

Management of Haors, Baors, and Beels in Bangladesh

Lessons for Lake Basin Management

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Bangladesh possesses enormous area of wetlands including rivers and streams, freshwater lakes and marshes, haors, baors, beels, water storage reservoirs, fish ponds, flooded cultivated fields and estuarine systems with extensive mangrove swamps. The haors, baors, beels and jheels are of fluvial origin and are commonly identified as freshwater wetlands. These freshwater wetlands occupy four landscape units - floodplains, freshwater marshes, lakes and swamp forests. Bangladesh is estimated to possess seven to eight million hectares of wetlands in the form of permanent rivers and streams (480,000 hectares), estuarine and mangrove swamps (610,000 hectares), shallow lakes and marshes (120 000-290 000 ha), large reservoirs (90,000 ha), small ponds and tanks (150 000-180 000 ha), shrimp ponds (90000-115000 ha) and seasonally flooded flood plains (5,770,000 hectares) (Nishat, 1993).

Haors, which are bowl-shaped depressions between the natural levees of a river subject to monsoon flooding every year, are mostly found in the eastern region of the country, known collectively as Haor basin covering an area of approximately 24,500 km². There are altogether 411 haors comprising an area of about 8000 km² dispersed in the districts of Sunamgonj, Sylhet, Moulvibazar, Hobigonj, Netrokona & Kishoreganj.

Beels are large surface waterbodies that accumulate surface runoff water through internal drainage channels; these depressions are mostly topographic lows produced by erosions and are seen all over Bangladesh. Beels are small saucer-like depressions of a marshy character. Many of the beels dry up in the winter but during the rains expand into broad and shallow sheets of water, which may be described as fresh water lagoons. In the active floodplains of the Surma-Meghna, the Brahmaputra-Jamuna, and the Ganges-Padma river systems, there are several large and small beels. In Bangladesh, there are thousands of beels of different sizes. Some of the most common names are Chalan beel, Chand Beel and Arial beel. Most of these large beels have shrunk quite considerably in recent decades. Beels are mainly fed by surface runoff water. A few larger ones are fed by floodwater during the wet season from the parent river channel. Normally, beels remain deeply flooded for most of the wet season.

Baors are oxbow lakes, formed by dead arms of rivers, are situated in the moribund delta of the Ganges in western part of the country. In Bangladesh, oxbow lakes are quite visible in the older floodplains. Locally, the feature is also known as beel, baor, and jheel. Usually, oxbow lakes are deeply flooded during the monsoon, either through local rainfall and runoff water or by river flood. During the monsoon season oxbow lakes act as local water reservoirs, and help to control the local flood level. In some areas, these lakes serve as valuable sources of irrigation during the dry season.

The Haor, Baors and Beels play an important role in the ecology, economy and livelihood of the country. Those wetlands have been highly explored for a long time; during the 1990s the nation realized the needs of resource management seriously and from then the management and conservation of those water bodies got priority. Though the status of nations wetland management initiatives are not in satisfactory level but in some cases the success is appraisable and can be followed for management of different lake basins considering the socio-economic and ecological context and with adaptation if necessary.

Wetland resources:

The life and livelihood on Bangladesh is dependent on the wetlands. The lakes are the source of fisheries, aquatic vegetations and other biodiversity, irrigation, navigation and flood control etc.

Fisheries resources

About 260 species of freshwater fishes are found in the inland water bodies of Bangladesh. Inland fisheries alone cover an area of 4.3 million hectares of which 94% comprise openwater capture fisheries, and only 6% close water system. The haors, beels and baors offer tremendous scope and potential to augment fish production by adoption of culture-based fishery enhancement technique. Sixty three species of fishes were recorded from the water bodies of Chanda Beel. (Chakraborty *et.al.*, 2005). The haors, beels and baors are the main source and reserves of the brood stock of fish. Tangua is one of the famous breeding ground for native crabs and flat fishes (*Chital*) of the country.

Biodiversity

Not only the aquatic biodiversity including, fish, snails, turtle etc., but many of the lakes that dried partly in the line season supports different types of terrestrial and aquatic vegetations. Around 400 species of migratory birds visited Bangladesh. Tangur Haor is an important Ramsar site. Huge number of migratory birds visited Hakaluki Haor, Hail Haor, Ramsagar, etc. One hundred sixty three species of wildlife were recorded found and or depended on the Chanda beel, among them 7 were amphibian, 21 were reptalia, 111 were birds and 19 were mammal (Chakraborty *et. al.*, 2005); among the birds 19 were recorded migratory. Seven species of snails are found in Chanda beel among them 2 has commercial importance (Khan *et. al.*, 2005).

Agriculture

The rims of the lakes are used for winter (boro) rice cultivation. The flooded fields in the monsoon became rich with minerals and are very fertile. There are also deepwater rice varieties. The deepwater rice has submergence toleration and elongation ability. At one time, undivided Bengal had about 15,000 varieties of cultivated rice but the germplasm of most of them is lost leaving only about 6,000 (Khan *et. al.* 1994). Lakes are the source of irrigation in winter. Almost every non-rice crops in Bangladesh grow in winter.

Flood control

Bangladesh is a low lying area. Because of its location, water of the Ganga-Bramaputa catchments flows through Bangladesh. The lakes act as natural reserves of the water.

Threats to the Lakes of Bangladesh

All most every lake of Bangladesh is under threat. There is huge population pressure, climate change impact and development interactions. The following are the major threats to the lakes of Bangladesh:

1. Disappearing
2. Pollution
3. Over harvesting of the natural resources
4. Land use conflict
5. Lack of up stream water flow in winter
6. Over flow of water in monsoon
7. Increase risk of flood
8. Entrance of saline water due to lack of water flow in winter

9. Land erosion
10. Siltation
11. Road construction and other development activities

Institutions involved in Lake Management in Bangladesh

Bangladesh Water Development Board is the main government-body to manage the lakes. Bangladesh Water Development Board (BWDB) started its operation in 1959 as the water wing of the erstwhile East Pakistan Water and Power Development Authority. As the principal agency of the government for managing water resources of the country, it was given the responsibility of accomplishing the tasks of executing flood control, drainage and irrigation projects to boost up productivity in agriculture and fisheries. After the independence of Bangladesh, the authority was restructured in 1972 into two different organizations to deal with water and power separately. BWDB was created under the Bangladesh Water and Power Development Boards Order 1972 (P.O. No. 59 of 1972) as a fully autonomous organization. The reform program and structural adjustment process were undertaken by the GoB for transformation of BWDB is the enactment of the BWDB Act, 2000 that requires the BWDB's functions be guided by the National Water Policy (NWPo) and National Water Management Plan (NWMP). Top management of BWDB is now vested in a policy and oversight Governing Council (GC) with thirteen Members headed by the Minister, Ministry of water Resources.

WARPO

Beside this other government agencies like the Department of Environment and the Department of Fisheries is also responsible for the management of environment and fisheries resource of the lakes respectively. These above mentioned departments are under the Ministry of Environment and Forestry, and Ministry of Fisheries and Livestock respectively. For most of the Lake the land rights are under the Ministry of Land. There are also other actors from Government working for Lakes, like Local Government Engineering Department, Space Research and Remote Sensing Organization etc.

A good number of Non Government Organizations are also working for the betterment of lakes. The activities of NGOs includes, flood control, natural resource conservation, livelihood development, farming and irrigation program, etc. Among these NGOs CNRS, IDEA, BCAS, AOSED, BRAC, Prosika, Nijera Kari, Samata, etc. are well-known.

Legislation for lake management

Although the existing laws in Bangladesh are not specific to the needs and problems of lake management and

conservation, but there are some sectoral laws having bearing on lake issues. These are:

1. The Haor Development Board Ordinance, 1997
2. Bangladesh Environmental Conservation Act 1995
3. East Bengal Protection and Conservation of Fish Act, 1950
4. Bangladesh Wildlife (Preservation) (Amendment) Act, 1974
5. The East Bengal State Acquisition and Tenancy Act, 1950
6. The Land Reform Board Act, 1989

Beside the national Laws, Bangladesh is signatory of Ramsar, CITES, CMS, etc.

Projects

The number of projects that have been implemented or ongoing for the development of lakes and or lake resources is quite large. As for example BWDB has so far implemented about 617 projects / Sub-projects, Non-Government Organization CNRS has implemented 22 projects in and for lake betterment. In Bangladesh in most of the cases the project activity ended by the completion of project period. But there are number of success stories. Some examples are bellow:

Meghna-Dhonagoda Project by BWDB

Attaining self sufficiency in food production has been an uninterrupted objective of the development planning in Bangladesh. So the efforts to elevate the productivity of her Agricultural sector to the possible optimum through application of modern technology is the main objective of the Government. Bangladesh Water Development Board under the Ministry of Water Resources has been involved in such activities for long time.

During 1964, M/S Pakistan Techno Consultant carried out a feasibility study of Meghna-Dhonagoda Irrigation Project. During 1977, after being requested by the Government of People's Republic of Bangladesh, M/S Chou-KaiHatsu of Japan & Prakaushali Sangsad Ltd. of Bangladesh jointly prepared revised feasibility study report under financial assistance from Asian Development Bank. ADB entered into an agreement during 1977 with Govt. of Bangladesh for financing the execution of the project. The execution started in full swing during 1979-80 and was completed 1987-88. Under the Command Area Development (CAD) activities the following were implemented:

- Rehabilitation
- Water Users Organization formation for water management
- Involvement of Water User Group in cost recovery
- Involvement of distress woman in embankment maintenance
- Integrated Pest Management
- Small Scale Fisheries Development

Community-Based Haor Resources Management under Sustainable Environment Management Program (SEMP 2.2.1/A) by CNRS

Sustainable Environment Management Programme (SEMP) is the first follow-up activity in the implementation of NEMAP (National Environment Management Action Plan). It is being executed by the Ministry of Environment and Forest (MoEF) from October 1998 and was completed in December 2006. SEMP comprises of 26 components (including PMU - Programme Management Unit) for 25 different projects and is being implemented by 21 Sub-Implementing Agencies (SIAs) through a 26 million US dollars grant from UNDP. SEMP is the largest programme of UNDP in Bangladesh. The objectives of SEMP are to build and strengthen capacity for environmental management at the Community (enable the poor to have access to environmental resources), Local (developing capacity to project the interests of the poor), and National (suggesting enactment of necessary and reduce existing laws, polices, etc.) levels. Along with these, SEMP also aims to prevent and reverse the present trend of environmental degradation, to promote sustainable development and reduce existing poverty and raise the quality of life. SEMP consists of five major sub-programmes: a) Policy and Institution; b) Participatory Ecosystem Management; 3) Community based environmental Sanitation; d) Awareness and Advocacy; and e) Training and Education. Community based Haor and Floodplain Resource Management Projects under the broader theme of participatory ecosystem management, officially comprising SEMP Components 2.2.1/A and 2.2.1/B, have been implemented by IUCN, Bangladesh Country Office with support from the Ministry of Environment and Forests and United Nations Development Programme (UNDP) from 1998 to 2006. There were three national NGOs namely-Bangladesh Center for Advance Studies (BCAS), Center for Natural Resource Studies (CNRS), and Nature Conservation Management (NECOM) have been associated for implementing projects in five degraded Haor and Floodplain areas of the country. CNRS worked for Haor, NACOM and BCAS worked for Padma-Jamuna, Brahmaputra-Stalakra floodplains; and the Madhumati floodplains respectively.

The overall approach adopted for implementation of the project is shown in Figure 1.

The project activities include Participatory planning, NR Management and awareness building organizing the users and stakeholders at local level, generate alternative livelihoods, disaster management (protect village mounds from wave action), disaster preparedness and coping mechanism. The community based fisheries management including fish sanctuary, swamp forest plantation, and green funding mechanism were developed under the project. The project has targeted to reverse the deteriorating trend of floodplain ecology as well as to ensure the sustainable use of wetland resources which include water, soil, rainfall, fishes, wildlife and plants.

Management of Aquatic Ecosystem through Community Husbandry (MACH)

Wetlands of Bangladesh are rich in biodiversity and have great ecological, economic and social values in ensuring livelihood security of millions of poor people particularly fisher community in Bangladesh. The wetlands are under threat and gradually degrading due to several anthropogenic and natural causes. Management of Aquatic Ecosystem through Community Husbandry (MACH) is a

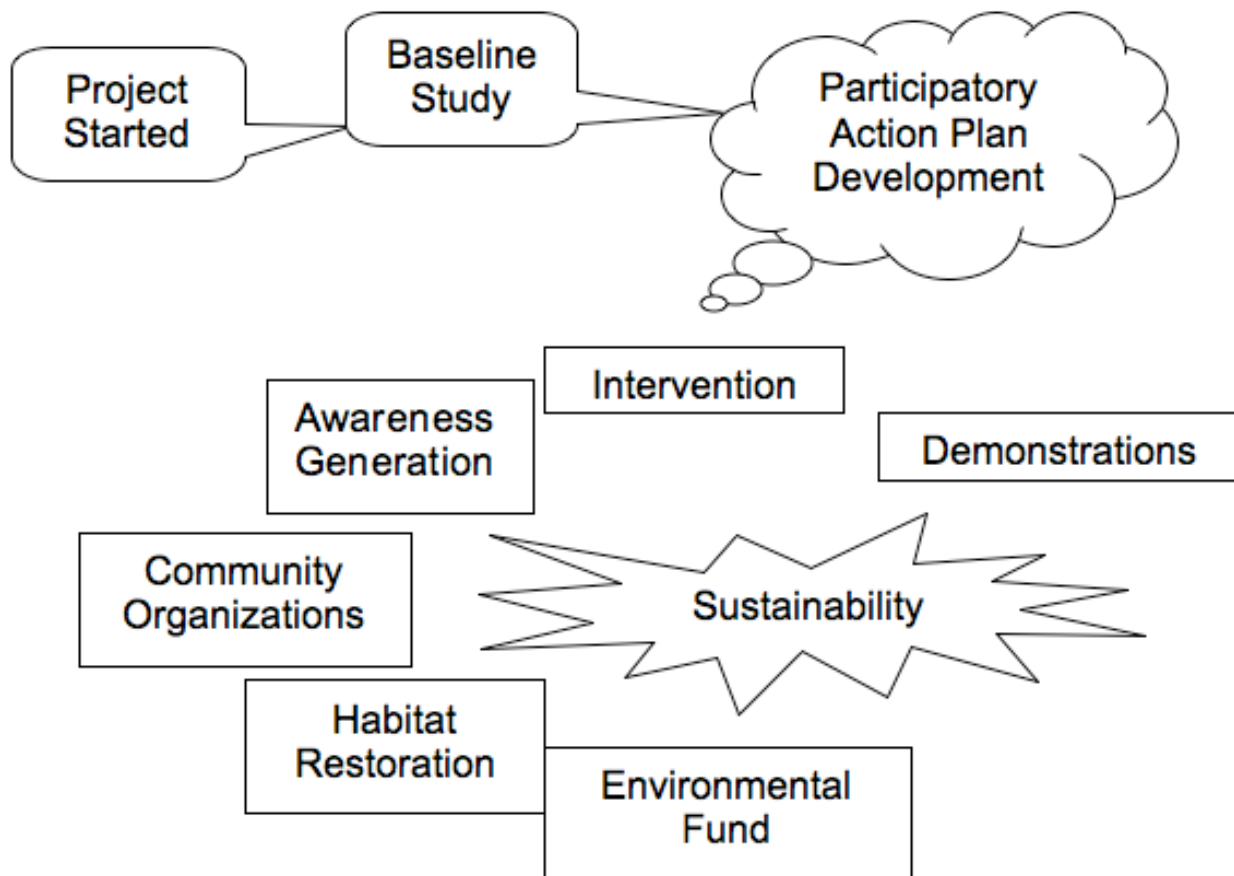
Government of Bangladesh project supported by USAID. MACH's goal is the promotion of ecology sound management of floodplain resources (fisheries and other wetland products) for the sustainable supply of food to the poor of Bangladesh.

The project has established community based co-management and helped restored and increase sustainable productivity in three large wetland ecosystems: Hail Haor in Sreemongal, Turag-Bangshi River and wetlands in Kaliakoir and the Kangsha-Malijee basin in Sherpur. The project was implemented by Winrock International, USA, BCAS and CARITAS, Bangladesh. The partners have worked closely with the department of fisheries since 1989. The project included realistic activity packages which covers household level livelihood planning and intervention, training needs assessment, awareness and institution building, habitat rehabilitation, afforestation, wise use of fish and other wetland resources, establishment sanctuaries, community development & local level institution building and social and biological monitoring.

CBFM

State owned waters in Bangladesh are usually managed under a commercial, revenue-focused leasing system

Figure 1. Overall approach for project implementation



controlled by the Ministry of Land (MOL). Poor fishers are effectively excluded from the best fisheries as they cannot afford to pay for the lease. The Community Based Fisheries Management (CBFM) project implemented from 1996 to 2006 by the international research organization the WorldFish Center, in partnership with the Government of Bangladesh Department of Fisheries (DoF) and local NGOs, in an action research project which has developed a series of community based fisheries management approaches (fisher-led, community-led and women led) for ensuring equitable access to fisheries resources for community based management groups.

Over a ten-year period, the CBFM project has established community control over 116 water bodies. Over 130 officially recognized, poverty-focused, Community Based Organizations (CBOs) are involved in the management of these water bodies. However, in return for access, the CBOs must embrace the principals of sustainable fisheries management.

One of the main actions of CBFM-2 has been to establish fish sanctuary-no fishing zones where a proportion of the fish in the water body are allowed to stay safely even when surrounding water levels are at their lowest

CWBMP

In Bangladesh there are 8 Ecological Critical Areas (ECA). Those ECAs are mostly wetlands, viz.

1. Hakaluki Haor
2. Cox's Bazar Beach
3. Sonadia Island
4. St. Martin's Island
5. Marjut Beel
6. Gulshn-Baridhara Lake
7. Tanguar Haor
8. Periphery of Sundarbans

The project Coastal and wetland Biodiversity Management Project (CWBMP) aims to implement the ECA legislation through the participation of local community and alternative livelihood options. The project has been implemented since 2006 in Hakaluki Haor, Cox's Bazar Beach, Sonadia Island and St. Martin's Island. Village Conservation Groups (VCGs) formed for the objectives of the projects implementing different activities including Alternative Income Generation, swamp plantation, mangrove plantation, no-fishing zone, etc.

Tools used in wetland development

Through the implementation of different project and program different successful tools have been developed for the conservation and management lakes, such as,

- Participatory Action Plan Development
- Community based Fisheries Resource Management
- Community based Fish sanctuary
- Restoration of Swamp forest, etc.
- Cultivation in Hydroponic

Participatory Action Plan Development (CNRS 2003)

PAPD is a process, which can create an enabling environment among the community people to build their consensus. The process is so structured that by going through a series of steps, consensus could be built over what actions were needed to better manage natural resources, particularly common resources. In Bangladesh the practice of PAPD is highly appreciated to make community participating the management of wetlands. PAPD was practiced successfully in management of Hail Haor, Hakaluki Haor, Arial Beel, etc. The PAPD method is described briefly in Annex I.

Community based Fisheries Resource Management

Community based fisheries resource management is a community consensus where the community themselves develop some norms and practices for the betterment of the fisheries resources as well as the security of their livelihood. The norm includes maximum size of nets, no fishing periods, avoiding harmful agricultural practices, etc. Community based fisheries resource management has been practiced in number of projects including CBFM-2 in around 116 wetlands over country (WorldFish Center). MACH project and ECFC project have also practiced the method. The method of community based fisheries resource management is briefly described in Annex II.

Community based Fish Sanctuary

Community based fisheries sanctuary has tremendous success stories. Resulted from the 4th Fisheries, MACH Project and CBFMS to there are around hundreds community based fish sanctuaries in various sizes over the country. The community based fish sanctuary is community announced and practices project areas that is a no fishing zone with a core area and a buffer zone. Community also facilitated some traditional techniques for the welfare of fish. Those sanctuaries are breeding grounds and ensure the brood stock that increases the fisheries resources. As an example of a Community based Fish Sanctuary the Baikka Beel is described in Annex III (CNRS 2007).

BAIRA -Floating Garden

Baira is an indigenous practice of the farmers of Gopalganj, Barisal, Patuakhali etc southwest districts of Bangladesh for cultivating seasonal vegetables and seedlings during the monsoon. Water hyacinths are congregated on the water to make floating organic platform the platform usually anchored in the convenient places of beel or canal. The surface of floating platform once decomposed and seeds of selected vegetables are placed in to a growth media prepared with the roots of submerged floating vegetation. Growth media is then put on the platform for germination and subsequent rising. Since the growth medium is organic the seedlings grow fast and usually the farmers sell the seedlings like cucumber, gourd, etc. in the local market. The seedlings are plans planted in the soil. Cultivation in the biara is a means of earning money for cultivars during monsoon when whole beel and its peripheries are inundated for about six moths of the year. There are 23 species of vegetables such as gourd, cucumber, eggplant, chili, spinach, ladies finger, lettuce, pumpkin, cauliflower, cabbage, etc., and 6 of spices such as zinger, garlic, etc., that have been successfully produced and harvested on baira (Islam and Haque, 2002).The brief to baira preparation is described in Annex IV.

Restoration of Swamp Forest in Haor

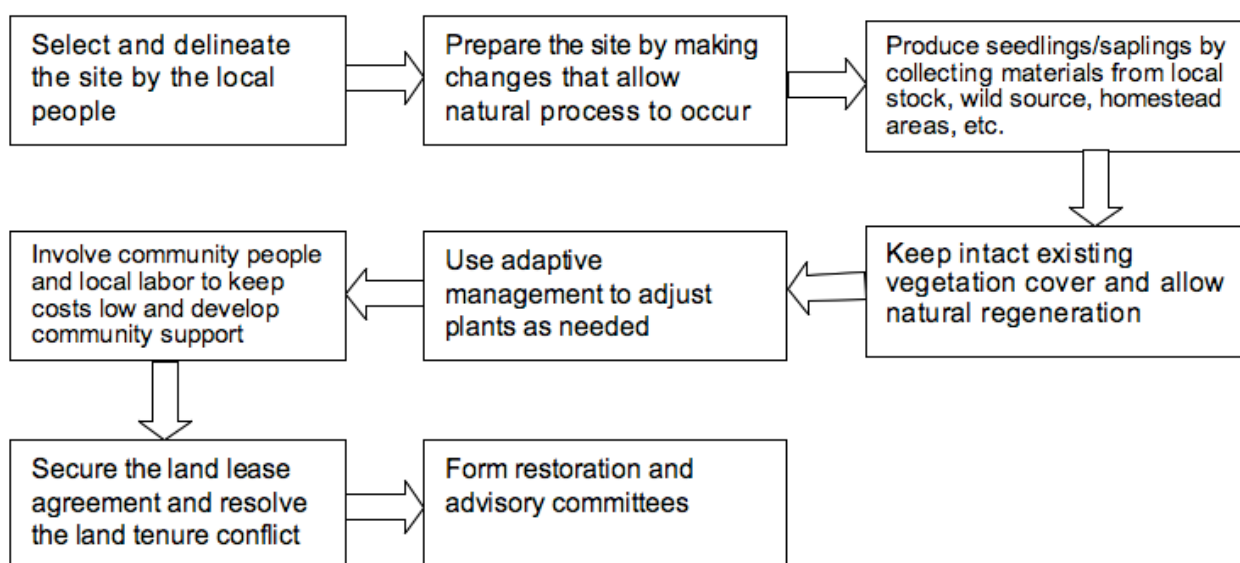
Freshwater Swamp Forest (FSF)¹ has declined tremendously over the years, though some remnants still persists in the greater Sylhet district. Most of these forests were under private possession as joint community property. Because of such joint ownerships these forests suffered most and many of them have been converted to agricultural fields. There

are many such examples, of which Tanguar haor, pagnar haor and Hakaluki haor area only to mention a few.

This type of fisherman wetlands forests consisting of ever-green tree species such as **hijal** (*Barringtonia acutangula*), **karoch** (*Pongamia pinnata*), **barun** (*Crataeva nurvela*), **balad-umur** (*Ficus heterophylla*), etc. occurring in varying proportions at different locations. The average height of such forest in general is about 10-12m. Their health is poor and the ecosystem condition is vulnerable. The existing vegetation occurs mostly on the elevated ridge like sites between the beels and/or streams. It can also be seen that parts of these raised grounds are raised further to build homesteads. The slops of such home stead sited facing the haor also bear there wetland tree species and magnificently function to protect the homestead from the adversities of waves and storm scouring, especially during inclement weather. The area of such individual patches of these forests, at present, varies from a few individual plants to a few hectares. The lower portion of the tree trunks of these forest remains submerged under 2 to 2.5m deep water for 3 to 4 months during the monsoon.

In association with stakeholder groups, IUCN in association with CNRS has identified the ecological importance of degraded swamp forest and assessed its economic role. Integrated approach with participation of the local people were designed and implemented for the restoration of these degraded swamp forest in the Pagnar and Sanur-Dakuar of Sunamganj District and in Hakaluki Haor of Moulvibazar District.

Figure 2. Summary of Implementation Stages



1. Natural forests with >30% canopy cover, below 1200m altitude, composed of trees with any mixture of leaf type and seasonality, but in which the predominant environmental characteristics is a waterlogged soil (unep-wcmc)

Protected lakes

In Bangladesh few large lakes are protected under different Acts and treaties (Table 1).

Ecologically Critical Area

The Government of Bangladesh has notified 8 ecologically important areas as Ecologically Critical Areas on 1999 under the Environment Protection Act 1995. With this notification the Government has prohibited the following activities:

- Harvesting any natural vegetation
- All kind of killing of wildlife
- Collection of snail, coral, turtle or any wild animal
- Any activities that can hamper the habitat of animals and plants
- Any activities that can change the character of land and water
- Establishing any industry that can pollute soil, water and/or air
- Any activities that can harm fish and aquatic animal

Report Card

Report card is a very simple, effective, participatory and empowering tool that can enable the community to establish a transparent and accountable participatory monitoring system. All the pages of the Report Cards consists a lot of relevant pictures of the indicators, which makes the Report Card a self-monitoring tool that allows the community to monitor the processes of any development program or activities in their command area. In this process, pictures are used to understand the activities of the respective stakeholders. These pictures are particularly helpful for those people who cannot read or write. Through observing the pictures, they will understand on which extent they have to score. The use and development of report for community based monitoring and evaluation is described as Annex V (CNRS & ITAD).

Table 1. Major Protected Lakes of Bangladesh

SI	Lake	Protected Under
1	Tangua Haor	Ramsar
2	Ram Sagar	National Park
3	Hakaluki Haor	Ecologically Critical Area
4	Gulshan Lake	Ecologically Critical Area
5	Marjut Baor	Ecologically Critical Area
6	Bikka beel	Fish Sanctuary

Lessons for Lake Basin management

In Bangladesh the natural resources of the wetlands are the main livelihood options for the people. The problems from industrial pollution are not that major. A number of projects and tools have been discussed and those tools were successfully implemented in a large lake basin. Considering the need and management contests the experiences from successful projects and the tools can be disseminated in the lake basin. For the sustainability potential consideration of intuitional arrangement is necessary.

Institutional Arrangement for Sustainable Resource Management

Eco-specific participatory natural resource management and human well being involves enabling the local community actors and institutions to build relevant capacity to participate in:

- Identifying and prioritizing problems and concerns with regard to sustainable natural resource management;
- Building consensus within and across stakeholders with conflicting interests and concerns;
- Identifying and selecting options and resources to address the concerns and interests;
- Developing action plans and secure commitments for responsibility sharing;
- Managing and monitor implementation if the plan, and
- Reviewing if results, outcomes of implementation and continue participatory planning and management cycle.

Objectives, key issues, problems and interventions for eco-specific participatory natural resource management were synthesized by Rahman *et. al.* 2003 from number of practices in Bangladesh (Table 2).

In designing interventions for management of a lake basin a review on the above mention table could be supportive. Establishing participatory natural resource management involves a process of learning by doing, and very actively yields some valuable results and experience, not only for the participating stakeholders but also for the facilitating actors and institutions.

Key considerations in eco-specific participatory natural resource management are presented below:

- Involve as many relevant government agencies and departments, NGOs and community organizations in the process as early a possible

- Time must be taken to identify the root causes of the major issues and problems
- Problem solving techniques should be used to identify the root causes of problems
- A thorough analysis of the situation must be undertaken taking all factors (internal and external) into account
- Measures must be taken to identify new and innovative approaches to address problems
- The development of a management plan must be seen as a part of the development of a co-management regime. It is only one of the valuable tools in the management process
- A flexible approach to decision-making must be developed
- Long-term resource management options must be formalized through a legal process
- The entire process is lengthy and requires long-term commitment from all sides
- Clear strategic objectives must be established during the process
- Activities must be oriented toward both establishment of community organizational structures and provision of other developmental benefits to the communities involved
- It must be understood that it may take 3-5 years for a co-management regime to be established and operating
- The co-management activities will complement local, provincial and national development activities
- Compensation of the short term losses must be considered that must be sustained for a longer term approach to sustainable utilization

Table 2. Objectives, Key Issues, Problems and Interventions for Eco-specific Participatory Natural Resource Management

Goal/Object	Key Issues (Problems/Constraints)	Key Intervention (Strategies/Actions)
Ecological Objectives	Increasing and indiscriminate exploitation of wildlife (fish, snail, turtle, migratory birds, bats) and plants used for food, building materials and medicine.	Facilitate communities to establish local institutions to develop and exercise code of conduct toward responsible management of natural resources and products
	Destruction of wildlife habitats due to conversion of wetlands and landscape, endangering the aquatic and terrestrial biodiversity	Facilitate communities to establish institutions to protect existing important habitats, and establish in-situ and ex-situ conservation sites, sanctuaries and other important habitats, nestling and breeding grounds
	Existing agriculture practices threaten population of important natural products	Facilitate communities to practice low external input based sustainable agriculture & integrate biodiversity concerns
Economic Objectives	Low level of income and earning opportunities	Facilitate communities to enhance capacity and practice alternative livelihood strategies
	Limited income opportunities during wet season	Facilitate community and vulnerable group initiatives toward assessment, planning and management of livelihood
	Absence of economic instruments, incentive structures and enabling community institutions	Facilitate community develop and establish appropriate instruments, structures and institutions
Social Objectives	Absence of enabling customs, rules, regulations, and others institutions and their enforcement	Facilitate communities to enable a process that results in establishing norms, standards other rules and regulations, etc. and appropriate organizations to enforce them
	Limited & declining access, control, ownership & use of natural resources by majority of vulnerable population	Facilitate consensus building and co-management of natural resources and products to ensure equitable access, control and sustainable use
	Lack of awareness, interest and co operation among local actors and institutions	Facilitate shared learning and knowledge management and joint initiatives that support the development of co-operation among actors and institutions

- If necessary, formal agreements on the ownership and management of the areas and resources contained therein should be established
- A flexible approach to co-management must be considered to assist in ensuring that the views of all stakeholders are incorporated in the process
- A legal agreement for the implementation of the co-management arrangement must be developed.

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Annex 1

Participatory Action Plan Development (PAPD)

PAPD is a methodology for building consensus among multiple stakeholder groups on the sustainable management of natural resources. PAPD uses different participatory tools to reach consensus among the community on actions that are needed to improve the management of natural resource. PAPD recognizes the many stakeholders involved in the management and use of natural resources and ensure that all stakeholders' views are represented. PAPD encourages community participants to respect others' concerns and to appreciate:

- their dependency on the natural resource base
- the function and values of natural resource system

PAPD is a dynamic method, but there are no immediate solutions. A continuous process of action and reflection is needed to further develop community action plans as livelihoods and the natural resource base changes.

The PAPD methodology was developed by CNRS in 1997 to build consensus among stakeholders in floodplain resources management in Charan Beel, Kalihati, Tangail district (Funded by the UK's Department for International Development DFID, Natural Resource System Programme Project R6756). CNRS acknowledges Information, Training and Development Ltd (ITAD) for the development of PAPD. In Bangladesh PAPD have been used by number of organizations including, Bangladesh Center for Advanced Studies, Bangladesh POUISH, Center for Sustainable Development, WorldFish Center, Intermediate

Technology Development Group (ITDG Bangladesh), IUCN Bangladesh, Department of Fisheries of Government of Bangladesh, for successful management of wetlands.

Figure 3. The PAPD method

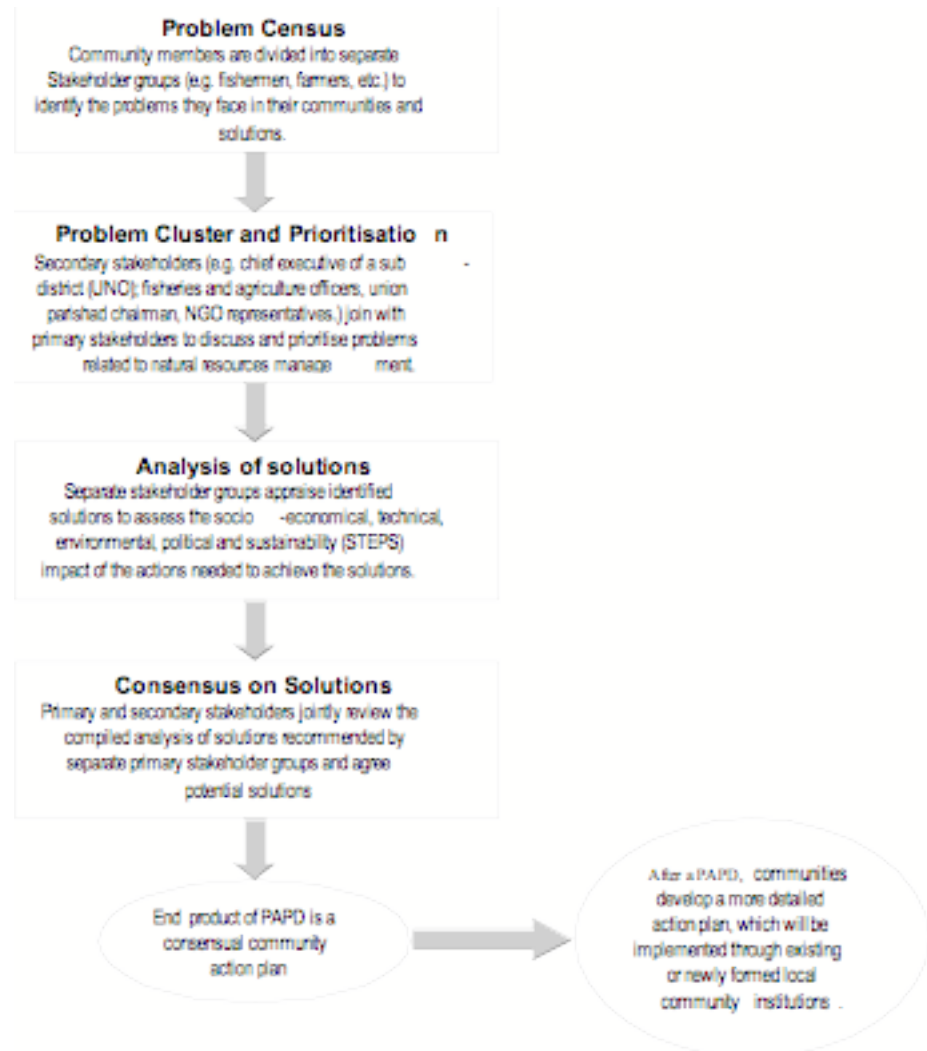
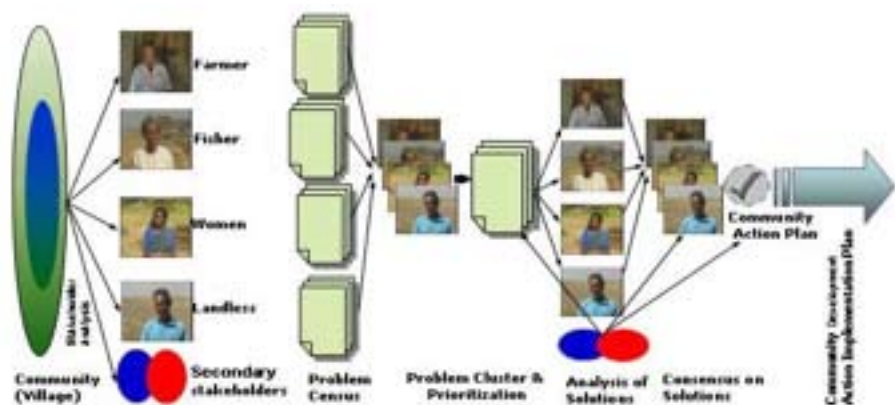


Figure 4. PAPD Activity Flow Chart



The PAPD method has the following 4 steps:

Step-1: Problem Census

Step-2: Problem Cluster and Prioritization

Step-3: Analysis on Solutions

Step-4: Consensus of Proposed Activities.

Annex II

Community based Fisheries Resource Management: Case study Kaliakaou

CBFM-2 project is managing Arial Beel of Kalikore sub-district under Gajipur district. There are 7 CBOs managing the water bodies. There are number of income generation options to reduce the passer of dependence of wetland resources. The CBOs are practicing micro-credit schemes for their sustainability. With their own fund community lease wetlands from government and follow the followings:

1. No use of destructive net/gear for harvesting of fish
2. No dewatering
3. No harvesting of fish from 15th April to 15 July
4. No use or rational use of pesticide and chemical fertilizer in the surrounding crop fields
5. No dumping of solid or liquid waste from industries
6. Conserve 10-15% area of wetlands as Fish Sanctuary

It was found that by following the above motioned rules the fish production of the wetlands have been increased significantly and the income of the CBO members has amplified.

Annex III

Baikka Beel Wetland Sanctuary

Baikka Beel Wetland Sanctuary is the first of its kind in Bangladesh. Baikka beel is about 100 ha of wetlands in the eastern part of Hail Haor near Sreemongal, a tea growing town in Moulavibazar district about 200 km northeast of Dhaka. On 1 July 2003, after a detail planning process, the Ministry of Land, Government of Bangladesh decided to reserve it as a permanent sanctuary for conserving and maintaining biodiversity and productivity of Hail Haor. It has since been developed as a safe haven for fish, birds, and other wildlife. It is a beautiful wetland where thousands of lilies and lotus bloom. Bird watchers and nature lovers have begun frequenting it especially in winter. An observation tower promises the visitors a good view of the beel, its residents and winter visitors.

How Baikka Beel is managed?

Barangangina Resource Management Organization (RMO) comprising of 45 villages (fisher, farmers, women and local leaders) looks after the sanctuary through agreement with the government. They protect the sanctuary as well as educate the wider communities on the need for its conservation and wise use. The local Union Parishad², the Department of Fisheries and an upazila³ level committee chaired by the Upazila Nirbahi Officer support their efforts.

What conservation management activities are in place?

To restore and protect the wetland habitat of Baikka Beel Sanctuary, MACH and Barangangina RMO are implementing the following:

- Excavation by dredger to deepen parts of the sanctuary to hold more water for fish in the dry season
- Placing concrete fish shelters in deeper parts of the sanctuary to enhance fish habitat and prevent poaching
- Planting swamp forest trees to restore habitat for fish and wildlife

How Baikka Beel Serves Hail Haor?

Hail Haor is one of the most important wetlands of Bangladesh. Lying between the Balishara hills on the east and Satgaon hills on the west, the haor has a catchment of 600 Km² that includes villages and farmlands, pineapple gardens, lush tea estate, and forest including Lawacharra National Park. The haor covers about 14,000 ha in the wet season but in the dry season the area falls to under 4,000 ha in about 130 beels and in narrow canals. More than 172,000 people in 30,000 households live in 60 villages surrounding the haor. Over 80% of those households fish in the haor, many as a regular profession. Local people also depend on the haor for grazing and as a wet season source of fodder, building materials, and plants (fruits, etc.) for human food and medicine. Studies have shown that these aquatic resources are more valuable per acre than rice production.

For many years the natural productivity and biodiversity of the haor have been in decline because of drainage for agriculture, intense fishing pressure, hunting, and recently conservation of wetlands to brickfields and aquaculture. However, since 1999 the MACH project has taken a comprehensive approach to restoring this part of the nation's natural heritage. The lives of fisher and other wetland users have been improved and once lost fish, birds and plants are returning to the haor.

Managing the haor are eight RMOs made up of local people who use the haor. The aim of each organization is to ensure sustainable use and protection of its area of the haor. They also influence resource users to behave responsibly in surrounding areas. They have set up small fish sanctuaries, re-excavated silted up areas, stopped harmful fishing practices such as dewatering, planted swamp forest trees, re-stocked threatened fishes, and observe a fishing ban when fish are spawning. Baikka Beel has received special protection as a permanent wetland sanctuary and is the largest spawning area of the haor. The result is that fish catches throughout the haor have doubled from 170kg/ha in 1999-2000 to 390kg/ha in 2004-2005.

² The lowest level of Local Government in Bangladesh

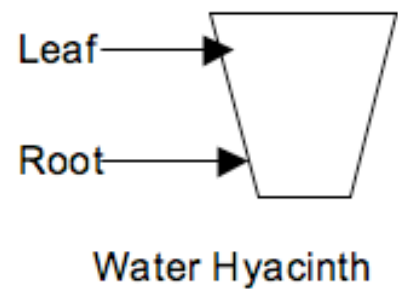
³ Sub District

Annex IV

Cultivation in Baira

Water hyacinth *Ichhornia crassipes* grow abundant in flood-plain of Bangladesh. In the southwester districts local communities make floating platforms of rotten water hyacinth locally termed as baira or dap or gathua. The size of Baira varies depending on availability of water hyacinth, and wave status of the wetlands. If the wetland is not rough with wave action than large size baira is possible. The common size of Baira in Gopalganj District is 12.5 meter X 1.5 meter (Thikader, 2004). To make a baira water hyacinths are damped floating in a flat from shape. In case of damping the roots are kept up for 3-4 bottom layers. To make the edge of the baira the water hyacinths are kept by placing roots inside. It takes one to one and half months to get a baira ready for cultivation. The common weight of a baira is around 0.5 meter which is result of a meter height tight damping. To prepare a baira it costs Taka 200-250 (US \$ 3-4); and farmer usually earn Taka 2000 (US \$ 30) in a season (Rainy season) from a baira.

Figure 5. Damping Water Hyacinth to Prepare a Baira



Annex V

Report Card

Report Card has been used by number of project in Bangladesh, like CBFM-2, MACH, etc. As an example the report card that is used by the CBOs of CNRS for the project MACH is described bellow:

Report card for the CBO is a simple monitoring tool, which consists of a total of thirteen pages. First and last pages are the cover pages. Then the next ten pages, which are after the front cover page, consist of relevant pictures of ten indicators. At the end of those ten pages there is another page consists of Score Card where the CBOs will provide the score and monitor themselves. The sizes of the pages are 12(X18).

Methodology of developing the Report Card

Through process mapping, at first the major activities for the sustainability of the CBOs were identified. The CBO members identified 10 major activities for both RMO and FRUG. Then with the help of an artist those indicators are transferred into a pictorial form. After developing these Report Cards those were tested in the field (SOS site). There the CBO members as well as the MACH staffs also gave their opinion about the pictures. According to their suggestions the artist made necessary changes and the Report Card is finalized.

Indicators

The Report Cards of those CBOs comprises 10 indicators. For each indicator an illustrated card is available to enable non-literates to understand the meaning of the indicators. The pictures describe of different level of performance and the member scores the indicator base on comparing or indication the pictures in the card. The group gives a score against the criteria from 1 to 5, where 5 = is the highest rate of satisfaction and 1 = the lowest rate of satisfaction. Table 2 shows the performance scale for different indicators. The final score could be an average of individual group members' scores, or a score reached by consensual agreement of members. The scores should be recorded in the format given in the Score Sheet.

Figure 6. Methodology of developing the Report Cards

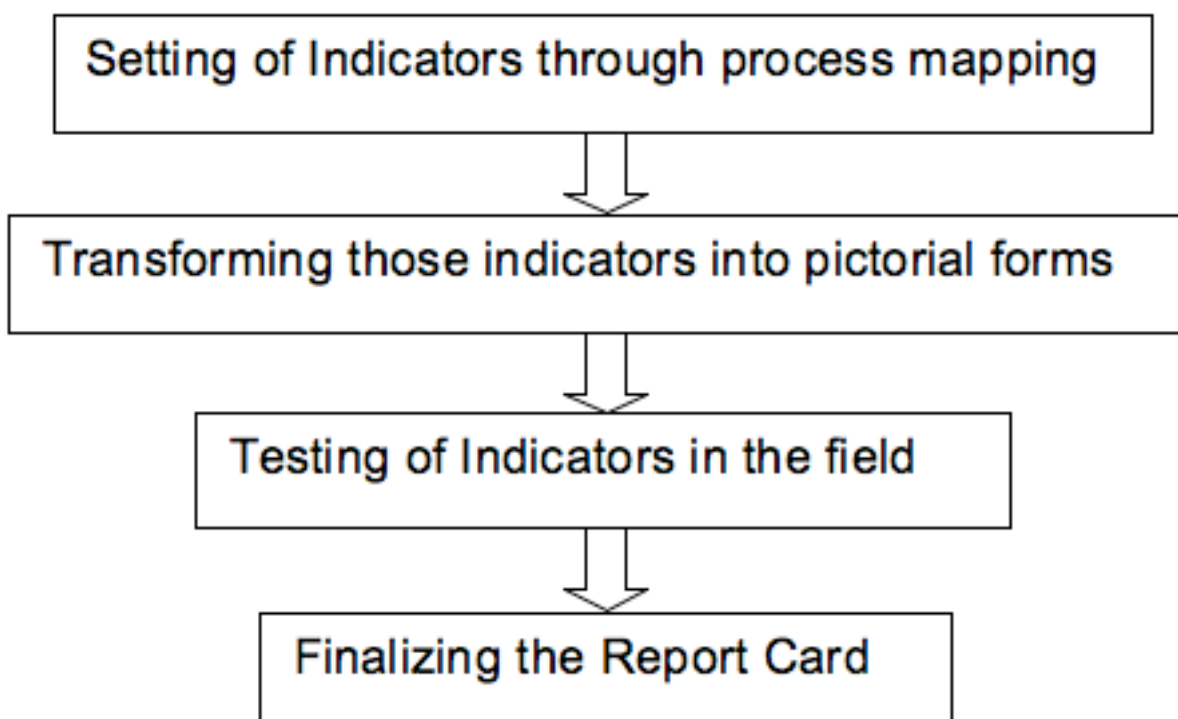


Table 3. Description of Indicators used in the Report Card of CBOs known as Resource Monitoring Organization (RMO), who is responsible to monitor the resource management under MACH project

Indicator	Description	Issues covered (sub-indicators)	Pictures in Card
1 Organizational dynamics	Poor and woman focused, registration, following constitution, Election.	Whether there is democratic practice within the organization, the members are following their constitution.	Poor and Women participating election, registration authority
2 Meeting	Attendance, regularity and timing of the meeting, effectiveness of discussions and decisions.	RMO members arrange regular meeting, most of them attend the timely and all the decisions are taken and all information are shared in the meeting. Functioning of EC and GB are ensured through the meeting.	Watch, Women actively participating meeting, Attendance sheet
3 Record keeping	Extent and inclusiveness of recording agenda, decisions, documents for account keeping, documents for ensuring transparency	Issues discussed and decisions taken in the meeting are documented, financial transactions are documented and all those documents are agreed and accepted by the members	Account book, regulation book, regulation writing, document keeping in a file cabinet
4 Access rights to the water body	Whether they are financially and technically capable of taking lease. Contribution of the members for taking lease of the beel as well as river. The access of the other fisher (who are not RMO member) in the water body	The selection procedure of the beel and availability of money. Appropriate timing and procedure of taking the beel. Consideration of the size of the beel.	Poor people fishing in a wetland; using water in irrigation from the wetlands
5 Activity Planning	Process, place and time of decision making, Participatory approach in decision making, Performing the activities in an effective way (Both technically and financially)	Different technical and social issues, A/C keeping, scheme planning; sharing with the LGC members and field visit expenditure. Taking local knowledge and assistance. Money flow system and follow up the activities. Distribution of profits.	Participatory Planning Meeting; Presenting an activity plan
6 Fish production	Fish abundance and diversity. Price of fish	Fish yield, beel environment, availability of fish in the market, health condition of the people.	Plentiful fish in harvesting and market;
7 Conservation efforts	Different activities such as plantation, excavation, maintaining close season, protecting harmful gears and implementing other fishing rules.	Decisions about sanctuaries, excavation and plantation such as number, place, sign etc are made. Extent of following fishing rules in the sanctuary Providing different materials for establishment and maintaining of sanctuaries.	No gear in wetlands, Fish sanctuary
8 Networking	Networking and communication for solving different problems, ensuring proper financial transaction, build technical as well as leadership quality.	Networking and communication with User Groups, Community and other GO and NGO. Necessary trainings and capacity building.	Use groups, Community, different relevant government offices and NGO liked with roads
9 Transparency and Accountability	Keeping the records of all financial expenditure such as bills, vouchers. Provides Institutional strength.	Ensure and increase the capabilities of the members. Smooth running of the organization.	Participatory evaluation, record books, bank statements
10 Endowment Fund	Fund flow system, A/C keeping, transparency, accountability, initiative taken for new projects etc.	How the fund is used at present and proper auditing of that expenditure.	Fund flow in a diagram