are deteriorated drastically due to illicit scooping of sand even from prohibited areas close to bridges and water intake structures. The main

intention of the effort should be to mitigate the negative impacts and enhance the positive ones.

Where economic activities like sand mining are causing biodiversity degradation directly, there is a need to use incentive measures to reduce the levels or change the ways in which these activities are carried out.

What measures can be adopted?

- A collaborative management agreement should be established between government and a community institution with the capacity to manage the river and its vicinity. Many of the examples of community economic incentives for biodiversity conservation such as: the establishment of tradable rights for residential and industrial developments, tradable permits for pollution and emissions, and quotas in resource use can be adopted.
- Incentives can be provided through improving the ways in which markets work. One way of doing this is to take steps to ensure that consumers are able to make choices based on the knowledge of whether commodities contribute to biodiversity conservation. Proper awareness should be created among all the residents in and around Palakkad District regarding the deteriorated condition of the river and the impact due to indiscriminate and illegal sand mining. They should be told not to use sand that is mined illegally and people who use such illegally mined sand should be brought under the law and should be levied with a hefty fine.
- Another way of using market incentives for biodiversity conservation is to make sure that the prices and markets for biological resources, sand in this matter, themselves incorporate efficiency and scarcity concerns. This scheme simultaneously

addresses a number of problems relating to indiscriminate sand mining – it protects the resource, raises revenues, increases efficiency, and make allocations more equitable.

- A common way of using fiscal instruments as incentives for biodiversity conservation is to manipulate the market prices of different products through the application of selective taxes and subsidies. In order to persuade people to change their sand consumption patterns, the government should implement a series of fiscal reforms in the construction sector. Examples of fiscal instruments include differential tax rates – such as relatively higher taxes on biodiversity depleting land uses, equipment, inputs and products, or subsidies to biodiversity-neutral or biodiversity conserving technologies, land uses and enterprises
- Bonds and deposits can be used in the commercial, construction, industrial and infrastructural sectors in order to provide disincentives to biodiversity degradation. They can be applied to natural resource-based industries such as forestry, mining, fisheries and other extractive utilization activities as a tool to discourage negative biodiversity impacts at the same time as promoting efficiency in resource utilization.
- A range of livelihood measures can be used as incentives for biodiversity conservation. These can encourage people to use and manage particular biological resources more sustainably or can strengthen and diversify rural livelihoods, make people rely less or move away from exploiting biodiversity.

Government should encourage local residents to come forward reporting the illegal mining of sand happening in their areas, by giving them benefits either in terms of job opportunities for their family members, or subsidies in certain matters. Community benefit-sharing is a

widely-used livelihood incentive for biodiversity conservation, using the revenues generated by protected areas to finance development activities in adjacent rural areas.

CONCLUSION

As the urbanization is growing rapidly than ever before, the demand for construction materials also increasing. The Bharathapuzha river basin is favorable for sand extraction in a scientific way. Evidences for indiscriminate and illegal sand mining in the river and the consequent environmental degradation are plenty in number. The greed of the mankind for money and the rocketing demand of sand for construction and other activities are all the way mounting the scope for indiscriminate sand mining by the sand mafia. Regulations part of the relevant laws, official authorities, courts, environmentalists and general public are the mute witnesses of the process. The river is on the verge of death, demanding the final rescue.

Incentive measures have long been used by governments to manipulate the ways in which macro and sectoral economies work. It is however only relatively recently that they have started to be applied to biodiversity conservation. Where broader policy, legal, market and institutional circumstances provide perverse incentives for biodiversity degradation, or disincentives to biodiversity conservation, there is a need to identify and overcome them, and to instead set in place a system of incentives that encourage biodiversity conservation and hence help in conserving Bharathapuzha. The choice of incentive measures must take into account the specific groups, activities and sectors which they aim to work on, must be based on practically implementable actions, and must be acceptable and sustainable within the broader social, political and cultural context within which they are being applied.

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