Study & Analysis on the degradation of Paravoor Lake

Analysis of the Wrong Developmental Policy pursued at the behest of traditional industries in collusion with indifferent administration together with detached consumerists quick buck attitude of newer generation and its impact on the pristine Environment, Aquatic habitat, Loss of biodiversity & Livelihood in Paravoor Lake

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SAVE the EARTH

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Introduction

Sustainable use of water over generations has been ensured through cultural adaptation to water and living in harmony with nature's ways. However in the last three to four decades at least in an Indian context the consequences of urbanization and adaptation to the consumer culture have taken its toll on water bodies. Ill conceived developmental policies to suit the needs of business or commercial interests have had detrimental effect on our water bodies and the ecosystem surrounding it. Water Resource Management or maintenance of our water bodies has been shoddy at best. The changes in water use patterns for industry & cultivation, and attempts to tamper with the natural water bodies and its flow patterns have caused enormous loss to the state of Kerala in terms of agricultural land & livelihood of the indigenous communities. In the Eighties there have been attempts to assist the farming community by means of water diversification and other irrigation techniques so as to increase food production. Appropriate water management techniques have to be adopted to ensure food security and to stop driving indigenous communities to desperation. But there is tremendous deficit in understanding of natural issues with in the perspective of development. Scientific communities are more confined to creating substandard research papers which are more of documentation in nature than any cutting edge research or findings to state, nor have we seen any worthwhile applications of such research. This too has been acquired by talking to local, indigenous people for the purpose of mandatory publications.

Policy Decision Makers in the various governmental departments have little first hand knowledge of the situation on ground and they are not in any way connected to the Scientific Community. NGOs or local level researchers are often ignored as mere activists and they get to interfere on developmental issues once the implementation process hits the ground. Political interference on behalf of the business interests they serve further drive the actual solution from the issue at hand. This complicates implementation further as environmental norms & natures principles would have already been tampered with. Vested approaches to development as mentioned above leads to social upheaval, conflicts and injustice. Communities who have been the guardian of the precious resources are submerged to be silent suffers, due to loss of livelihood and breakage of natures chain system where one leads to the existence of other.

Most always the end result of such development is irreversible environmental destruction, loss of biodiversity & economic hardships to the indigenous population. Local Population under the garb of government orders generated by political parties whose source of funds are never made available is forced into forfeiting their lands to give way to huge industries, energy plants and other enterprises. All over the world it's the native people that continue to suffer from high rates of poverty, health problems, crime and human rights abuses. While they live in their habitats fully enshrining the principles of Gross National Happiness (GNH), we want to bring them under growth measured by GDP. The native community is among the first to feel the impacts of climate change even though their lifestyles are practically carbon neutral.

This kind of irresponsible, special interest lobbies led development approach has to be stopped if we have to put a halt to economic hardships under the nomenclature of economic developments. UNDPs Human Developmental Report 2011 highlights further how the world's most disadvantaged people suffer the most from environmental degradation in their immediate personal environment, and they disproportionately lack political power, making it all the more harder for the world community to reach agreement on needed global policy changes. But for local policy initiatives protection of key habitats, prevention of flow modifications, conservation of specialized ecosystems and prevention of use of pesticide in upper catchments and regulation of tourism in critical habitats are the only ways out of the current quagmire.

With Carbon Increase setting in it at alarming speed, it becomes all the more critical due to global climatic change and its effect on the water level rise, in the costal & inland bodies. Local Self Governing Institutions, Town Planners, Agricultural officers and Elected Representatives have to work closely together with the indigenous people to understand the mechanisms of nature before applying scientific solutions and administrative procedures to come up with appropriate answers to local developmental issues which affects livelihood, habitat &biodiversity.Panchayati Raj Act in its true spirit has to be imbibed by all stake holders to adopt such an approach. Its about time local bodies and native people together can chart their developmental needs, sustaining life in all its forms so that natures chain systems are left untouched for then next generations.

In the above described context let's approach and analyze Paravoor Lake against the wrong developmental policies pursued by subsequent administrations. The impact of the ill-conceived developmental policies on the pristine Environment, habitat, loss of biodiversity, Livelihood factors affecting the indigenous fishermen community, overall state of fresh water fishing occupation in Kollam district and the current ill health of the once majestic lake. In the process we can look at the corrective measures that need to be adopted to nurse it back to its former glory.

Objective of the study

The main objective of the study is to thoroughly understand the negative impact on the Flow Modifications in Paravoor Lake and make out a cause for what can be salvaged by reversing the damage. In addition to the above an

honest attempt is being made to examine in depth the below, so that the responsible authorities can be made aware of the same.

1. Impact of Flow Modification on Biodiversity loss as well as to study the impact it has had all along the upstream Ihthikara river banks.
2. How has the tampering of nature's mechanism due to the simple act (in administrative terms) of closing the estuary, wrecked havoc in Itthikkara River, Paravur Lake and its ecosystems.
3. State of the industry which led the clarion call for closure of the estuary under the garb of agriculture.
4. Freshwater Fish availability in Paravoor Lake
5. Impact of Flow Modification on Livelihood of Indigenous People
6. Degradation of the aquatic Habitat
7. Health of the Paravoor Kayal
8. Impact of Agriculture upstream Ihthikara
9. Salinity in Upstream Ihthikara River
10. Loss of Biodiversity
11. Land Erosion

It's HELP Foundations objective that we want to bring in researchers to study the issues mentioned in detailed, so that we can work with the researchers and the indigenous communities to restore nature to shades of its glory by turning the clock full circle. It's our awed goal that we at HELP Foundation will be able to bring in systems and processes in association with the local administration so that the indigenous people will be entrusted with the task of being

1. Custodians of the Paravoor lake there by preserving it for future
2. Nurture Paravoor Kayal back to health so as to be able to restore its lost glory
3. Restore the natural opening of the estuary with just a nudge from the local fishermen as and when needed
4. Revive the tradition of fish based medicine that was practiced by the fishermen community
5. Responsible tourism with all its indigenous cultural feel
6. Sustainable Development can be carried out in the region

Figure 1: Itthikkara River & Paravur Lake

Chapter 2

Background

Paravoor Lake is famous for its breadth taking natural beauty, fish rich waters and the natural estuary. Ihthikara River when in spate empties its flood water into the lake which in turn naturally opens up the estuary with slight assistance from the indigenous fishermen community. Through this natural occurring it empties the rain waters from Kollams elevated areas into the Arabian Sea as and when needed during the monsoons. This phenomenon of nature, safeguards the people along the Ihthikara River banks as well as the fisher dwellings on the banks of the Paravoor Lake. Ihthikara River flows about 3 Kms through the Paravoor Lake via Ihthikara, Pullichira, Kakkotmoola & Mayyanad before flowing into the Arabian Sea through the natural estuary at Lakshmipuram Thoppu, Mayyanad. Ihthikara River's natural flow through the Paravoor Lake this far can only be explained by an indigenous fishermen and it with awe one views a local fisherman navigating the choppy waters when the river is in deluge.

Ihthikara River is 56 km long which originates from the low hills situated near Madathuri kunnu at about +240 m above M.S.L and from the hills located south-west of Kulathupuzha in the Western Ghats, flows mostly through Kollam District finally emptying into Paravoor Kayal. The village of Ihthikara is located on the river, 15 km from Kollam and 2 km from Chatanoor. This naturally occurring phenomenon which results in amalgamation of river, lake & sea has been nature's way of taking care of the residents along the banks of the river without any fury or destructions. As well as this is the single most reason why waterborne diseases are not prevalent in this region during rains. This being the scenario the general perception in administration circles is that when the sea is in spate or rough sea during the monsoons, it breaches the embankment and mergers with the Paravoor Kayal and not the other way round.

Nature unique amalgamation of three forms of water bodies produces a unique fertility which fishes prefer to thrive and fisher folk love to feast upon. Indigenous people link this phenomenon to the local church festival as it coincides with the rainy season. It's their belief estuary will break open and they will have a season of plenty once the flag is hoisted at Pullichira Marian Church. There has been a three way mechanism where fishes which initially originate from the paddy fields along the Ihthikara River would get carried down to Itthikkara River during rainy season. They grow up in the fresh waters of Ihthikara and in spate get washed down 56 km down south to the Paravoor Lake. The force of the underwater stream (Itthikkara River which flows through Paravoor Lake) is such that it's slow but firm knock on the tiny strip of land at Lakshmipuram Thoppu (Mukkam) in between the sea and the lake, eventually leads to the natural opening up of the estuary. This enables fishes from Arabian Sea to move into the Paravoor Lake swimming up the fresh water stream flowing into the sea in the guise of looking for the fresh water source. This unique phenomenon had tremendous benefits for aquatic habitat, environment, ecosystem and huge benefits to the fishermen community at large.

Once the excess water gets emptied into the Arabian Sea and the flow becomes a trickle, the estuary closes itself due to sand formation developed by the combinations of under water currents from lake, river & sea at the mouth of the estuary which works in varied directions so that sand heaps up and its back to normal. This is a huge tourist draw for people from far and near as they get to walk on the mud deposits formed during this unique natural occurrence. This natural system gets repeated time and again when nature deems it necessary to protect its inhabitants.

Protection from Flood

Itthikkara River passes through the villages of Vayala, Pampira, Ayur, Thiruvambhagam, Atturkonam while Adichanallore, Chathannur and Chadayamangalam are some of the important places in the basin. The above said natural phenomenon has been protecting the southern parts of Kollam especially Mayyanad, Mukkom, Thani, Kakkottumoola, Nedumgolam, Kurumandel areas from flood waters since time immemorial. Policy planners under the influence of business interests with active support from local politicians made a case so as to save agriculture land at Itthikkara from salinity through the estuary. It was perceived and projected that water from the sea was creeping upstream Ihthikara, during high tide and the only solution is closure of the estuary permanently. This had repercussions in the Legislative Assembly too, as the case was seemingly put up on behalf of the farmers of Itthikkara and that salinity was preventing agricultural activity.

Local Administration at the behest of political influence decided that the best course of action is to create a shutter or spillway mechanism where by it can be opened up towards the sea to empty flood waters in the downward direction only. Here man intervenes in nature trying to alter what it had conducted itself impeccably for centuries, using plain administrative powers to modify the natural flow, without ownership of the issue. As always the environmental and habitat degradation in their immediate personal environment of the indigenous fishermen community, their perils and the biodiversity losses went unnoticed. Its worth mentioning that the indigenous community did put up a spirited fight against the same, but their lack political power or inability to use the Gramsabhas, made it hard to get their message across to the administration officials to reverse course. On speaking further to the fishermen they still harbour a lot of remorse at the administration officials who took extraordinary interest so as to execute the permanent closure of the estuary.

Significance of the phenomenon

This unique phenomenon of nature imbibes in it flow management systems like fresh water management, control of saline water, cleansing of the saline content in the river and flood control. More importantly studies have to be done to ascertain how the amalgamation of river, lake and sea waters assists the respective fish species from the various water bodies and contributes immensely to the livelihood of the indigenous fishermen community. This natural occurring sustains the entire stretch of Itthikkara banks, the health of Paravoor Lake, prevents water logging in mainland, occurrences of water borne diseases and maintains its natural ecosystems and biodiversity.

During monsoons as the river is in spate it cleanses the system of its accumulated salinity thereby aiding further growth of its fresh water fish species till the next monsoons. Fresh water fishes which originate in the paddy fields all along Itthikkara river banks finds its way into the river during rainy season. This prevents surplus water logging in the fields which is detrimental to agriculture. By virtue of this happening the plains around the Itthikkara rivers bank never gets into a deluge like situation, thus saving lakhs of rupees on relocation and diseases during monsoon. This process in itself sustains fresh water life in Itthikkara River.

With the impregnation of Paravoor Kayal's underbelly with water and fresh fish species of unique medicinal properties from the river, the fishing community is on song. As all they have to do is venture out and lay their nets for a bountiful catch of freshwater fish. Once the water in the lake reaches a certain level and the mouth of the river is in full force the estuary opens up naturally like opening of the womb into the mighty Arabian Sea without any man made mechanisms. It's another mater that a small nudge here or there by the local fishermen aids the process of the opening the womb, by performing the role of the watchful midwife.

When fresh water guts into the sea, the stream of fresh water forms a rare distinct stream pattern in sea and eventually draws sea fishes towards it and in the process they get closer to the source of fresh water closer to the Mayyanad beach and eventually finds it way into the Paravoor Lake. Lakshmipuram Thoppu's sea faring fishermen feast on this tremendous opportunity as well as there brethren in and around Kollam & Thiruvanathapuram coasts. The entire region feasts on this abundant natural wealth by moving into festive spirits.

As the river runs through Paravoor Lake with full force it prevents the intrusion of salinity upstream. Once the flood water recedes, and the inflow into the sea tapers, the estuary closes itself naturally thereby preventing further entry of saline water into the lake. Overall it's a culmination of several important sequences in the natural flow system which sustains life in the water bodies as well as assists the regions people by preventing floods and providing immense livelihood opportunities.

Fish Rich Waters

Pollution, illegal commercial development, modification of natural systems and man induced flaws in the flow systems of Paravur Lake are posing serious threats to a large number of freshwater fishes. The risks faced by fresh water species were highlighted in the assessment of the freshwater biodiversity, carried out by the IUCN Global Species Programme's Freshwater Biodiversity Unit. The importance of freshwater species, ecosystems and services to human livelihood and wellbeing is increasingly being recognized to support decisions for the protection of wetland species and livelihoods. Costal Zonal Regulation Act adds to the complication of protection of fresh water resources. Traditional medicine using fish is based on the availability of fresh water fishes. It is not known much nor is it practiced today due to its non availability, and it's in its last legs with a handful of old people being aware of it.

Itthikkara River flows to the Paravur lake carrying abundant water for all seasons to meet the requirement of people in and around Paravur & Mayyanad. Paravur Lake, Itthikkara River and Arabian Sea altogether makes it prime and suitable for fishing all year round. And the sea shores are inhabited by traditional fishermen. These fish rich waters were a source of livelihood for people from the Ashtamudi region in lean season, as they would navigate down Kollam thodu to fetch for their livelihood as well it's the same for fishermen up to Varkala. Woman vendors who used to collect fish from the Ashtamudi based fishermen would move down to Mukkam Kadavu at Mayyanad for the catch when their fishermen travel down to Paravur Lake for their livelihood in lean seasons.

Fresh Fish based Medicine

Indigenous people have had there own very effective fish remedies, for certain common ailments. This was a way of life until it was intervened with. Now these kind of rare fresh water fishes are not to be seen in Paravur Lake. As Kerala State Biodiversity Board (KSBB) and Department of Aquatic Biology and Fisheries, University of Kerala, has finalized or is in the process of finalizing the Malayalam names for around 180 species of freshwater fishes of Kerala, It's about time that these stream of local medicine be looked into and preserved for future generation.

A few examples of the ailment and the medicinal fish are described together. Blank (arsus, asthma), Kaitha koora (ulladivatham), Pallathi or Kurathi Challa (taken along with Ayurvedic medicines).The intake or preparation method is word of mouth as its not practiced due to nonavailablity of fresh water fish species in Paravur lake. While sufficient data is not available some of the valuable fresh water fishes endemic to the Itthikkara River and its medicinal properties, they may soon wilt away if prevention, conservation and restoration measures are not introduced quickly.

Otter Population

In India, major threats to otter populations are loss of wetland habitats, reduction in prey biomass, pollution and poaching. Development projects such as flow modification, and aquaculture activities took the major toll of wetlands in Kerala. Increased human consumption during the last century, inadequate and ineffective rural development programs have not been able to address the problems of poverty, forcing people to be more and more dependent on natural resources. Consequently most of the wetlands and waterways do not have adequate prey base for sustaining otter populations.

Paravur Lake was famous for its Small-clawed otter. Otters thrived because of the availability of prey biomass in the Paravur Lake. It is a sight to behold an otter resting on rock formations after a sumptuous meal on the banks of Paravur Lake. Asian small-clawed otter is the smallest otter species in the world, weighing less than 5 kg. It lives in mangrove swamps and freshwater wetlands. This otter is distinctive for its forepaws, as the claws do not extend above the fleshy end pads of its toes and fingers. These attributes give it a high degree of manual dexterity in using its paws to feed on molluscs, crabs and other small aquatic animals.

The oriental small-clawed otter lives in extended family groups with only the alpha pair breeding and previous offspring helping to raise the young. Paravur Lake is ideal for their nesting burrows dug into the muddy banks where they live. This species spend most of their time on land unlike any other otters. Paravur Lake and the Itthikkara river ecosystem is perfect habitat for the Asian Small Clawed Otter.

Figure 2: Otter at Paravur Lake

Mukkam Sea based Fishermen

Mukkam once was thriving seashore of indigenous fishermen, mostly relying on non mechanical means for their livelihood. There were close to 18 kambavallas operating of Mukkam coast. These waters aided by the naturally occurring phenomenon of the estuary, sometimes twice a year made their livelihood secure. More than 100 families depended on the Mukkam Sea and followed the traditional practices. Mayyanad market was awash with fresh sea produce, not till long ago, from the catch of Mukkam shores. It was a unique sight to see Mukkam traditional Muslim woman fish vendors walking to the nearby market with natural fish basket on their head. These women wore a full-sleeve blouse, typically made of embroidered cloth, a special kind of moondoo and a cloth to cover their heads.

One of the most important preoccupation of the men folks were sewing of nets & preparation of other traditional gear for fishing. One of the well known traditions of love and brotherhood practiced at Mukkam was if a net had been pulled ashore then the people in the vicinity would be provided with enough catch to take home. This is diametrically opposite to the modern consumerist's society where everything is a service and there is service charge involved with it.

Chapter 3

Tampering with Nature

Itthikkara Brick Companies

Excavation of clay and sand from paddy fields for brick making had acquired a rampant pace in the 80s & 90s in and around Itthikkara. From about one hectare of paddy-field leased from farmers, a brick manufacturer can rake in a whopping annual profit of more than two lakh rupees. Also, because the brick manufacturer could afford to pay more, most of the women who used to work in paddy-fields did switch over to the brick industry. This has resulted in the current dilapidated state of Itthikkara paddy fields as they are now mere water logged ponds. With availability of cement bricks and no more cheap land available for sand and clay excavation the industry is in decline. But the environmental havoc wrecked by the Brick industry is there for generation to deal with.

Closure of Estuary

Ignoring the various sane voices of the indigenous people who have been the beneficiaries of nature's protection and living in harmony with it for centuries the administration went ahead with police protection to murder nature and Lakshmipuram Thoppu. Literally snubbing their illiterate protests and by forcefully threatening them the district administration with full armed backup closed the natural estuary too the glee of the businessmen and the politicians who represent them.

The fact of the matter is the vested lobby behind the closure of estuary was Itthikkara based brick companies under the garb of agriculture. As Saline waters mixed with the fresh river water during opening of the estuary it affected brick making, which was a thriving business in the Eighties. It's another matter that none of the said companies is around today, as mud bricks are not used any more in abundance in the construction industry. What more under the garb of modern mass tourism which is the biggest polluter things started moving at a rapid pace to usher in economic benefits to the locals, at least that was how it was sold. The estuary which was dead and buried and shown as estuary in revenue department, reincarnated as a legitimate thriving coconut plantation and the necessary titles accorded to it. This brutal murder of nature's flood control mechanisms happened in 1986 and the devastating perils after that has been visible for all around.

Figure 3: Estuary Location at Lakshmipuram Thoppu

Paravoor Spillway (Cheep)

Meanwhile upon closure of the natural estuary, the spillway was built at a location suggested to suit the tourism lobby, heavily influencing the elected representatives of the Paravoor Municipality. What was strange is, it defied all norms of commonsense and engineering fundamentals and was build way away from the natural mouth of the Itthikkara River through Paravoor Lake into the Arabian Sea. To put it short the Spillway is located at the opposite end of Mukkam boat jetty (Mayyanad Mainland) that is in a north south direction. While the Itthikkara river turns into the bosom of Paravur Kayal from the Eastern direction (underneath the railway bridge) and flows straight to the western direction. In effect the spillway is build away from the natural path of the river stream at an angle of 90 degrees perpendicular to it.

The solution designed by modern engineering to substitute nature became the problem itself, as it once again reinforces the message of not to tamper with nature. Not only does the spillway not deliver what it was designed for, but it has created other natural problems like change in water currents & loss of land. During monsoons when the river is in spate through the lake, it starts exerting tremendous pressure on the tiny strip of land (Lakshmipuram Thoppu) separating Paravoor Lake & Arabian Sea instead of the spillway. As there is no functioning outlet at the place where the stream finally force stops at Lakshmipuram Thoppu unable to break open into the sea as tons of huge special purpose boulders placed by the administration guards it . It could be another matter than nature will one day break open all its man imposed shackles, causing tremendous loss of costal land and grave destruction. It well could be a disaster waiting to happen

Figure 4: Spillway as seen from Paravur Lake

Flood of 2010

In 2010 when the threat of spate loomed large from the Itthikkara River threatening to submerge the entire southern parts of Kollam district with the spillway not function as envisaged, the district administration was forced to make way for a manmade estuary. The land stretches along the Itthikkara River got inundated causing severe water

borne disease and permanent damages to the ecosystem as well as loss of agriculture. Under orders from the coastal tourism lobby as it was causing severe damage to their tourism infrastructure the administration decided to cut open the estuary at the very spot of the natural fishing harbour at Mukkam subduing fighting fishermen. Incidentally this was the only place where there is a natural beach and that too was obtained by the fishermen community after agitating against the district administration to retain their right to livelihood when boulders were laid all along to coast to prevent erosion.

By this action they virtually killed the last pocket of non mechanized traditional sea fishing group (kambavalla) who pull their nets from the beach after laying it in the sea. What is even worst this is 200 meters to the left of the natural estuary while the spillway (cheep) is about a 1.5 km from the natural estuary. Had this reopening been done at the spot of the natural estuary we would have been good for ever.

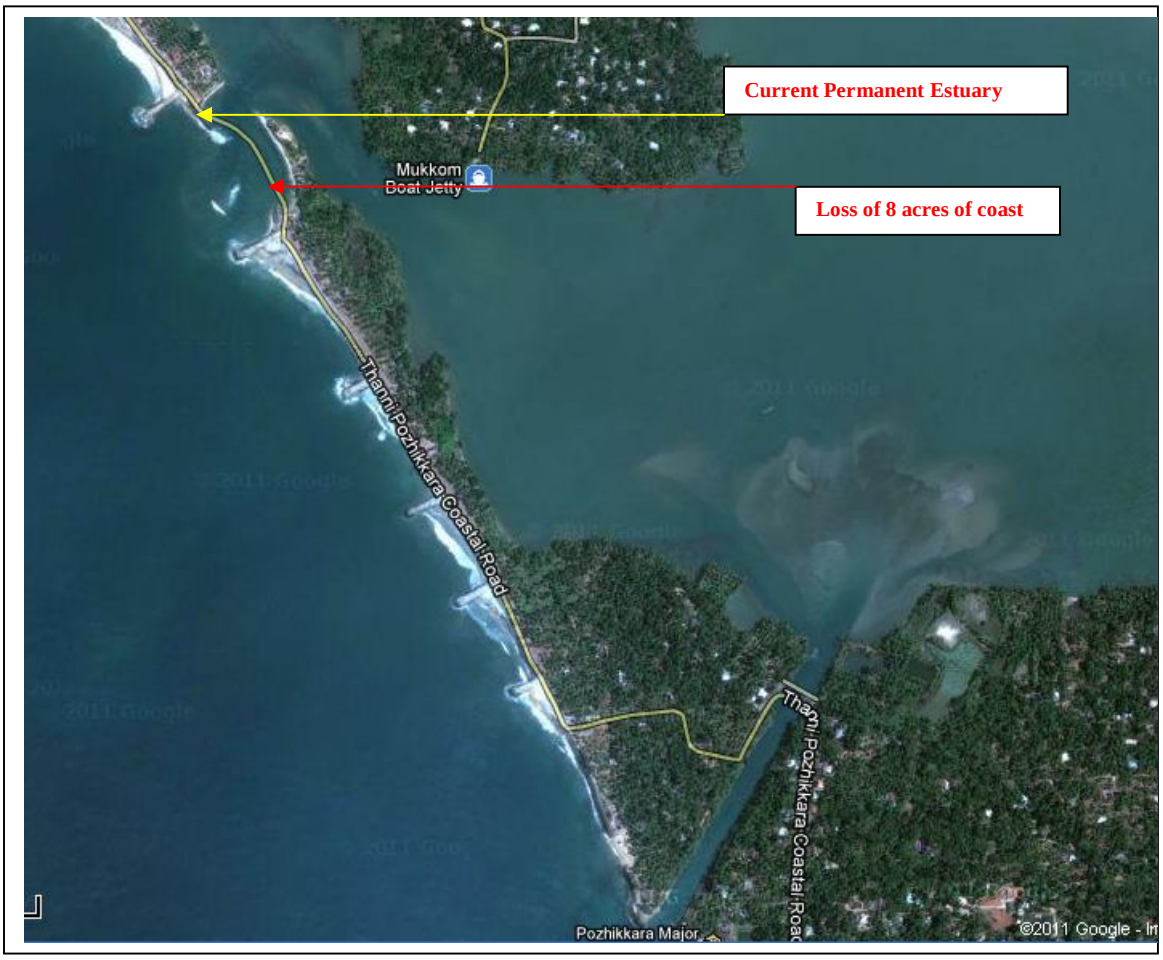

Figure 5: Current Opening (man made estuary)

By re-engineering the estuary at a location which doesn't suit the natural flow, eight acres of costal land (red arrow) was washed away by sea putting at risk lives and dwellings as well as bringing to a complete halt the livelihood of fishermen at Lakshmipuram Thoppu, Mayyanad (Mukkam). Mukkam is the sea front of Mayyanad village, approximately 3.5 km extending from Thani up north up to the cheep at Paravoor. This strip is so narrow that its maximum width is 100m and minimum width is 40 meters. Such a fragile ecosensitive place has been tampered without trying to understand how nature works and to satisfy a few business stalwarts. This is more akin to the issue of Plachimada where the whole village was made to suffer for Coca-Cola to continue their profiteering activities.

Loss of Sea Bed

With the development of Tangaseeri Fishing Harbour by laying capes into the sea tampering the natural ebb and pull of the waves has resulted in loss of seashore down south towards Paravoor. These capes were supposed to be laid out at two places

1. One from the Cape of Tangassery in South east direction up to the Maruppakallu of a length of 1200 meters.
2. Another one from the East of Kochupilamoodu Mahatma Gandhi Park is South west direction of a 1000 meters (That is the present location of Beach Orchid Hotel)

This has resulted in the further loss of sea bed at Mukkam. Its another story where due to political interface where the second cape has to come up at Kochupilamoodu has not be constructed instead to safeguard business interests the cargo harbour (which was designed as a separate entity) got shifted into the fishing harbour thereby resulting in another environmental catastrophe in the making. Records available with the department of Harbour Engineering confirm this (See figure below). Today at the place of the second cape we have a five star hotel and a paid park of the municipal corporation.

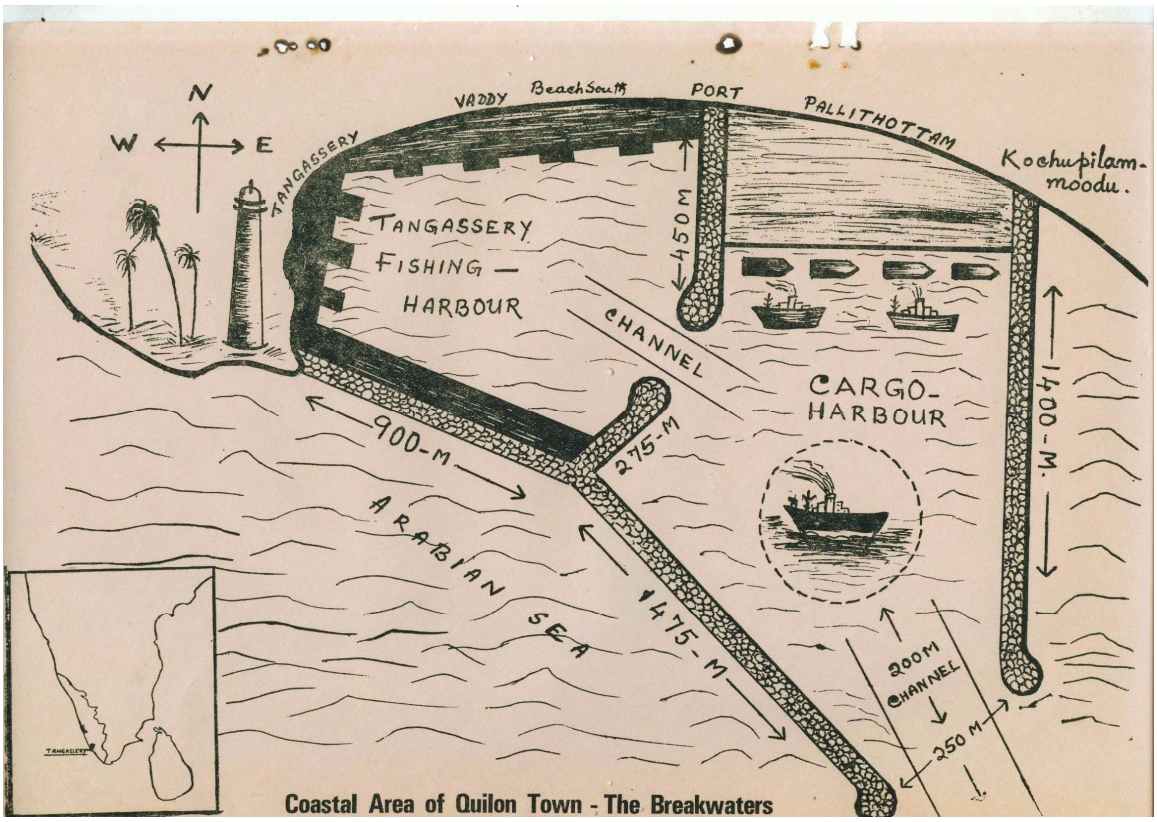

Figure 6: Plan of Tangassery Fishing Harbour & Cargo Harbour as originally conceived

As the cargo harbour needs constant dredging the coastline of Port Kollam caved in resulting in loss of housing and lack of space for parking boats. This issue also needs to be pondered as it's a classic case of Cargo harbour swallowing the fishing harbour; just like the closure of the natural estuary to suit business interests the administration is stifling the Paravoor Lake, its ecosystems, biodiversity & livelihood. As well this is causing permanent change to the character of Itthikkara.

With the existence of Capes at Tangaseeri Port the coast line up to Paravoor was subjected to constant sea erosion thereby resulting in loss of dwelling and livelihood. This necessitated the need to lay rocks along the once famous beaches of south Kollam, thereby permanently altering the face of Kollams coastline for ever. It's another story whether the environmental impact of such a construction was studied and it's after effects were recorded or not. The process of environmental clearance too has to be looked at closely, as to whether there are simulation models available on the possible after effects, the long term impact and the need to go in for such a permanent alteration. In short a traditional fishing harbour the only one in Asia designed to protect them is the cause for them loosing their dwellings and the entire Kollam coast south of Tangassery getting altered by loosing its virgin beaches..

In a span on two decades the natural fishing harbour has given way to a cargo harbour. More akin to brick industry fighting the farmers cause at Itthikkara. What an irony, usage of public money to cause wanton destruction which are mostly irreversible, and will remain permanent scars. Case studies like this highlight how we obtain developmental project clearances based on influencing factors rather than need based long term studies and environmental impact assessment.

Due to the above development the once famous fishing harbour at Mukkam which relied on Kambavalla (non mechanized) to fish at sea had to stop the practice due to lack of beach and more importantly the change in tidal current patterns due to the placements of capes. These changes in sea currents have made non-mechanized sea fishing virtually impossible as it's a deterrent to their lives. In short the once famous coastline or virgin beaches of Kollam has been reduced to a stretch of rocks. Overall the width of land in between Paravoor Lake and Arabian Sea has been reduced further on both sides make it all the more prone to erosion further and merger of lake and sea becoming a reality in not so distant future as more perils dawn upon as in the form of climatic changes and sea level rise..

Another pertinent factor which caused the erosion of seabed at Lakshmipuram Thoppu is the permanent disability of the natural estuary. Itthikkara River through Paravur Lake breaks open during deluge as a natural estuary into the Arabian Sea, as this happens the silt & sediments carried by the rivers tumultuous muddy waters get deposited at the mouth of the estuary on the sea side. This increases the sand deposit on the seashore and thereby augments the beach. Had the estuary being functional, at least the Mukkam beach would have stayed put negating the negative effects of construction of Tangassery harbour. Mukkam beach, if it continued to stabilize itself through the sand deposits at the mouth of the estuary, it could have prevented further seabed erosion down south of Lakshmipuram Thoppu, Mukkam towards Paravur. Instead today they are protected by boulders all along from Tangassery down south through Paravur and even further down towards Varkala.

Cultivations at Itthikkara

Cultivation activities at the rich embankments at Itthikkara near Kottiyam have came to a stand still as the fields have given way to sand mining. The entire stretches of paddy fields on both sides of the river have become ponds which are now used for commercial prawn cultivation. The river bed at Itthikkara as seen in the figure is strewn allover the place and virtually the river is everywhere, in short contaminating the entire area with its slight saline water. And this is essentially what is needed for Prawn Cultivation. A perfect situation created by modern day aquaculture techniques to obtain foreign exchange at the expense of nature.

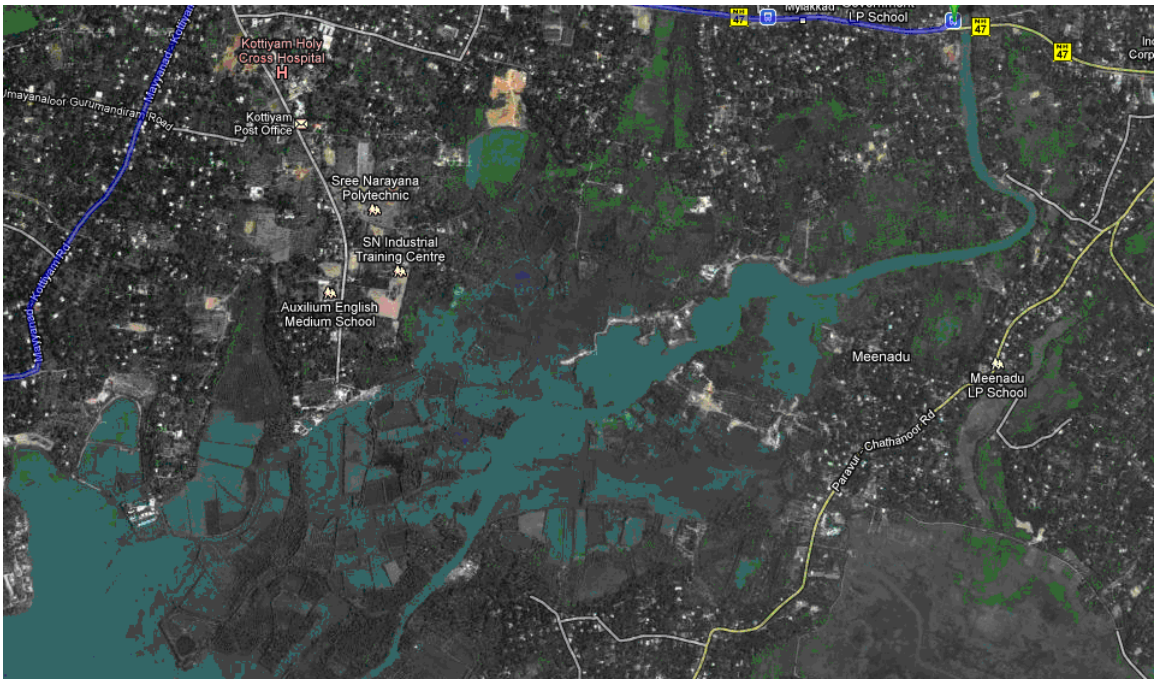

Figure 7: State of Itthikkara River due to sand and clay excavation

As time elapsed, today the prawn cultivators are forced to constantly protecting the ponds embankments by raising the mud walls as the estuary is of permanent nature now. Previously the nature engineered estuary used to close itself

once the purpose was done, while the human engineered one doesn't have some systems inbuilt. Due to permanent estuary Itthikkara River gets constant saline intrusion from the sea thereby altering the ph level of the water so that prawn culture becomes difficult. In short the entire agricultural land for which the estuary was once blocked is now fully engulfed in saline content. And now we have resorts coming up on the once famous nutrient rich agricultural land. Such rampant degradation of land and soil has to be looked into with all earnestness.

In a span of three decades Itthikkara has gone from fertile agricultural land and farming to brick companies which led to sand and clay excavation from the fields. Once the fields became water logged people became innovative and started to cultivate tiger prawn to cater to the export market. Now that the permanent closure of the estuary is asking serious questions at the modern prawn cultivators thereby receiving less rent from prawn cultivators. Thus land owners are making way for tourism infrastructure both small & huge. Look at the natural transition in seamless fashion from agriculture to brick companies to prawn culture and now tourism assets in the form of resorts all aided by the local administration.

It's another issue how clearances for resorts was obtained against CRZ act in collusion with the Local body officials whose aim is to make quick bucks in the span of three years they are posted at a particular location. Still the most important question left unanswered is who will pay for the catastrophic environmental damage and can we ever restore nature here to its perfect past. Modern Environmental Engineering could provide the tools to remedy this or may not as global warming is fast catching up and may submerge the area completely as the flood control mechanism of nature has gone awry.

State of Itthikkara River

The once sprawling fresh waters of Itthikkara has become more saline in nature as the water is not flushed out during monsoons to the Arabian sea due the estuary being blocked permanently. The natural cleansing of the river water by natures own mechanism was the key to its aquatic life biodiversity. Once famous fresh water fishes of the Itthikkara River has all but vanished. Fishing families along the river bank are forced to put up with their loss of livelihood.

People who live near the river and its tributaries indeed are deeply concerned about the decline of the river's water retention capacity due to loss of tree cover, top soil loss, illegal sand mining and also the serious water pollution issues due to garbage disposal into the river all through the stretch of it. There is now acute shortage of water in summer. The once healthy river turns almost completely into a dry bed in summer. Rampant illegal sand mining all along the river has made the river shallow due to caving in of its sides and the river bed is virtually like plain land as sand islands crop up during dry seasons highlighting the plight of the Itthikkara River. The deafening sound of huge machines sucking out sand is more or less routine during any part of the day as its mandatory business. Of late the river has broken up into several rivulets as the original bed has been permanently damaged due to the brick manufacturing industry & illegal sand mining.

Status & Distribution of Biodiversity & Marine Wealth

Paravoor lakes aquatic wealth has been its indigenous fishes as well as regular augmentation of fresh water fish from Itthikkara River. Old timers lament the loss of biodiversity and the salinity in the lake which is the cause of biodiversity destruction. Moreover now since there is a permanent breach 200 meters to the left of the estuary, it has further made the waters at Paravoor Lake more saline as its always connected to the sea. This causes the saline water to creep upstream into the Itthikkara River, continuously affecting its freshwater habitat.

The irony is that when large number of Brick factories existed along Itthikkara banks the estuary was closed to prevent saline intrusion. Now the Brick manufacturing industry is in decline and there is a permanent opening allowing sea water intrusion to Itthikkara River through the Paravoor Lake and there is nobody to spread tears apart from the indigenous people who depend on the water bodies for their livelihood. It's imperative that urgent measures to restore the same have to be taken up and planned by the local administration together with the indigenous people.

Otter Habitat at Paravur Lake

Consequent to the above described actions of tampering with nature, Paravur Lake today does not have adequate prey base for sustaining otter populations. Paravur Lake fish breeding grounds are filled with accumulated sand from the sea and this has caused alarming decline in the fish population. Moreover since the natural estuary mechanism is not working due to the flow modification by closure of the estuary, accumulation of persistent pesticides such as chlorinated hydrocarbons and organophosphates through agricultural runoffs, silt and sand deposits has caused the otter population to look for other pastures. Loss of mangroves due to aquaculture and human settlements has added to the otter's woes.

Moreover with the shallow waters not adequate to sustain minimum descent level of fish population, the otter population is virtually nil. It has been close to a decade since the sighting of an otter at Paravur Lake. A host of measures coordinating all the government departments is needed to reverse the cycle of decline and the indigenous community participation is central to it.

Chapter: 4

Key threats to the Paravoor Ecosystem

Dwindling Fish Species

Fishing in Paravur Lake as a natural way of livelihood is almost coming to a standstill due to lack of aquatic life. Livelihood through fishing here is fast becoming a part-time activity and fishermen are force to try their hand at other life sustaining occupations. The risk faced by the fresh water fishes and its high economic value have been raised in various studies and reports but to no avail. Most of the threatened species and few of them on edge of being extinct are spoken about by the indigenous people. A rare sighting of any of the endangered fishes brings a rare pleasant glee from the old timers. One is left to rue the plight of the next generation as they don't know what they are missing in their pursuit of urban happiness and fast money. They are left to inherit a brutally raped mother earth whose assets have been plundered and its tongue chopped off.

Lack of scientific nomenclature and Paravur Lake specific names is the cause of not listing many of them. Some of the species of fishes which are almost extinct or far and few in the Paravoor lake are Kaivetti, Poonthi, Tirutha, Puzhamala, Attukonju, Kaithakoora, Attuvaala

Species that are on its last legs and which would be around a few more years in the Paravoor lake are Kanambui, Maalai, Mural, Thedu, Karimeen, Muzhi ,Paral or Kuruva

This makes way for serious pondering from government officials, environmentalists, NGO etc. They have to work hand in hand with the indigenous community to start to arrest this decline for the future of this key wetland ecosystem and the very survival of a host of fresh water species.

Sand deposits

Reverse Engineering in its true sense is scripted here, where nature is trying to undo the harm that has been inflicted upon it. A spillway (cheep) which had envisaged out letting flood waters to the sea is instead transporting sand inwards from the sea.

Figure 8: Sand Deposits at the middle of the lake

Sand gets deposited in the lake through the spillway in huge quantities during high tides. Paravur Lake decline started with closure of the estuary and the faulty design principles applied along with a host of other unethical consideration that got factored in while implementing the spillway. The once mighty lake with minimum depth of about seven meters is now very shallow except in a few areas. Huge tracts of sand have been deposited all along the lake creating virtual sand mounds or tiny islands.

.And this has been seized upon as a tourist attraction by the current generation, so as to get a unique view from the middle of the lake. Tourists are transported from mainland to the sand island formation, and during summer its doubles up a cricket ground. Alas what destruction have we wrought upon nature, by temporary passing industrial phases and a few jobs under the banner of economic development & growth. This once again calls for a strong debate amongst policy makers on the infatuation of GDP led growth over GNH (Gross National Happiness). Ultimately how can anybody gain from nature's misery.

Moreover due to the non functioning of the natural estuary the sand and mud carried by the river gets deposited in Paravur Lake on a regular basis. When in spate the estuary used to open up naturally flushing out all of the silt and sediment deposits etc from the riverine system and thereby the Paravur Lake. This natural cleaning up of the system has not been happening since the permanent closure and thereby is leading to the slow death of the lake.

Chances of the lake virtually splitting into three or four sub lakes or smaller water bodies due to the sand deposits is an imminent reality. Immediate steps have to be taken to dredge the sand mounds along with the closure or modification of the spillway so that sand doesn't get transported into the lake further

Breeding Grounds

Paravoor Lake in its original splendor had a lot of laterite stone formation (padarppan kallu) which has huge number of cavities all across the length and breadth of it. It's in these cavities that the fishes lay eggs. This rock formation has been completely submerged by sand that these natural breeding grounds are not any more seen. This has resulted in very limited availability of fish as well as led to the extinction of a few species. Once famous otters of Paravoor Lake which used to thrive on these fish rich waters are no more. Removal of sand deposits, restoration of the natural flow systems and finding a lasting solution to the ill-engineered spillway (cheep) is key to revive the breeding grounds.

Sand deposits both from the river and the sea should not rest at the bosom of Paravur Lake completely submerging the stone formations. Nature should be allowed to handle this itself, What's more important here is at least the authorities are made aware of their follies and in future such ill-fated developments are not taken up without proper assessment and impact study factoring in the local knowledge. Modern day legislators representing the Eravipuram and Chatanoor constituencies can take a serious look at this debacle and are probably the best people to make amends.

Habitat degradation

Mangroves, River Fishes, Lake Fishes, Otters, various other special purpose micro organism and a host of other aspects of nature that once thrived in this unique ecosystem is alarmingly vanishing. Habitat degradation is happening at such a quick rate. Those mangroves which thrived once all along the lakes borders is not seen anymore. The lake is very shallow and small islands or sand dunes are visible across multiple places in the lake. The shallower the lake, it's non conducive for breeding and fish population gets affected. Moreover the increased saline content in Itthikkara River and Paravur Lake due to the non functioning of the estuary at Lakshmipuram Thoppu, the waters are not any more conducive for fresh water species and it's very limited or low in supply.

Itthikkara River and its banks are in much worse shape due to the lack of water retention capabilities (sand mining) and the increases saline content (estuary).More importantly locals point out to the lack of medicinal property and indifferent taste of the fishes due to the increased saline content. Overall rampant degradation of habitat and disappearance of various micro organisms along the Itthikkara River and Paravoor Lake is of serious concern. Most often due to the lack of indigenous knowledge based understanding of issues or even scientific thinking these issues don't get highlighted nor are academic institutions or researchers highlighting these pressing issues.

Exploitation

Illegal fishing techniques employed by the next generation of fishermen are of grave concern to the already depleted fish stock of the region. Poisoning (method employed in paddy fields earlier) & Application of Electric shocks causes grave damages to the fingerlings as they are the immediate casualty of these methods. These and few other local illegal methods even though banned by law continue unabated.

Often one wonders don't we have adequate laws or is it lack of enforcement what is to be blamed. Exploitation of natural resources is considered a fast and easy way to amass wealth by a generation who has not grown up through adversaries. What can stop such rampant loot and destruction of nature. I believe the key to this rests with the administration officials and the enforcement agencies.

Exotic species

Exotic species or alien species pose many negative questions on the environment, the economy, and human health. When species are introduced into an area, they cause increased predation, competition, disease, habitat destruction, genetic stock alterations, and even extinction. A leading cause of biodiversity loss in many Paravur Lakes aquatic ecosystems is the introduction of exotic species.

These species pose a clear threat to the indigenous aquatic life in the Paravur Lake and the fresh water river of Itthikkara. Local fishermen who are engaged in fishing for a living need to be involved in such drive to weed out the alien species which are nothing but pure predators that cause loss of biodiversity. A drive towards this is necessary so as to retain the biological cycle and balance that was inbuilt in the system. Significant effort is needed to be input with all concerned authorities, local administration and indigenous population towards this laudable goal.

Pollution

Wetland' is a general term applied to land areas that are seasonally or permanently waterlogged, including lakes, rivers, estuaries, and freshwater marshes. Paravur Lake is one such vast wetland, where the plants in wetlands help filter pollutants in the water. Unchecked pollution had affected the natural lifeline of wetlands in the country.

Discharge of domestic effluent, agricultural runoff, open defecation, dumping of garbage, carcasses etc are the primary causes of pollution of Paravur Lake. Polluted build up and prevention of natural mechanism (estuary) to clean the system is leading to the non-availability of desired quality of lake water. It's about time the local administration took active interest in protecting the lake so as to prevent further loss of biodiversity. Are we asking for too much from the newer generation, when even house hold waste are dumped on the wayside or across the fence as its somebody else's business.

Livelihood Impact

Livelihood of the indigenous fisher people who use their knowledge of the sea and specialized fishing techniques alien to the mechanized fishing business for a living is in peril. Due to destruction of nature & its system it is virtually impossible to eke out a living by fishing alone. This is become a part time activity for their daily needs. The significance of this method practiced through generations is that loss is nil if the fish-net is pulled in empty. All that these indigenous people loose is there days effort, while in the mechanized sector fishermen (seen in fishing harbours) incur huge amounts of fuel and other expenses. Moreover they are needed to venture out deep into the sea. In addition to that the pollution these fishing vessels cause is so detrimental to the environment & fish stock.

Thus it becomes all the more important to preserve such communities and traditions who are dying a slow death due to the permanent changes development has brought upon them. Slowly but steadily these people are forced to migrate towards other jobs, where they fare badly and this affects their morale and self confidence. More importantly the next generation of fishermen are not being trained in the indigenous techniques & methods. If one tries to understand how fish is caught through indigenous means, its nothing but pure engineering & science applied through various calculations factoring in the tide, currents, wave formation and seasons. Today all you need is a high speed boat equipped with GPS and strong nets to sweep the entire the seabed in one go, which is leading to rampant degradation of fishing habitats. And this can be bank rolled only by businessmen and corporates.

Another statistic point to such displaced people migrating to Gulf countries in search of work, but returning empty handed to start picking up their fishing gear to start all over again. Under these circumstances one is left to brood aloud as to who is responsible to compensate for the loss to these native people, is it the politician or the executive which consist of bureaucracy, police & the judiciary.

Illicit Sand Mining

Illicit sand mining is continuing unabated on all sides of the Paravoor Lake, under cover of darkness. This has reduced the depth of the lake as embankments have caved in causing irreparable damage to breeding grounds. In addition to that it has also significantly reduced the population of fishes as well as virtually made extinct various important species, causing significant biodiversity loss in Paravur Lake.

Moreover on the already severely eroded sea side (due to the construction of the fishing harbour at Tangaseeri) there is looting of sand happening at night, from which certain minerals like ilminite can be filtered out. It's very lucrative given the need for such sand by public sector companies in Kollam District. Sand mining is prohibited in the areas under CRZ as per law. Only manual sand mining was permitted in non-CRZ areas, but only mechanized sand mining continues unabated. This adds further to the already eroded land thereby making the coastal highway road untenable.

Land Grab under Tourism

Land is critical for tourism development that too pristine coastal land to develop tourism products. Land grab by real estate developers, resort owners and tourism lobbies lack any process of ethics and flout all norms & regulations.

Acquiring sea land or coastal land purely for commercial tourist activities by driving out the indigenous people are wrecking havoc on livelihood and environment. Inhumane displacement violating fundamental human rights in collusion with local administration have to be halted completely. Various acts like Costal Zonal Regulation Act and funds like Tsunami related ones are cleverly manipulated and made use of for the above purpose.

As stated by Kerala State Council for Science, Technology & Environment a careful reading of the CRZ act shows that the communities traditionally dependent on the coast for their livelihood, who in most cases have lived in harmony with the coastal environment have little to lose by the stringent implementation of the act. In fact, they stand to gain a lot. The development pressures which threaten their livelihood would be inhibited by the act. The act will help to rejuvenate the coastal ecology in several ways. It can lead to substantial improvement in the quality of coastal habitats. This being the act, the implementation of the same questions the very motives of it and needs a lot to be desired.

Not being in power and not being connected means these poor millions of fisher folks get unwittingly entangled and displaced in an increasingly decrepit system, thereby forfeiting their all to the tourism lobbies who have worked hard to earn their spoils. The psyche of the powerful is to bend rules for oneself and others for a consideration. Wonder what cost to environment & livelihood and at whose expense are these being carried out.

Chapter: 5

Conservation Recommendation & Conclusion Priorities for the region

HELP Foundation calls for structural changes in decision making with respect to the approach to developmental issues so as to address a deepening environmental crisis which has generated profound change and great uncertainty. Till recently the entire region has taken for granted the benefits of developmental growth and its economic benefits. But now we have been called to cope with the negative dimensions of GDP lead growth like displacement, land grab, degraded environment, loss of biodiversity, polluted water bodies, illegal mining, modification of natural systems

Economic, Social & Regional events in and around the vicinity of the locality have coalesced together and their adverse impact is now being felt across local communities spread on all sides of the lake, and are left to fend for themselves. There is deficit in local administration which necessitates the need for strong and effective Gramsabhas for impartial decisions based on indigenous knowledge led decision making by the local people. Gramsabhas should be revitalized and reformed so that the local community is part of the decision making and not left to corrupt officials either elected or official. Such an approach to development would bring in rural solutions laced with knowledge of the region. This coupled with the local administration and the backing of the scientific community would bring in the best of developmental solutions completely in harmony with nature.

In addition to the same the world is increasingly faced with unprecedented social and political upheaval in its quest for natural resources. Spiraling food and energy prices and shortage of food and natural resources are introducing fresh instability. Uneven growth and inadequate spread of jobs, denial of basic human rights and improper distribution of the economic benefits are leading to growing intolerance of youths in the local communities. The idea that prescriptions to local issues have to be imposed from outside is fraught with danger. Instead make the local people the custodians of the natural assets in their region. Issues like sand mining & destruction of pristine nature for quick fast buck could be prevented for ever by this approach and people will continue to live in peace and harmony with nature.

Tsunami fund led eviction and the subsequent planned grab of coastal land coupled with the costal zonal regulation act are fraught with grave national security issues. At Lakshmipuram Thoppu (Mukkam) near the estuary there is a well orchestrated move ongoing to grab the land from communities that have lived there for generations. These indigenous people dwelling there have not been granted land rights by the subsequent administration. Moreover Paravoor Municipality stepped in to establish control of part of the land splitting the community into two under the influence of tourism businesses under its jurisdiction. This coupled with insensitiveness of the Mayyanad Gramapanchayat has driven the community to despair and they are in the process of being messed up for ever.

Powerful tourism businesses are working over drive to grab a share of the fortune. Once they are evicted into ill-conceived multi layered flats far away from their place of livelihood, the coast is fraught with dangerous costal security implications. One wonders loudly which authority coined the notion of a fishermen living ever happily in a multistoried flat. Such a scenario would facilitate a vessel from sea to slip pass to the mainland through the estuary with ease, when this can be easily thwarted by the sheer presence of the local fishing community. While plans are afoot for securing the coast lines of Mayyanad with costal police stations and armed forces under the garb of modernization and national security, this could be easily achieved at a pittance by making sure the indigenous fishermen community continues to say in their habitat.

Environmental degradation is often linked with poverty and has not been highlighted. As with economic growth oriented policies development comes to the fore. Most often projects are cleared without proper study of environmental impact. Seldom has obtainment of Environmental Clearance been a hurdle to business as for the administrative class its just cause for a few illegal bucks. Livelihoods of people who have depended on these resources as their source of income are almost always the causalities. Sustainable development that embraces human rights in particular and incorporating the apt developmental solution in consultation with the Indigenous people and approval of the same in the Gramsabhas is the way forward so that the region and its people wont end up being the casualty.

Scientific knowledge alone cannot provide solutions for issues concerning nature and its unique ways. Gramsabhas and the elected representatives have to fulfill this most important task given the negative effects of globalization and the interests of the business communities. Most often outsiders have little first hand information of the region except return for their investments. This is a classic case of Chatanoor MLA highlighting the issue of farmers in his constituency (Itthikkara) and enforcing a solution in Paravoor Lake at Mukkam which falls under Eravipuram Constituency. These kinds of vested interventions prove how catastrophic it can be to nature, the existence of the triad nexus of corrupt businessmen, politician and the executive. They act in concert to exert their will, subvert all norms to generate black incomes. Environmental wrongs one done are very difficult to have it reversed as its affects the entire lifecycle system of nature and those who depend on it. It more often than not leads to severe devastations. Such one sided flow alterations or exploitation of natural resources for commerce assumes important dimensions in a globalized era. What must be emphasized here is the protection of rights of the traditional communities and making them part of the solutions.

HELP Foundation has carried out this study together with the indigenous community, for the objective of evolving a management plan for sustainable management of the estuary and for the full ecosystem development (restoration) of Paravoor Lake. The shores of the lake and the banks of Ihthikara River are home to important species of rare birds, animals & aquatic wealth. Any decisions made concerning the natural estuary at Lakshmipuram Thoppu, Mayyanad and its sustainable management attains significance as it has to be dictated purely by nature. This is home to not only a significant section of the population who live on its shores but also a large spread of aquatic wealth which adds to the important biodiversity to the lake's environmental habitat. Most natural systems are resilient in nature and if allowed to recover, these water bodies can perform vital ecological functions, whatever the modifications or truncations and support a substantial amount of biodiversity. Native vegetation binds the soil together and prevents erosion. Restoration of the modified flow system will help tremendously in providing habitat for the native species. It also is key to reviving habitats for the endangered mammals which once thrived in the region.

Universal assessments indicate that though biodiversity provides for almost all the needs for our living, it has not found its way into the lexicon of the common man yet. It is a resource that is given to us only to be handed over to the next generation, never appreciated and over-utilized. Biological diversity upholds the very survival of humans on earth, and is the basis for development and peace. However, natural resources and biodiversity are exploited to such an extent that resources are lost forever and it's significantly alters the livelihood of indigenous people and other life forms in nature. Unlike elements of climate change that can be reversed through mitigation and adaptation action, these resources once lost are gone for good.

Below are the sequence of events that need to be done on an urgent basis to restore Paravoor Lake and its environs to former glory.

1. Closure of the temporary estuary which is of permanent nature
2. Opening of the natural estuary at its original location where the mouth of Itthikkara River meets the Mukkam coast at Lakshmipuram Thoppu, Mayyanad
3. Removal of clogged sand at the mouth of the spillway
4. Partial or complete closure of the spillway
5. Dredging of vast stretches of sand islands in the middle of the lake
6. Non mechanized Sand Mining to be encouraged selectively at village level, away from the banks of the lake and completely stop the mechanized illicit sand mining process
7. Address the declining fish stock production through concerted efforts to conserve the fish stock in a sustainable manner and with indigenous community participation
8. Promote ecotourism with better facilities of inland navigation and services in the form of indigenous boats service
9. Developing of marine bio-reserve or fish habitat cum sanctuary and entrust ownership of the same to the indigenous fishing community to bring back the lost species and nurture the lakes health back to normal.
10. Improved shore protection through mangrove afforestation for ecosystem development on the banks of the estuary
11. Revive mangrove forests all along the banks of the Paravoor Lake
12. Identify and phase out the pollution sources
13. Start actions to revive and sustain the otter population.
14. Actions to start Restoration & Protection of the Itthikkara river
15. Formation of Paravur Lake & Itthikkara River Protection Authority with adequate representation for local bodies and indigenous people.
16. Work towards listing this as a Ramsar Site or other similar protection mechanisms as defined by the Ramsar Convention for the conservation and sustainable utilization of wetlands
17. Built a bridge over the estuary so that the coastal highway can be restored once for all