
Sustainable Regional Development In the Catchment of Chilika Lagoon, Orissa State, India

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1. Introduction

Chilika lagoon, situated on the east coast of India, is the largest lagoon in India. Chilika lagoon provides highly productive eco-system to the livelihood of more than 200,000 fishermen and valuable biodiversity hotspot to a wide range of species, including endangered species listed in IUCN. However, the lagoon environment has been under serious threat due to high anthropogenic pressure, especially after 1980's. The environmental deterioration caused the fishermen to get less profit and keep them poor as well as ruined its enriched eco-system rapidly.

To solve the above problem, Chilika Development Authority (CDA) was established in 1991 to restore the lagoon eco-system and promote capacity building for the local people in and around Chilika lagoon. At the instance of many peoples who demand recovery of the lagoon environment, CDA has implemented hydrological interventions such as opening of a new mouth with integrated strategies, which contributed to the drastic economic growth for fishermen as well as wetland conservation. At the same time, the decision making process of those interventions which paid more attention to information sharing with the local people led to promote them to recognize the importance of environmental awareness and wise use. In fact, the enhanced awareness among the stakeholders accelerated environmental movements by the initiative of NGOs, Self Help Groups (SHGs), Community Based Organizations (CBOs) and researchers as well as CDA. They formulated successful activities such as Dengai Pahad Participatory Integrated Watershed Management Project (DPPIWMA) and Campaign for Conservation for Chilika lagoon (CCCL).

This paper tried to describe the detailed process of how each stakeholder in and around Chilika lagoon has implemented to step up actions toward sound environmental management which is famous for successful wetland conservation, and then illustrate what kind of factors should be needed to sustain innovative communities.

2. Background

2.1 Characteristics of Chilika Lagoon

Chilika lagoon is the largest brackish water lagoon in India. It is located in Orissa State, India, situated between 19°28' and 19°54' North latitude and 85°05' and 85°38' East longitudes (figure 2.1).

This area covers a vast water area of 1,055 km², which swells to 1,165 km² during rainy season and shrinks to 906 km² during summer season (A. K. Pattnaik 2002). Chilika lagoon becomes less saline during July to December due to rush of flood waters from 52 rivers and rivulet. On another front, it becomes more saline during December to July as the supply of flood water is cut off when south wind begins to blow and saline waters rush from Bay of Bengal at the time of high tides (Patro 2001). The average depth of Chilika lagoon is around 50 cm in north sector, while the maximum depth of 3.7 m is found in central sector (A. K. Pattnaik and Doi 2005). Besides, the depth near seashore along with Bay of Bengal is quite shallow. Chilika lagoon is a unique assemblage of marine, brackish and fresh water eco-system with estuarine characters.

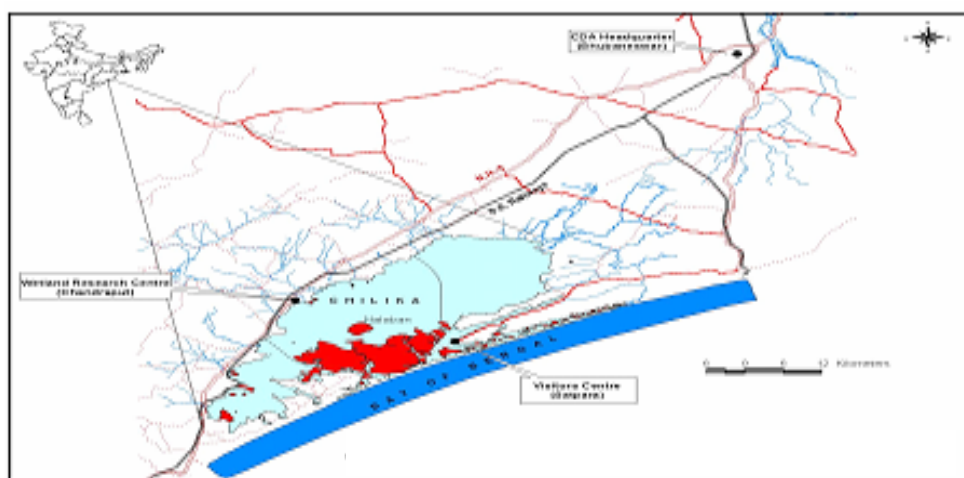


Figure 2.1 Map Information of Chilika Lagoon

Chilika lagoon holds a pride of place as a magnificent beauty of nature like numerous hillocks and islands in the lagoon. Many poets have written poems on this beautiful lagoon. To hand the beauty of Chilika lagoon, an English textbook for high school student is designed to lead the reader to understand the following story; *“Gopabandhu Das who was an Oriya famous poet became impatient to see the beauty of the march of colorful sights and sounds of Chilika lagoon while going by train. He asked the speeding train to stop for a moment so that he could enjoy the beauty. It is because of the beauty that arrests him much”*.

Recognized these enriched characteristics of the environment in the world, it became a wetland of international importance under Ramsar Convention 1982 based on its unique biodiversity and socio-economic importance, having been designated as a first Ramsar site of India in 1981. Chilika lagoon is enriched with varieties of terrestrial fauna and flora. For example, Chilika lagoon attracts a great large number of resident and migratory birds more than one million from the Aortic and Central Asian regions like Himalayas, China, Siberia, Caspian Sea, etc and also there are many endangered species listed in the IUCN red list of threatened species like the Irrawady dolphin. At the

same time, Chilika lagoon is endowed with highly productive eco-system and valuable biodiversity, which enables to support livelihood of more than 200,000 fishermen and thousands of local persons who are engaged in allied fishery business activities (CDA 2005a). The linkage between the people and Chilika lagoon is so close that environmental conservation of Chilika lagoon is required to maintain or protect for their development, taking into consideration of multiple aspects to support their life as well as its rich eco-system.

2.2 Rapid Environmental Degradation of Chilika Lagoon

As opposed to the rich eco-system of Chilika lagoon, it had been facing serious problems. One of the most critical treats to the general ecology of the lagoon environment is siltation (CDA 2001; A. K. Pattnaik 2002). The catchment area of Chilika lagoon composes of rocky, sandy and muddy substratum. It contains a wide range of sedimentary particles i.e. clay, silt, sand, gravel and shell banks (Panigrahy 2002). Out of those particles, the major part of the catchment area is silt. S.S.Pattnaik (2002) estimated that around 1.6 million tones of sediment has annually got deposited in Chilika lagoon by rivers Daya and Bhargavi in the north-east of the lagoon, several streams and nallas and by other means. Lastly, the lagoon environment drastically has been deteriorated in visible ways since 1980s due to rapid choking of the mouth and increased run-off of silt from upstream by anthropogenic activity. High siltation happened to affect the exchange of water between the sea and river, resulting in fall in the salinity level of Chilika lagoon alarmingly. Salinity reduction plays vital role in influencing on the eco-system of Chilika lagoon. Its fall has led to prolific growth of the freshwater invasive species. In fact, the weed-spread area of Chilika lagoon proliferated from 20 km² in 1972 to 684.70 km² in May 2000 (CDA 2005a). According to Ghosh (2002), the annual invasion is calculated at 15 km² per a year.

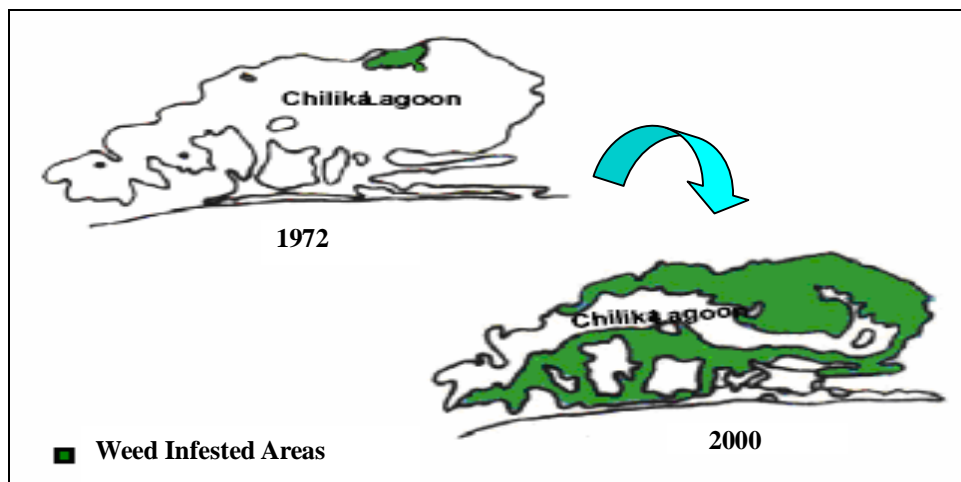


Figure 2.2 Proliferation of Invasive Species in Chilika Lagoon
Source: Chilika Development Authority

As a result, the spread of the invasive species restricted the feeding as well as the breeding ground of the many economic valuable species of the fishes as figure 2.2 has shown the distinct difference. In short, siltation from upstream, which led to the shrinkage of the water spread area, decrease of salinity and prolific growth of weed infestation, had a serious negative impact on habitat of wildlife and fishery resources. Fishery statistics past the few decades (Department of Fisheries & Animal Resource Development and CDA 2005) shows how fishery activities were hampered by rapid change of natural environment (figure 2.3).

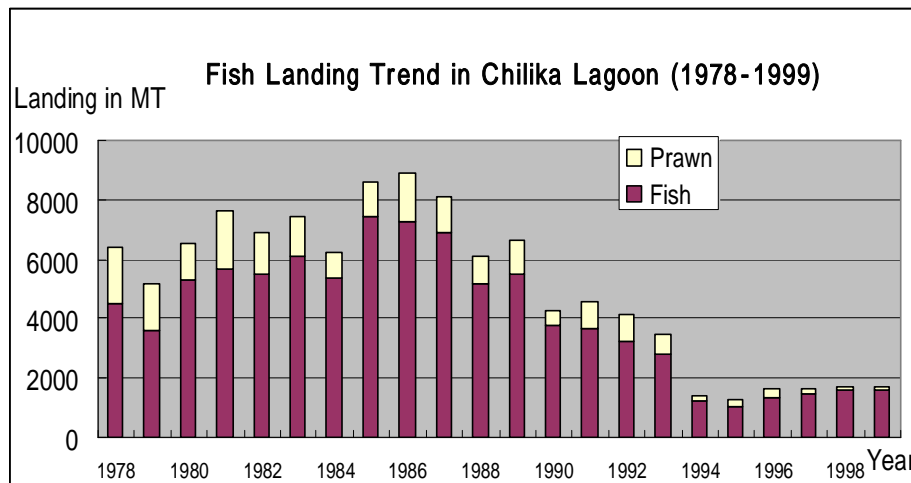


Figure 2.3 Fishery Production of Chilika Lagoon

Source: Department of Fisheries & Animal Resource Development, and Chilika Development Authority (2005)

These changes of the lagoon environment caused the local people who depend directly or indirectly on natural resources in Chilika lagoon to get less benefit and keep them poor. As a result, in spite of the numerous well-being characteristics, Chilika lagoon was listed in the list of Montreux Record in 1993, which is the principal tool of the Ramsar Convention for highlighting Ramsar sites where an adverse change in ecological character has occurred, is occurring, or is likely to occur. It created an urgent necessity to step up actions toward wetland conservation.

In response, the stakeholders in and around Chilika lagoon shared a common mind that the lagoon environment should be improved for wetland conservation and empowerment of fisher livelihoods. Accordingly, to solve this critical situation of Chilika lagoon, Chilika Development Authority (CDA), a Government of Orissa Agency, was established in 1991.

2.3 Establishment of Chilika Development Authority (CDA)

There have faced with serious environment problems in Chilika lagoon since especially 1980's. One of the important causes why Chilika lagoon has deteriorated its environment was run-off of silt

from upstream by anthropogenic activity such as deforestation, population increase, etc. Its impacts on the lagoon environment eventually exceeded the acceptable environmental limit and then made those who relied on fishery resource in Chilika lagoon poor step by step. Finally, they strongly strived to call for the demand that the lagoon environment should be recovered to develop their capability for better livelihoods. At the instance of them, Chilika Development Authority (CDA), a Government of Orissa Agency, was established in 1991. The main objective of CDA is as follows.

- To protect the Chilika lagoon ecosystem with all its genetic diversity
- To survey, plan and prepare the project proposal for integrated resource management for all round development in and around the lagoon
- To execute various multidimensional and multidisciplinary developmental activities either itself or through some other agency, to cooperate and collaborate with other institutions of the State, national or international institutions for all round development of the lagoon.

One of the most honorable features of CDA is that its organization was strategically introduced to integrate ministerial authorities of Orissa state and involve among the stakeholders in and around Chilika lagoon. The area of Chilika lagoon is so huge that there are many implemented agencies which have responsibility for each role and function at district level, state level and national level. Therefore, CDA strategically involved the representatives of the stakeholders to implement comprehensive policies and measures related to environment problems in Chilika lagoon effectively. Members of the Governing body of CDA include secretaries of relevant departments, district collectors, experts and other resource persons. The organization chart of CDA is shown in Figure 2.4

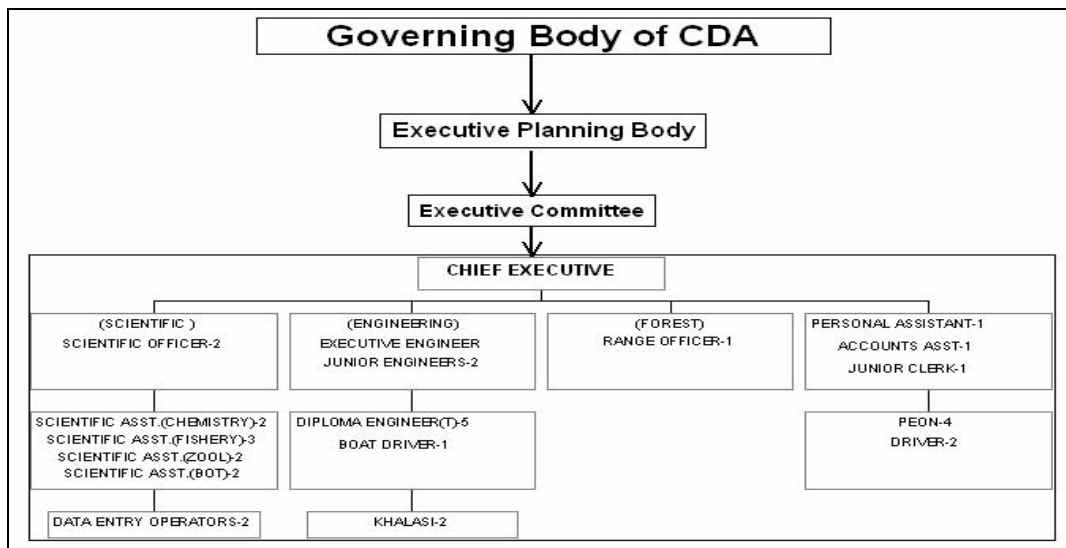


Figure 2.4 Government Body of Chilika Development Authority

3. Natural Restoration

3.1 Opening of the New Mouth

Having been under the serious threat in Chilika lagoon, CDA firstly has discussed about some technical implementations. As the above mentioned, the government recognized that siltation is the main reason to pose grave problems in the lagoon environment. It prevents the water circulation between river and sea as silt has been accumulating near the estuary. As a result, the salinity level has decreased to a large extent and much migratory fish, prawn and crab have been blocked the route from sea to river and vice versa. Those changes threatened the habitat of wildlife and fishery resource. Taking into consideration of those views, in September 2000, CDA implemented an opening of new mouth artificially along the sand spit at a distance of 11 km from Chilika lagoon and desiltation of new dredged channel. Figure 3.1 has shown the overall image of hydrological interventions by CDA initiative. The following tried to describe the process how CDA has decided to the implementations with focus on opening of a new mouth.

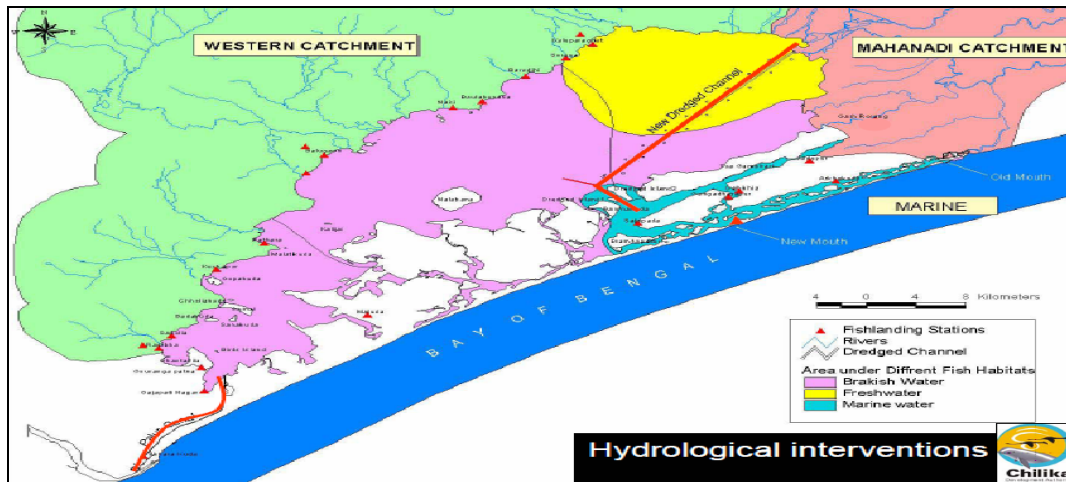


Figure 3.1 Image Information of Opening of the New Mouth in Chilika Lagoon
Source: Chilika Development Authority

Before opening of the new mouth, many studies related to natural environment of Chilika lagoon have already presented increasingly after 1980's in accordance with the fact that the ecological balance of Chilika lagoon got faced deplorable condition. In particular, some important studies commissioned by CDA contributed to make a decision of opening of a new mouth near Sipakuda, in collaboration with Central Water and Power Research Station (CWPRS), National Institute of Oceanography (NIO), Ocean Engineering Centre, etc as follows (CDA 2001; CDA 2005a).

Central Water and Power Research Station (CWPRS) carried out the hydrological and two dimensional mathematical model studies. The studies concluded that the tidal influx into Chilika

lagoon was considerably reduced because of the shoal formation along the lead channel and continuous shifting of the mouth, which was resulting in significant hydraulic head loss. They further concluded that the salinity flux and tidal flux into Chilika lagoon would not improve unless the location of new mon to be opened is closer to the lagoon. On the other hand, the Ocean Engineering Centre also recommended CDA to dredge a specific site for desiltation, while NIO carried out some hydrological surveys and assessed the environmental impacts of the desiltation on the eco-system of Chilika lagoon..

Although CDA recognized the necessity that opening of a new mouth was inevitable from scientific evidence, the above decision had still some uncertainties and high risks, which might have had irreversible impacts on the eco-system of Chilika lagoon. Under the circumstances, a chief executive of CDA, who had crucial responsibility for it, faced the difficult phase for judging whether a new mouth should be opened or not near the estuary. On the strength of his prominent ability of integration, coordination and negotiation, however, he could finally make a sensible decision that the new mouth should be opened, which resulted in successful intervention for wetland conservation. One of the most honorable things, his judgement was based on not only scientific evidence from many studies, but also practical experience. It means that, in addition to scientific evidence, he could obtain practical information on opening of a new mouth through interaction with some government officers of Kushiro prefecture, researchers and the local people of Saroma Lake, Japan, which environment is quite similar to Chilika lagoon. His visit for Saroma Lake was organized by Ramsar Center Japan (RCJ) initiative, which is a NGO to help to put into practice the basic principle of wise use of the Convention among Japan and Asian regions. He met some RCJ members when CDA was held on “Conference of Sustainable Development in Chilika lagoon in 1998. They discussed about the environment of Chilika lagoon and then RCJ decided to invite him to visit Saroma Lake to inform him of useful advice and experience as a case study of Japan. This occasion led not only to support valuable advice to make a decision to open the new mouth, but also subsequently to establish friendly relations between Chilika lagoon and Saroma Lake in 2003 called as “Sister Wetland”. As a result, those supports from scientific and practical evidence through his strong leadership led to make a decision of opening of the new mouth. In addition to the implementation, his prominent initiative led to make a decision of dredging new channels for desiltation, which also contributed to restore the enriched ecosystem and increase the amounts of fish landing.

Putting it all together, two movements i.e. acquisition process of scientific and practical knowledge, contributed to make a decision to open the new mouth near Sipakuda. Before the intervention, it is also worth noting that CDA strived to inform the local people of the decision in simple terms with local language to have them understand and agree with the desiltation programme. The chief executive has been in constant dialogue with the local leaders and fisherman community leaders as needed. Consequently, the interaction with full respect for their cultural and social

situation led to agree with the decision without resistance. The above movements and preparations toward opening of the new mouth are summarized as follows (table 3.1).

Table 3.1 Historical Movements toward Opening of the New Mouth

Date	Contents
1991	Chilika Development Authority (CDA) was established.
1992	The National Institute of Oceanography (NIO) carried out a detail study of the wave climate of the inlet, long shore sediment transport along the coast and the bathymetry of the lead channel.
1994	Central Water and Power Research Station (CWPRS) carried out the hydrological and two dimensional numerical model studies and started to discuss about opening of a new mouth.
1997	A.K.Pattnaik took over a chief executive officer of CDA and then CDA broadly started to cope with the environmental problems in Chilika lagoon with a Special Problem Grant (SPG) by Ministry of Finance, the Government of India.
1998	“Conference of Sustainable Development in Chilika lagoon” was held by CDA initiative. During the conference, Dr. Pattnaik as a chief executive officer met some RCJ members and discussed about environmental measures in Chilika lagoon with a view of Japan’s case to be learned
1999	Ocean Engineering Centre recommended CDA to dredge a specific site for desiltation near outer channel of Chilika lagoon with a technical guidance.
2000.1	CDA strived to inform stakeholders living in and around Chilika lagoon of the decision that the new mouth shall be opened opposite to Sipakuda village.
2000.9	The new mouth was opened near Sipakuda

3.2 Impacts on the New Mouth

After strategic hydrological interventions by CDA, the eco-system of Chilika lagoon seems to change drastically. The interventions contributed to improve natural and social environment of Chilika lagoon to a great extent, in terms of salinity, weed proliferation, fishery resource, income generation and people impression. Those are as follows.

3.2.1 Salinity

Compared with pre-opening of the new mouth, the salinity level has totally been increased after the implementation to a great extent. The value of salinity level changed from 8.9 ppt during 1999-2000 to 11.45 ppt during 2001-2002 and 14.675 ppt during 2004-2005 according to the interview with scientific staffs. Figure 3.2 has shown the drastic change through the contrast between

before and after it. In particular, the salinity level of northern sector of the lagoon was remaining zero almost throughout the year, but after the implementation, the salinity level of the northern sector improved to a large extent. The opening of the new mouth contributed to provide a stable salinity regime with less fluctuations and improved water clarity.

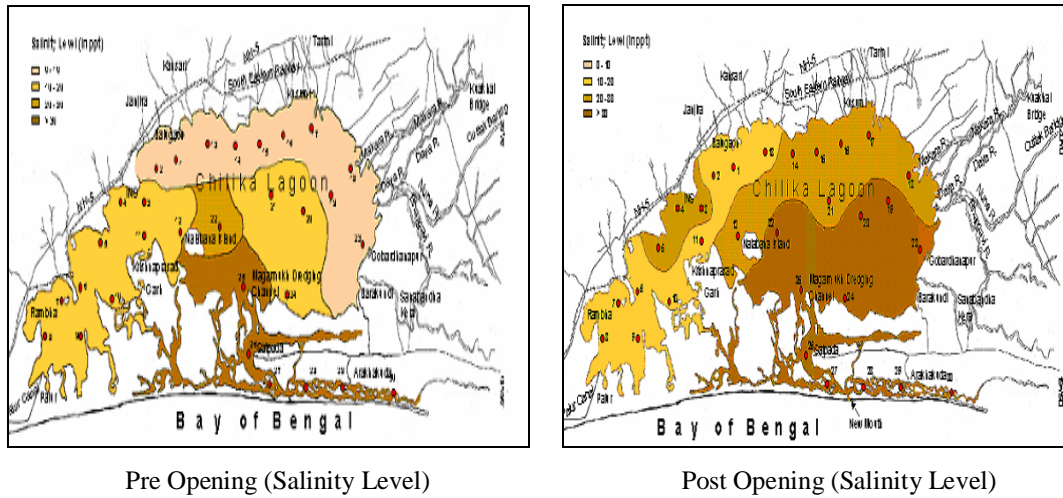
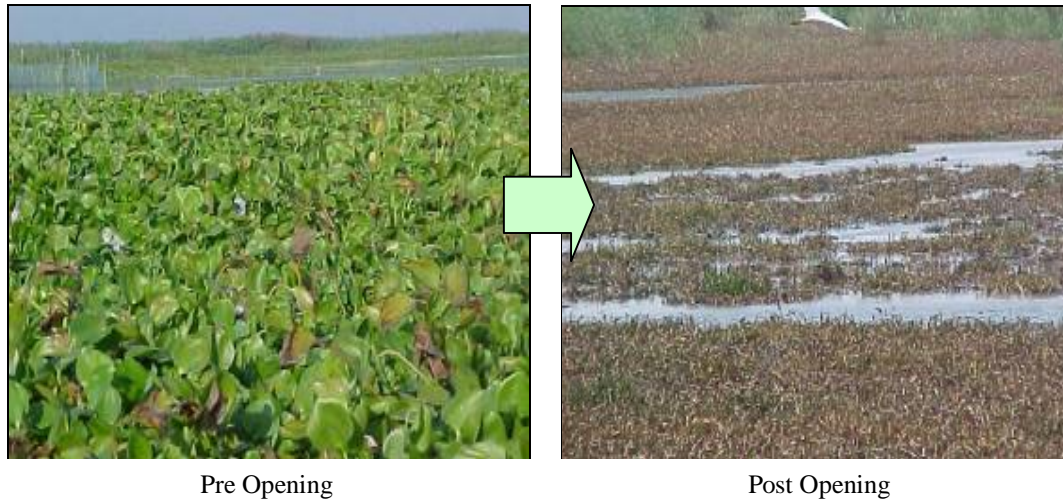


Figure 3.2 Change of Salinity Level between Pre and Post Opening of New Mouth
Source: Chilika Development Authority

3.2.2 Weed Proliferation

For fresh water invasive species, the area infested with water hyacinth has decreased after opening of the new mouth due to increase the salinity level. The weed-spread area of the lagoon changed from 508.51 km² in May 2000 to 157.05 km² in May 2001 (CDA 2005a). Accordingly, picture 3.1 illustrated that it is no wonder how the weed free area has been expanded drastically. The weed disappearance promoted fishermen's activity for navigation without some difficulties as well as increase of fishery resource.

On the other hand, sea grasses was drastically recovered in estuary, lagoon and shallow open shelf of the seacoast, which is an important indicator of the health of Chilika lagoon in terms of economic and environmental aspects (CDA 2003). Sea grass serves as nursery ground for a large number of fish and invertebrate species. Especially, sea grass provides the treasurable habitat for turtles, etc. listed in IUCN. In fact, the sea grass area has been increased 86.84 km² in June 2004 from 24.8 km² in April 1999 according to the interview with A.K.Pattnaik.



Pre Opening

Post Opening

Picture 3.1 Reduction Image of Coverage of Invasive Species

Source: Chilika Development Authority

3.2.3 Fishery Resource

For fishery resource, there have been remarkable improvements. As against the average annual fish landing of 1600 metric tons prior to the implementations, the amounts of fish landing including fish, prawn and crab during the year 2000-2001 improved to 4982.75 tons. Still more, in 2001-2002 the fish landing was recorded to be 11,988.88 metric tons, 10,893.79 metric tons in 2002-2003, 14,053.22 metric tons in 2003-2004 and 13,098.48 metric tons in 2004-2005 (Department of Fisheries & Animal Resource Development and CDA 2005), which indicates a significant improvement (Figure 3.3).

Opening of the new mouth led to promote auto recruitment of fish, prawn and crab juveniles from sea to the lagoon and vice versa. The free breeding migration enabled those species to survive for long period. Besides, the new mouth created comfortable habitat condition of those species with stable higher salinities. It is particularly worth noting that 38 species of fish, 4 species of prawn, 5 species of crab hitherto not recorded from Chilika lagoon have been collected after the implementation. Out of those fish, 6 species of economical important fish reappeared. Besides, the crab landing which had dwindled to around 9 metric tons also improved to around 155 metric tons after it (Department of Fisheries & Animal Resource Development and CDA 2005).

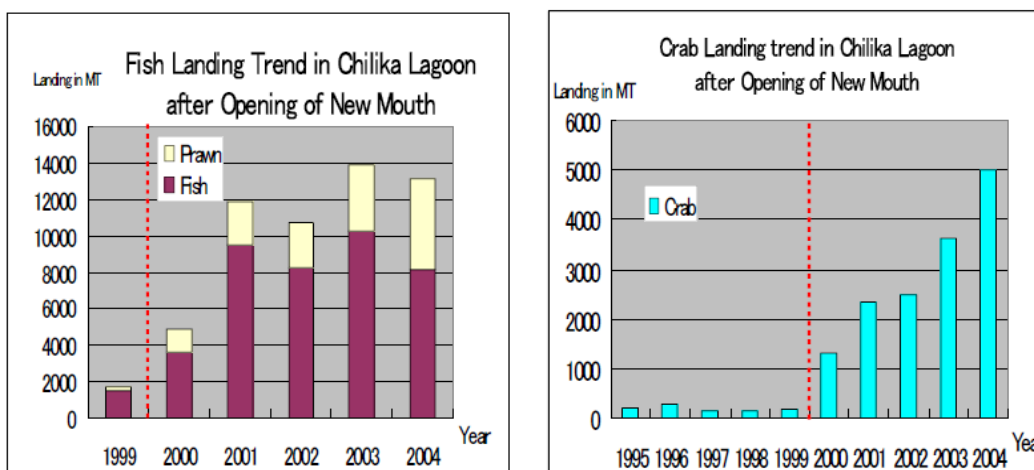


Figure 3.3 Fishery Production of Chilika Lagoon after Opening of New Mouth
Source: Department of Fisheries & Animal Resource Development, and Chilika Development Authority (2005)

3.2.4 Income Generation

The drastic recovery of fishery resource brought significant benefits to the beneficiaries engaged in the fisheries in and around Chilika lagoon. According to the official report (Department of Fisheries & Animal Resource Development and CDA 2005), the catch per unit effort (CPUE) which is the total catch divided by the total amount of effort used to harvest the catch was estimated to be 8.267 kg/ boat/ day in 2003-2004 from 1.905 kg/ boat/ day in 1999-2000. In proportion to the change in CPUE, the average income per fisherman family per year has been estimated to be Rs.52,963 in 2003-2004 from Rs.4,968 in 1999-2000, according to the government estimation. Fishermen's income per a family in 2004 increased around 10 folds as much as the one in 1999. Judging from those results, it is expected that those who engaged in the fisheries could enjoy much benefits from Chilika lagoon after the interventions by CDA, in response to enormous increase of fishery resource.

3.2.5 People Impressions

The local people living in and around Chilika lagoon were greatly impressed by the successful implementation in those days. During the implementation, many inhabitants near Chilika lagoon were observing the situation with anticipation for the recovery of Chilika lagoon. On the mouth opening day, thousands of them and more than one hundred boats were gathered at the site and they were singing and dancing with musical instruments. Some people prepared their food nearby. It looked that the day was a kind of merry event. After opening of the new mouth, all inhabitants including fishermen, women, and children of all groups visited there with joy everyday.

Taking into consideration of its successful renovation, the Ministry of Environmental and Forests requested that Chilika lagoon should be removed on the Montreux Record of Ramsar sites

undergoing adverse changes in ecological character and identified a number of factors contributing to critical situation. In response to this request, a Ramsar Advisory Mission visited Chilika lagoon to review the management actions undertaken in the light of many viewpoints and finally concluded that given a commitment to future actions, Chilika lagoon should be removed from a listed site of the Montreux Record of Ramsar. In this regard, Chilika lagoon is the first Ramsar site from Asia to be removed from the Montreux record. Consequently, CDA got the Ramsar Wetland Conservation Award in November 2002, which aims to recognize and honor the contributions of individuals, organizations and governments around the world towards promoting the conservation and sustainable use of wetlands.

4. Participatory Community Management

Although CDA has achieved successful natural restoration with sensible decisions of hydrological interventions, the catchment area has been constantly facing the silt accumulation from 52 rivers and rivulets, which brings in around 1.6 million ton of silt into the lagoon (S.S.Pattnaik 2002). In the context of this, it might be said that those technical interventions can be just temporal end-of-pipe measures to cope with siltation, even if the interventions had great impacts on natural and social environment in and around Chilika lagoon. Under the circumstances, the attempts to control the siltation by proper treatment in the long term as well as the end-of-pipe measures are required according to the characteristic of the lagoon environment. Emphasis should be made on involvement of the stakeholders including local people covered with the catchment of Chilika lagoon. In other words, participation of the local people in daily life is a key factor whether silt can be dealt with in a sustainable manner or not.

In this area, there is a close relation between natural environment and human activity which depends on it for food, fuel, fodder, water and etc. When their economic condition worsens, they tend to overexploit the natural resources for more profit. Due to dependency on erratic rainfed agriculture in and around Chilika lagoon, the farmer found it difficult to gain sufficient profit. Therefore, they begun to expand their cattle herds for financial security. As a result, it caused to overgrazing in the catchment area of Chilika lagoon and then soil erosion to the lagoon. Besides, there had remained a large number of lacks for basic needs to be solved in the catchment area such as low sanitation, saline drinking water, poor health condition, etc. In this context of it, the attempts to cope with natural resource management with the strategies of poverty reduction were required to sustain the lagoon environment in the long term.

4.1 Dengai Pahad Participatory Integrated Management Project (DPPIMP)

Considering those affairs, CDA designed a watershed management project not only with an

objective of stabilizing soil erosion and water, but also to enhance the productivity of the natural resources in a way that are ecologically and institutionally sustainable. Besides, to ensure participation of the communities in the project area, CDA adopted a concept of a participatory micro-watershed management, which aimed to facilitate the community, CBOs and NGOs at the outset of the project; each participant was involved in the decision-making process of the project, trained for the purpose of empowerment of their capacity building. This project was conducted during the period from 2001 to 2005. The following summarized their activities in the project, according to the interview with project operators and some reports (CDA 2005a; CDA 2005b; CDA 2005c; CDA 2005d)



Picture 4.1 Scenery of Dengai Micro Watershed Area
Source: CDA

4.1.1 Brief Information on Project Site

The proposed project area consists of three villages and the total geographical area of the project amounts to 640.745 hectares. There are seven hillocks of medium height situated around the villages. The biggest hill is called as Dengai by the local people, so the project name was named as “Dengai Pahad Participatory Integrated Management Project”. This project site was selected by CDA in consultation with external groups such as NGOs, consultants, etc., based on the following criterion (see table 4.1).

Table 4.1 Selection Criterion of Project Site and its Remarks for Dengai Pahad Watershed

Element	Parameter
Topography	<ul style="list-style-type: none"> • The hillocks area completely barren and subjected to severe erosion • The watershed area can be negotiated through the year easily by road
Land Use	<ul style="list-style-type: none"> • All the agricultural lands are rainfed. • There is scarcity of water during summer months. • All categories of land type like hillocks, pediment slope, upland, medium land, extensive forest land, government wastelands constitute the watershed
Basic Possession	<ul style="list-style-type: none"> • Acute shortage of cereals, pulses, oil seeds and fodder, fuel in the area.
Race	<ul style="list-style-type: none"> • About 51% of population is Scheduled Caste/ Scheduled Tribe. • More than 85% of the families are below poverty line.
Work Pattern	<ul style="list-style-type: none"> • Huge migration of labour to distant places for earning wages

Village Affairs	• Presence of conflict among inter and intra village
Feasibility of management	• The Range officer was well acquainted with the area because CDA has initiated some plantation work on participatory approach during the year 1999-2000,

4.1.2 Rapport Building & Basic Survey

To begin with the start of this project, it was inevitable to ensure inter-confidence among the stakeholders to involve people's participation in the project site. Therefore, frequent visit were made by the team leaders and the consultants for the purpose of group discussions. They held informal meetings with the local people living in the project site to ascertain their prevailing social structure and economic background. According to the discussions, involvement of the existing leaders, social workers and volunteers were identified as a key to work out the effective modus operandi for community participation in this project. These efforts of informal interactions with the local people helped project operators to understand their ethos in those villages; the cultural practices, believes, customs, cosmic relationship as well as the people's vision about development in relation to modern participatory integrated watershed management. Besides, it also helped the experts to decide the finest slot to suit the lifestyle of the community. In this phase, emphasis was made on the revival of good indigenous knowledge to strengthen the collective and community spirit which was further utilized for the participatory integrated watershed management programme.

The next step was implementations of PRA (Participatory Rural Appraisal) exercise in all project areas with people's participation. PRA is expected to be a desirable way to the understanding and expression of local diversity, and to enabling local people to assess, analyze, cope with, adapt to, and exploit accelerating change (Chambers 1994). The approach of PRA was aimed to identify the present status of the natural resources and social pressing problems, root cause of degradation of the natural resources in the past, peoples perceptions their immediate and long term needs etc.



Picture 4.2 PRA Exercise
Source: CDA

This exercise with people's participation enabled the local people to understand their economic, social and cultural backgrounds, and promote their motivation toward start of the project. Those findings were identified in the way of 26 items and documented during the PRA exercise. Based on those outputs through the PRA exercise, it obviously found that the low productivity which is the cause of poverty was due to degradation of natural resources.

4.1.3 Training for Capacity Building

Empowerment is only possible through a series of participatory training. The training covered such programmes as the immediate needs for the local people, technology, production system, people's participation, principles of financing, post project management principles and methodology, participatory planning, implementation, monitoring and evaluation, establishment of nursery and so on. Those training programmes for capacity building at the community level were organized for the purpose of eliminating the



Picture 4.3 Training to the Local People

Source: CDA

During the term of those trainings, a series of trainings were imparted by specific consultants and experts of universities, government departments with an object to promote their capacity building and strength community level institutions which will have a great influence on ensuring the long term sustainability of those programmes. The trainees were provided booklets with local language to understand the training contents easily. Out of those training programmes, technical trainings were included site specific agricultural and horticultural practices, suitable water harvesting measures, in situ soil and moisture conservation, nursery and planting techniques, pisciculture, floriculture and so on. While the local peoples were imparted technical training on various aspects of watershed management, efforts were made for harmonious blending of age old traditional practices and indigenous knowledge with modern scientific techniques.

4.1.4 Development of Economic Activity

The initial activity depends on whether the watershed project will be successful or not because it plays a great important role in building a good relationship of trust and securing full cooperation among the stakeholders. Considering its importance, several meetings were organized to identify their economic activities with care of indigenous systems. After discussions through those meetings, this project was decided to step up actions at two levels; community oriented interventions and individual or beneficiary based activities.

In the first case, some activities such as agriculture, horticulture, pisciculture, crop plantation, handcrafting, etc. were conducted with a view to improvement of their economic condition. Each activity was imparted various training programmes to empower their capacity building and provided materials and infrastructure under steady supervision by consultants and experts. Taking an example of the pisciculture activity, the beneficiaries started to clean and repair each 14 tank, then breed a few species of carp fish, and harvest those fish in a proper manner, with financial and consulting support by CDA and related experts. The total annual harvest from 14 ponds amounted to 4930.50 kg of fish.

Out of the total fish harvest, 3414.50 kg was sold for an amount of Rs.97,385 and the benefit was shared on an equity basis among the beneficiaries. In this regard, 10% of the total sale was sure to be deposited in watershed development fund, which was established for the purpose of sound management toward sustainability in their own, even after the project was terminated.



Picture 44 Freshwater Carp Culture
Source: CDA

On the other hand, individual or beneficiary based activities such as backyard plantation, sanitary latrines, improved cook stove, etc. were also carried out for better livelihoods as well as environmental management, according to the concept of cost sharing mechanism. The above beneficiaries were selected by a watershed level organization, which has responsibility for project management in three villages from a comprehensive standpoint. Instead of getting the benefits from each activity, the beneficiaries have been called for due payment to manage all the activities without financial supports from the governments after the project finished.

4.1.5 Creation of Sustainable Project Management

That makes little sense to sound environmental management unless the project continues. To ensure the continuous activities operated by the project, the proper management integrated by proper mechanism is absolutely imperative factor as well as the promotion of their capacity building. In line with the necessity, a watershed level organization was initiated with a view to enabling environment with transparent decision-making process of the project. Thus, watershed association by law and watershed committee consisted of 13 selected members from each village in due process have been developed for the mobilization. Those organizations were in charge of coordination and negotiation of various activities operated by the project for the beneficiaries. Emphasis was made on the care of their economic and social status i.e. the landless, impoverished farmers and women.

On the other hand, the project intended to formulate user's group, self help groups (SHG) and watershed volunteer. To facilitate their activities, five monitoring committees were also formulated under the watershed association to act as a bridge between the user's group and the consultant or experts, and monitor such activities as agriculture, horticulture, vegetable, pisciculture, SHGs activities to confirm whether everything in each activity is going well or not. These formulations in this project are expected to play a important role in ensuring the continuous activities, in terms of conflict resolving, problem solving, welfare oriented, equity oriented or development oriented. Figure 4.1 shows the structural body of the project management as follows.

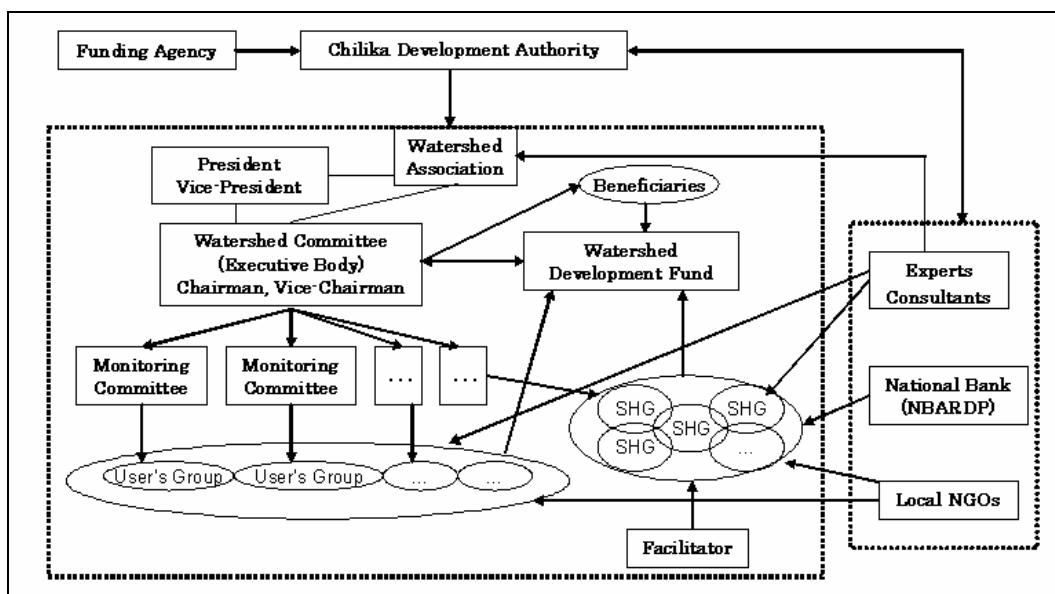


Figure 4.1 Structural Body of Dengai Pahad Integrated Watershed Project

4.1.6 Women Empowerment

Although it goes without saying that women have a significant role in sustaining their family livelihoods by way of labour as well as housework and child rearing, their social position has been looked down upon lower so far (Ogata and Sen 2003). In fact, they haven't never traditionally involved in decision-making process among their village communities in the project site. Thus, women empowerment is a crucial key to improve village development and decrease domestic violence as well



Picture 45 Meeting of Self Help Groups
Source: CDA

as natural restoration. Having recognized its importance, two trained women as facilitators carried out PRA exercise to identify their pressing problems and desired measures. Based on the outputs through the PRA exercise, 24 SHGs were formulated with utilization of micro credit and in turn start income generating activities through some workforces by the initiative of local NGOs and the governments. Still more, 32 training programmes for women empowerment were organized, in collaboration with the National Bank of Agriculture and Rural Development as technical and financial support. Out of 32 activities for women, 21 activities are successfully still going on now. Consequently, it seems that their empowerment against the prevailing social status has been getting better including the involvement of the decision-making.

4.1.7 Penance Day

Through the rapport building and training, the local people became aware of the recognition that their behavior like overexploitation of the natural resources past the decades caused to environmental degradation. They felt their reckless behaviors with little care of the natural resources as penance, so they finally decided to hold an event of “Penance Day” on June 3rd 2001, which aimed to make amends for past blunders and positively conserve the environment in their own. More than 5,000 inhabitants including men, women and



Picture 4.6 Observation of Penance Day
Source: CDA

children of all age groups voluntarily assembled at a barren hillock and then planted a large number of seeds of Mango, Panas, Tamarind, Neem, Karanja and Cashew around the hillocks. Surprisingly, the adjacent village people also joined the event with them to observe the day.

4.2 Formation of Environmental Conservation Network¹

After opening of the new mouth by CDA initiative, it seems that environmental movements have been expanding all around Chilika lagoon step by step since CDA implemented successful hydrological interventions. It might imply that the decision making process before opening of the new mouth played an important role in promoting the environmental movements. The process paid more attentions to dissemination activities related to environmental impacts on the interventions to the local people for the purpose of their understanding of the desiltation programme, which promoted to recognize the importance how the environment has strong ties with their life style.

So far, there have been some activities aimed for enhancement of environmental awareness by the local NGOs, the governments, etc. However, those activities have been operated without little cooperation among them, while each project or programme related to environmental awareness rushed to carry out randomly. It is said that it caused to bring less impacts on its enhancement, according to an interview with a leader of local NGO. This loose approach prevented the effective enhancement of environmental awareness among the stakeholders, so the dissemination of environmental awareness was needed to step up the strategic actions.

Under the circumstances, both demands between CDA which aimed to accelerate environmental

¹) This section is referred to interview with executive members of CCCL and some reports (CCCL 2002a; CCCL 2002b; CCCL 2002c)

movements toward sustainable development and some highly motivated persons belonging to local NGOs which more recognized the importance of collaborative environmental actions were finally met. As a result, 20 local NGOs were combined to form a “Campaign for Conservation for Chilika lagoon (CCCL)” on 29th June 2001, in collaboration with CDA.

This network played an important role of directing the common goal toward environmental conservation and enhancing environmental awareness among the stakeholders for better coordination of activities and information dissemination. The structural body of CCCL is very unique system with support from related consultants and experts. CDA also contributed to CCCL activities on the basis of provision of current information on natural and social environment in and around Chilika lagoon and financial supports such as



Picture 4.7 Meeting by CCCL with SHGs

expenditure of their meeting, field visit, etc. This integrated network is mainly organized by 4 steering members; convener, co-convener, secretary, finance executive who have responsibility for dissemination, negotiation and coordination of their activity. Figure 4.2 shows the overall image of CCCL structural body.

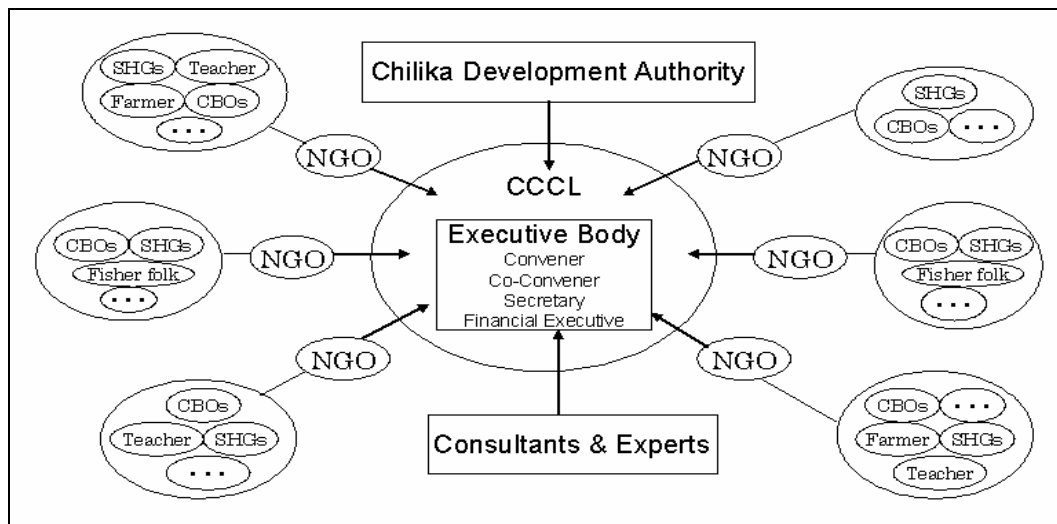


Figure 4.2 Image of CCCL's Structural Body

After the establishment of CCCL, first of all, it held several each zonal meeting in 4 sectors to discuss about problems in and around Chilika lagoon among each NGO secretary. Eventually, they themselves identified 22 serious thought to be solved in Chilika lagoon and then they managed to put together their consensus by way of goal objective, philosophy and operation policy. As a result, this

network enabled all concerned group to develop toward their common goal and serve to reinforce each activity smoothly, if they have to. In fact, CCCL has accomplished several joint activities as creation of Centre for Environmental Awareness Education (CEAE), publication of quarterly newspaper, holding of nature camp, wall paintings, production of the audiovisual materials and its application through the use of indigenous culture, training for the fishermen and women, etc.

5 . Analysis of Innovative Factors toward Sound Environmental Management

The successful environmental activities contributed to develop their capabilities for better livelihood as well as natural restoration to a great extent. Based on the successful progress from those activities, five innovative factors can be illustrated on how to get through the environmental crisis of Chilika lagoon. In the case of Chilika lagoon, the following shows each innovative factor needed as sound environmental management according to lessons learned from their actions against pressing crises.

5.1 Involvement of Various Stakeholders with Rapport Building

There is strong evidence that all activities tried to involve various stakeholders in common.

In the case of opening of the new mouth, CDA sought for stronger ties with external institutions or groups to make a sensible decision whether CDA should open the new mouth or not. In the decision making process, the executive chief of CDA decided to open it based on scientific and practical information from external institutions or groups. In particular, CWPRS contributed to give useful suggestions that the new mouth should be dredged near Sipakuda to recover the lagoon environment from the viewpoint of scientific evidence, while RCJ also encouraged CDA to operate it from the viewpoint of practical information.

On the other hand, DPPIMP involved various stakeholders such as the governments, local NGOs, consultants, experts, user groups and SHGs in the project site, having recognized the importance of participatory community management. The experience has shown that the participatory community management could be one of the effective measures to facilitate the project without any resistance. They built strong confidential relationship by way of active interaction from the early planning stage. For example, it found that there was a long-lasting conflict among villages in the project site through PRA, which was just stirred by small misunderstanding. This conflict has been regarded as the barrier to ensure the accessibility of the natural resources and provision of equitable distribution to the poorest, the vulnerable groups, the marginal farmer and the landless. In this case, a series of training programmes in participatory process made them together and resolved their ill feelings each other with rapport building. Therefore, one can say that community participation involved by the stakeholders is inevitable factor to succeed environmental management.

Besides, each NGO which belongs to the members of CCCL has been linked to many local groups such as fishermen, farmers, teachers, children, SHGs, CBOs, etc. Thus, many NGOs have already built close partnership among concerned groups. Taking into consideration of this, the formation of CCCL will have a potentially strong power to mobilize the involvement of the various stakeholders as well as the member groups. Recently, promotion of environmental awareness by NGOs has been increasing to enhance wise use for wetland conservation, in collaboration with funding agency and the governments. In this sense, the cooperative strength of CCCL is expected to conserve Chilika lagoon and develop their capability for better livelihood.

5.2 Strong Leadership

Leadership must be one of innovative factors in three activities. It is likely that not any activities would be carried out without strong leadership.

The chief executive of CDA took a rational decision to open the new mouth. At that time, his decision had unforeseeable risks to a great extent, which might do damage to the lagoon environment. In this regard, however, he could finally manage to decide it with care of risks, based on scientific evidence from a great number of data and practical experience from the overseas experience. He could cope with the complicated decision through active interactions with various stakeholders. In addition, before the introduction of DPPIMP, he also recognized the necessity that comprehensive measures including upstream of the catchment area should be implemented. The introduction of DPPIMP was derived from the recommendation from research institutions with scientific evidence and frequent visit by the chief executive of CDA for the purpose of understanding of current situation through open dialogue with local people. It is not too much say that his rational and ardent work strongly contributed to be carried out the operation of DPPIMP.

As well as his prominent work, of course, some government officers, consultants, experts, NGOs and facilitators took the lead in the process of DPPIMP implementation. They planned and managed a series of training programmes to improve economic and social conditions for the local people as well as conserve the lagoon environment. On another front, a project facilitator who was in charge of 20 SHGs also managed to assist their activities with good faith.

In the case of CCCL, some representatives of NGOs who had highly motivation for wetland conservation strived to formulate CCCL and facilitated to manage it devotedly, in spite of having stopped their body due to the political issue. In particular, a representative of NGO aggressively encouraged the formation of CCCL by way of many interactions with CDA and other NGOs.

In this sense, it is expected that their pioneer work and ardent wish had strong influences on successful environmental management. If not strong leadership, those activities would never happen.

5.3 Indigenous Knowledge

Indigenous knowledge is unique to a specific culture and society and basis for local decision making in various stages among certain community (Sen 2005). It defines social and natural environment in certain area and is based within its own philosophic and cognitive system (Rao 2006). Utilization of indigenous knowledge also is expected to inspire the local people to have a strong rising interest when a project starts because it is easy to adapt themselves to the implementation. In the process of community



Picture 5.1 Environmental Awareness Show by Daskathia

participation, there were many attractive practices using indigenous knowledge. For example, in the case of DPPIWMP, attempts to apply for indigenous knowledge and skills in the project site were conducted to create an enable environment of project implementation among the people. In the site, little people could even read and write their native language, so indigenous method was effective measure to involve them in the decision making process of DPPIWMP. In particular, out of those indigenous practices, most uniqueness and appealing method is Daskathia (a form of street play), which is local traditional folklore to describe religious and mythological story through songs (see picture 5.1). The folklore has both elements of entertainment and awareness. It is a kind of dance music, play and comic question-answer dialogue with a pair of special wooden clapping disks, a cymbal. Daskathia traditionally used to sing mythological story songs. Taking advantage of the amusing and interesting characteristics of it, a NGO staff utilized Daskathia as a tool of environmental awareness programme combined with the topics of Chilika lagoon, root causes of environmental degradation, importance of conservation measures and wise use practices, natural resources, birds, etc. as well as the mythological story. The exciting performance which illustrated the relation between the myth and the environment in Chilika lagoon led to all attention from the audience, irrespective of young or old persons. The folklore has been taken advantage of many events for environmental awareness programmes including CCCL activities. As a result, the interests and impressions of the local people have been promoted to empower their capacity building for wise use practices without much residence. In this way, utilization of indigenous knowledge is one of the best communication and awareness methods.

5.4 Self-Development Mechanism (Autonomous Body and Financial Independence)

Even if a project implemented by the governments contributes to improve social or natural environment, there will be little meaningful without care of self-development mechanism; it will be require to solve pressing problems in their own after the project finished. There have been much

experience that most of projects often failed to sustain their activities in the long term, due to improper approach or management. In this sense, dependency on the governments in terms of financial support at least should be broken to develop their capabilities for wetland conservation and better livelihood in the long term.

In the case of DPPIMP, the governments created “Watershed Development Association”, which aimed to drive the autonomous management mechanism led by the local people. The association plays an important role in maintaining their continuous activities and coordinating their demand on an as needed basis. Under the scheme, each beneficiary shall pass on the benefits as due payment to the association. For example, 10% of the total benefits in each project must be deposited in the watershed development fund, which strategically manage their fund to maintain their activities and support all the members in the project site even after the project finished. This commission will enable the local people to make ends meet financially with bottom up approach under the proper mechanism. After April 2006, their trial without financial support from the governments or funding agency has been carrying out to manage their activities in their own. In this regard, of course, the governments and consultants are expected to offer some advice like technical consultation as needed to the executive members of watershed association. What is more, the watershed community after a series of training programmes formulated a micro plan which was designed to decide some interventions to be taken up by the association consisting of seven members from each hamlet. Those challenging and innovative trials will lead them to continuous activities which will be sustained in the long terms without any financial supports.

6 . Barrier to Innovative Communities

Compared with past decades, the economic and environmental condition in and around Chilika lagoon has been developed to a great extent. It can be said that the successful activities contributed to the drastic improvement of the lagoon environment, promotion of capacity building for better livelihood and strengthening of cooperative environmental network toward wetland conservation among the stakeholders.

On the other hand, however, we should keep in mind that the lagoon environment has been constantly influenced on a great number of silt from upstream. In particular, unwise use of the natural resource accelerates the silt accumulation to the lagoon. In this sense, comprehensive measures should be continuously carried out as well as temporal technology solution to reduce its adverse impacts on the enriched eco-system. In this regard, however, there was a problem related to the activity of CCCL.

In 2001, CCCL has formulated for the purpose of ensuring wise use of the natural resources and wetland conservation of Chilika lagoon. But their activities which are potentially expected to have a

strong influence on people's mind toward environmental awareness forced to break off due to political issue. To be sure, the trend of environmental movements toward sustainable development in and around Chilika lagoon was increasing step by step. In the meanwhile, there has been a serious conflict over fishery right in Chilika lagoon between fishermen and non fishermen caste. Fishermen caste traditionally enjoyed the fishery right to capture fish and sell it to others in Chilika lagoon. However, due to high demand of fish and prawn in international market, non fishermen caste has been tempted to enter the fisheries in Chilika lagoon with a view to earn more profit. Under the circumstances, the governments admitted non fishermen caste to enjoy the fishery right after many political arguments according to Hon'able Orissa High Court dated on 23.11.1993 (Samal and Meher 1999). Since then, this trouble has been trapped in a cage of complicated chaos, so the breakthrough has been still never found.

Under the circumstances, some NGOs out of CCCL members strongly stood up for the demand that only fishermen caste belongs to fishery right, not non fishermen caste in the heat of their arguments. Accordingly CCCL faced difficulties in organizing their activities due to the disturbance and resulted in loosening up their solidarity among CCCL. Taking into consideration of that each NGO which has own work to be done as well as CCCL activities, it was easy to collapse CCCL body; CCCL finally stopped their bodies in 2003.

Despite the collapse of CCCL activities, however, CCCL was drastically revitalized in the process of the following sequence. Executive members of CCCL who have strong willingness to conserve Chilika lagoon tried to regroup their body again. Fortunately there was a chance to have a possible project in collaboration with CCCL, so the highly motivated members promoted to rebuild their body. In the process of revival of CCCL, they removed some NGOs which advocated the fishery right for fishermen caste with care of mutual respect to all. As a result, CCCL has restarted to manage their activities since December 2005. Surprisingly, new 4 NGOs joined CCCL activities without any notice to them when CCCL hold on a zonal meeting. This fact might imply that the environmental awareness of the local people has been enhancing and the environmental movements in the center of CCCL will be developing in the future. Based on the above process, one might bear firmly in mind that any persons should be not allowed to criticize against the opinion of others and bring up the subject of political issue with less care of mutual respect.

7 . Conclusion

This paper introduced the successful three activities to conserve the lagoon environment and develop capacity building for better livelihood. After these ameliorative steps, the natural resources in and around Chilika lagoon has been improving to a great extent. At the same time, the local people who rely directly or indirectly on the natural resources also got much benefit, due to amazing

natural restoration. In response to the recovery, the local people became aware of the importance of the depending-relation between the environment and human activity, their mind has been enhancing toward environmental awareness and wise use.

Through the analysis of this paper, one might know that sustainable development will be needed to meet not only “hard measures” such technology solution like opening of the new mouth, but also “soft measures” such sustainable network building like management of the watershed association and CCCL. As population is increasing and the society becomes increasingly complex, the impacts by hard measures would become less effective. For example, opening of the new mouth would be temporal effect due to silt accumulation from the upstream in response to the constant anthropogenic activity, even if the interventions had strong impacts on wetland conservation at that time. On the contrary, the impacts of soft measures will have more effective measure in the long term. For example, proper management of the watershed association is expected to play a great important role in coping with much barriers that the local people are tempted to practice unwise use for wetland conservation due to their poor awareness, little cooperative system, some conflicts among them, etc. Thus, this approach of building sustainable networks will attribute to sound environmental management with care of sustainability not so as to exceed the acceptable environmental limit, which we can meet our needs to live in a stable environment.

Like influx of a great number of silt from upstream of the catchment area into Chilika lagoon, no issues faced by the lagoon environment have been solved by just temporal measure. Behaviors of human beings have some influences on the environment to live and cope with our life. Taken into consideration that anthropogenic activity will be having extremely serious effects on our environment hence, comprehensive hard and soft measures should be carried out toward sustainability. In doing so, five innovative factors are expected to promote sound environmental management, though each innovative factor depends on the location or situation.

Acknowledgements

I would like to thank all members of Chilika Development Authority and Pallishree (grass root NGO). Especially, I would like to really thank a chief executive of CDA, Dr. A. K. Pattnaik and secretary of Pallishree, Mr. D. P. Dash who supported my work through many interviews and provision of various data and papers on all fronts as needed. Without their cooperation, this report would have never completed. Thank you so much for your support and your generosity.

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