

Equity and Social Justice in Water Resource Management in Bangladesh

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Executive Summary

In Bangladesh, equitable and sustainable water management is critically important due to the country's geographical location, low-lying topography and high incidence of poverty. A large proportion of the rural poor is dependent on natural water bodies in floodplains and in hilly watersheds for their livelihood. Their subsistence is based on food production, fishing, harvesting wetland plants, plying country boats and other activities which depend on healthy aquatic ecosystems.

However, the management of water resources in Bangladesh tends to involve a centralised, heavy engineering approach in order to control floods and install irrigation. The other uses of water, such as domestic use and sanitation, fisheries, navigation, ecology and biodiversity, tend to be overlooked, undermining the lives and livelihoods of the rural poor and ecosystem health. The construction of irrigation canals and the intensive use of water for irrigation have caused natural water bodies such as rivers, canals and wetlands to dry up, thereby denying opportunities for subsistence food production to the landless people and small and marginal farmers. Furthermore, normal annual flooding provides numerous benefits such as common access to the large natural floodplain fishery, deposition of fertile loam on agricultural fields, and flushing of stagnant water in low-lying areas. Disrupting this normal process through heavily-engineered flood control structures has many consequences, such as increasing flood levels in adjacent areas. The access to water resources and the costs and benefits of water resources development are therefore distributed unequally, with the rich benefitting more than the poor.

The authors propose a framework for promoting equity in water management and preserving the environment. This includes:

- Ensuring multi-objective planning and decision making. For water management to be equitable, planning needs to encompass the multiple water users and purposes, water rights and associated vulnerabilities.
- Prioritising public health security.
- Maintaining ecosystems, protecting livelihoods and providing multi-functional infrastructure in rural areas.
- Ensuring public participation and forming water and ecosystem-based local management zones.
- Formulating regulations governing equity and the environment.

Equity and Social Justice in Water Resource Management in Bangladesh

Golam Rasul and A. K. M. Jahir Uddin Chowdhury¹

Introduction

Water is of paramount importance for sustaining life, development and the environment. The availability of water is the key determinant of economic growth and social prosperity. However, water is a finite resource and its use for one purpose reduces its availability for other purposes. Competing water needs trigger conflicts between disparate water users such as the rich and the poor, or between different sectors and regions, such as domestic and agriculture, agriculture and industry, agriculture and fisheries, upstream and downstream, rural and urban areas, and fisheries and flood control. Increased demand for water stemming from population and economic growth and ecosystem services on the one hand, and the problem of water management in flood control situations on the other, have posed significant challenges for the planning and allocation of its uses among competing demands (Syme *et al.* 1999).

This paper looks at these water management and equity issues in Bangladesh, where equitable water management is critically important due to the country's geographical location, low-lying topography and high incidence of poverty. The paper outlines a framework for preserving the environment and promoting equity in water management.²

Water and equity

Water management activities generally involve constructing water control structures (dams, polders, drainage ditches etc) to increase water access and reduce the risk of water-related natural hazards such as floods. However, these structures often change water regimes, with consequences for the distribution and allocation of water resources among different stakeholders (Chowdhury *et al.*, 1997). Although the intention of water resource development projects is to provide economic benefits to society, the benefits

1 The views expressed in the paper are those of the authors, and are not necessarily related to the organisations with which they are affiliated.

2 This study is based on both primary and secondary information. The secondary information was drawn from various sources including government reports, books and journal articles. The primary information was collected through diverse means including field observation, group discussions and key informant interviews. Information collected from the different sources was triangulated to check its validity. The authors' long research experience in the water sector was also useful.

and costs may not be distributed equally to all sections of society. Little attention has been paid to the equity of water resource development in many South Asian countries. As a result, there is often strong resistance to water resource development projects. The non-governmental organisation *Narmada Bachao Andolan* (NBA) in India is a glaring example of such resistance; it mobilised tribal people, *adivasis*, farmers, environmentalists and human rights activists against the Sardar Sarovar Dam being built across the Narmada river in Gujarat State and forced the government to cease the project (Phadke and Patankar, 2006).

Management of water resources has critical implications for people's lives and livelihoods, for overall economic development and for social prosperity. Social theories of justice, equity and fairness underscore the need for ensuring social justice in water resource management (Syme *et al.*, 1999; Tisdell, 2003). The equity concept implies protection of water rights and access to safe drinking water, which is a basic human need. According to Phansalkar (2007), equity in access to and use of water and the distribution of the impacts of water resource development intervention have four elements:

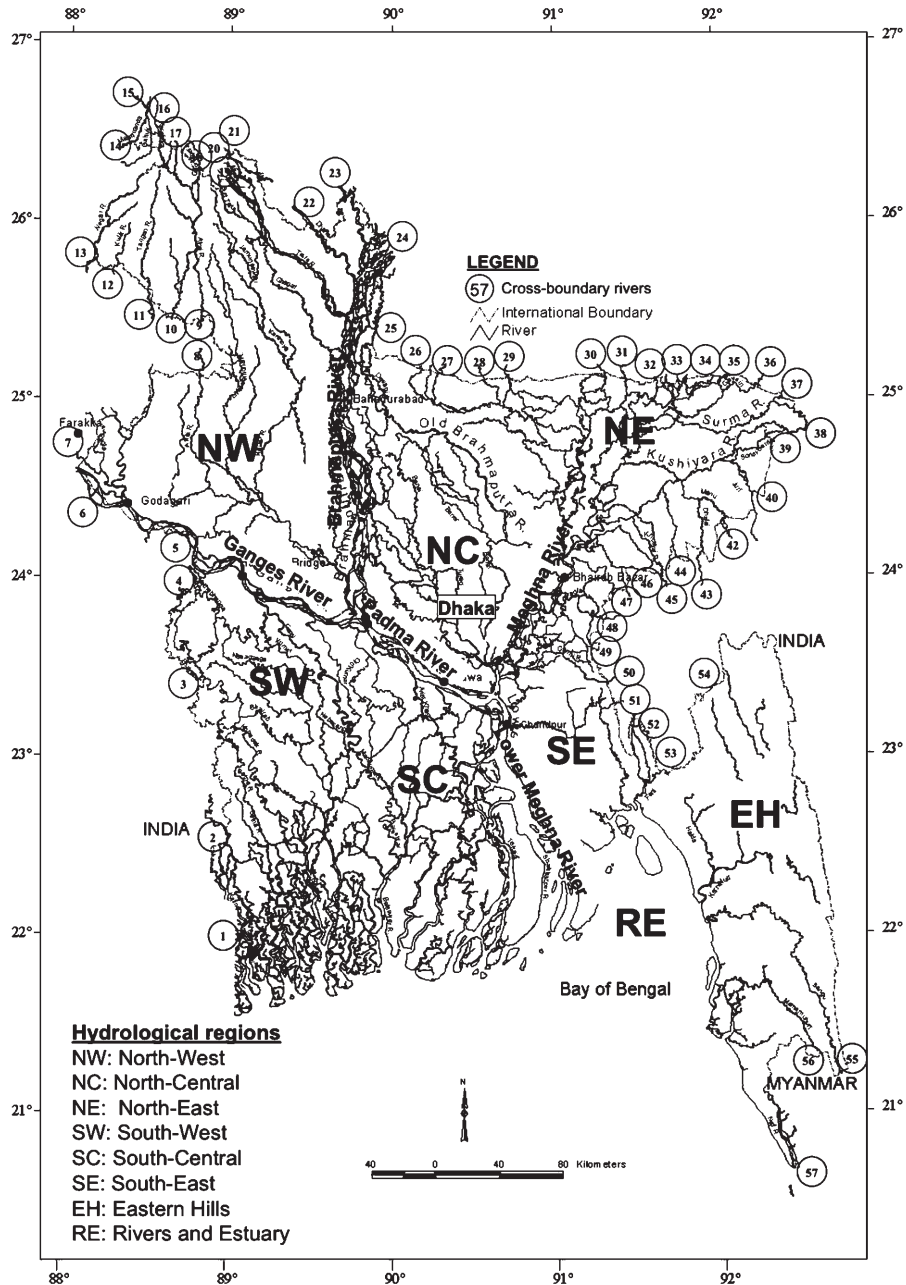
- (1) Social equity: equity between different groups of people living in the same location.
- (2) Spatial equity: equity between people living in different regions (Saleth and Dinar, 2004).
- (3) Gender equity: equity between men and women in sharing labour costs, efforts to access and use water, and its benefits.
- (4) Inter-generational equity: equity in enjoyment of natural resources, including water, across generations of people (Divan and Rosencranz, 2005).

Water sector development in Bangladesh

Bangladesh is mostly a deltaic country characterised by a dense network of rivers (Figure 1), *khals* (floodplain channels) and wetlands. Unconsolidated floodplain sediments occupy about 80% of Bangladesh's area, while tertiary hill areas in the north-east and east account for about 12%, and pleistocene terrace areas in the centre and north-west make up the remaining 8% of land.

Bangladesh is predominantly a rural and agricultural country. Over three-quarters of its population live in rural areas (Table 1) and agriculture still accommodates almost two-thirds of the country's total labour force, and is about one-quarter of its gross domestic product. It is the most densely populated country in the world (over 150 million in an area of 147,570 km²). About 50% of its people live below the national poverty line and over one-third of its population lives on just below US\$ 1 a day (Table 1). A large section of the rural poor is dependent on natural water bodies in floodplains and in hilly watersheds for their livelihood. Their subsistence is based on food production, fishing, harvesting wetland plants, plying country boats and other activities dependent on water resources. The socio-economic features of Bangladesh thus underline the significance of ensuring equity in water allocation and water resource development projects in the country.

FIGURE 1. RIVER SYSTEM AND HYDROLOGIC REGIONS OF BANGLADESH



Source: Bangladesh Water Development Board. 2005. *Bangladesher Nad-nadi* (in Bengali). Bangladesh Water Development Board, Ministry of Water Resources, Government of Bangladesh, Dhaka.

TABLE 1. BANGLADESH: KEY SOCIO-ECONOMIC INDICATORS	
Indicators	Status
Population in 2006 (million)	144
Rural population as % of total population in 2003	76%
Gross national income per capita in 2006 (US \$)	480
Population below national poverty line (survey year 2000)	49.8%
Population below US\$1 a day (survey year 2000)	41.3%
Human development index (HDI) rank in 2005	139
Human development index value in 2005	0.520
Population without access to safe water (1995)	21%
Population without access to sanitation (1995)	65%
Life expectancy at birth (yrs)	63
Infant mortality rate in 1,000 live births (1999–2000)	79.9

Sources: World Bank (2008) and Ahmad *et al.* (2001).

Water resource management in Bangladesh can be traced back to pre-colonial Bengal. Water management has been institutionalised since 1959, when the then East Pakistan Water and Power Development Board Authority (EPWAPDA) was established and assigned responsibility for water resources development. EPWAPDA and subsequently the Bangladesh Water Development Board (BWDB) undertook many projects to control floods and build drainage for irrigation (Box 1). By June 1990, BWDB had constructed 7,555 km of embankments and 7,907 hydraulic structures under 437 projects (Thompson and Sultana, 1996).³

The focus of water sector activities has been on flood control, drainage and irrigation to support the agriculture sector. As a result, the role of water in other sectors, such as domestic water supply and sanitation, fisheries, navigation, industrial uses, hydropower, ecology and nature and disaster management, has mostly been neglected (Ahmad, 2003). However, the 1999 National Water Policy (NWP) recognised for the first time the role of water in poverty alleviation and called for inclusive water management, taking into consideration the national goal of poverty alleviation, amongst others (Ministry of Water Resources, 1999). The policy was further revised in 2000 and approved by the government. The stated goal of NWP is 'to ensure progress towards fulfilling national goals of economic development, poverty alleviation, food security, public health and safety, a decent standard of living for the people and protection of the natural environment'. To facilitate the implementation of the NWP, the government approved a 25-year National Water Management Plan (NWMP) in 2004. The plan provides guidelines to develop pro-

³ A few of the most important projects are the Teesta embankment project, Kurigram project, Brahmaputra right bank embankment projects, Haor projects, Chalan beel projects, Monu river projects, Pabna irrigation projects, Ganges-Kobadak project, Dhaka-Narayanganj project, Meghna-Dhonagoda project, Chandpur irrigation project, Polder scheme and coastal embankment project (Thompson and Sultana, 1996).

grammes for better management of water resources in the country. The main elements of the NWMP include the multi-use approach to water (not just flood protection but also irrigation, drinking water and other uses) and an emphasis on 'soft' approaches, such as better management of water resources, instead of just hard engineering approaches.

However, despite this increasing emphasis on incorporating social justice, there has been no systematic study on how social and environmental aspects are being incorporated into water management projects in Bangladesh (Thompson and Sultana, 1996; Ahmad, 2003). Against this backdrop, this paper examines how and to what extent the concept of social equity has been integrated into water resource management projects in Bangladesh and how the benefits and costs of water resource development projects are distributed among the different sections of society.

BOX 1. THE HISTORY OF THE WATER SECTOR IN BANGLADESH

EPWAPDA was established on the recommendation of the Krug Mission after a devastating flood in 1954. The EPWAPDA was responsible for the planning, design, operation and management of all water development schemes. In 1964, it prepared a 20-year Water Master Plan, which involved a massive flood control and drainage programme, to be followed by irrigation. Emphasis was laid on the construction of embankments and polders over much of the country. Following independence in 1971, the EPWAPDA was restructured and responsibilities for planning and management of water resources were handed over to the newly created BWDB. The BWDB became the national focal point for water management and took many initiatives for water sector development. However, its orientation has remained almost exclusively on increasing agricultural production to achieve national self-sufficiency, for which it tends to seek structural engineering solutions.

Social impacts of water management projects in Bangladesh

Water management projects and rural livelihoods

Water supports a variety of livelihood activities in rural Bangladesh. However, the heavy infrastructural and engineering approach to water management can have implications for these livelihoods. Poorly planned infrastructure aimed solely at flood control and irrigation for agriculture has limited inputs from local people and often ignores the other uses of water, particularly those on which the subsistence of poor people are based. A review by Halcrow *et al.* (1998), based on data from water management projects implemented thus far, found that these projects are biased towards agriculture and ignore the importance of water for other uses, such as in fisheries, navigation industries, forestry, domestic water requirements and sanitation, livestock, poultry, horticulture, and other human and environmental services. It concludes that not making sufficient provisions for the water needs of these other sectors poses serious threats to the livelihoods of many social groups who live on traditional occupations like farming, fishing, and cattle breeding. Some of these impacts are outlined below.

Impact on subsistence food production

Bangladesh has extensive floodplain wetlands that harbour and support a wide range of aquatic plants and biodiversity (Khan, 1997). Wetland plants are harvested by the rural poor as a source of supplementary food, and for firewood, thatching, mat-making, livestock fodder and medicinal use. Further, these plants provide vital nutrients for open-water fisheries. In Bangladesh, these floodplains tend to be modified by the water control structures. The construction of irrigation canals and the intensive use of water for irrigation have caused natural water bodies such as rivers, canals and wetlands to dry up, thereby denying opportunities of subsistence food production to the landless people and small and marginal farmers, who cannot afford to pay for water from irrigation schemes (Sultana and Thompson, 1997; Craig *et al.*, 2004). Constructing big irrigation canals establishes relatively large farmers' property rights over water (Box 2). Small and marginal farmers, who use natural water bodies to irrigate their farms using traditional methods, consequently face difficulties that often affect their livelihoods.

BOX 2. SOCIO-ECONOMIC HARDSHIPS DUE TO LAND ACQUISITION FOR FLOOD CONTROL

Flood control projects involve acquiring substantial land for embankment construction. Land acquisition causes immense economic and social suffering to the poor households who lose their land. Among the worst sufferers are small agricultural landholders who lose their land, and households who lose their homestead land. Because of the loss of homestead land, which in many cases was their sole property, people become homeless and are compelled to migrate elsewhere. Obtaining financial compensation is a lengthy process and it does not make up fully for economic losses because of land price inflation. More importantly, the social costs are not compensated for by financial compensation schemes, and there is high dissatisfaction among people who are affected by land acquisition. HIFAB and MARC (1992), under the flood action plan (FAP)-15 study, assessed the economic and social impacts of land acquisition in six BWDB projects throughout the country. Household surveys in these six projects showed that 38% of households had lost their land and 4% had lost their homesteads.

Loss of livelihoods for fishermen

Bangladesh's extensive network of rivers, canals and floodplain wetlands provides a habitat for rich open-water fisheries. Canals link up floodplain wetlands and rivers provide an aquatic habitat suitable for reproduction, migration, breeding and growth of freshwater fish. A large section of the rural population depends on fishing in these natural water bodies for their livelihoods. In the north-west and south-west regions of Bangladesh, small and landless farmers in agricultural communities were found to be significantly dependent on fisheries, while in the north-central, north-east and south-west regions, over 60% of all categories of farmers have had some participation in fishing (ODA, 1997). Subsistence fishing is carried out by households for domestic consumption as well as for commercial purposes. Fish are a major source of protein for the rural poor.

Open-water fisheries are self-sustaining as long as the habitat is not disrupted by a change in water regime. However, flood control and irrigation reduce aquatic habitat and block the movement of fish between river and floodplain. Water control structures on

rivers and canals also obstruct fish migration routes (Tsai and Ali, 1997). Flood control, drainage and irrigation projects have caused many floodplain wetlands to shrink and lose hydraulic contact with the river. Consequently, aquatic habitat is rapidly shrinking and many fishermen have lost their livelihoods (WARPO, 2001b; Ministry of Water Resources, 1999). This is also reducing aquatic biodiversity and protein availability for the rural poor (Sultana and Thompson, 1997). Flood control and water conservation projects benefit the richer sections of society by creating opportunities for culture fisheries or fish farming, but the poor do not have enough capital to invest in culture fisheries.

Loss of livelihoods for boatmen

The dense network of rivers and canals in Bangladesh performs an important socio-economic function by providing an opportunity for waterway transport. Inland waterways are a cheap means of transport in Bangladesh. Non-mechanised and partly mechanised country boats provide access to outlying rural areas, which are otherwise unreachable. These boats are the only means of movement during floods in some areas. The country boat is a cheap means of transporting the paddy (rice) harvested in remote agricultural lands. Country boats account for nearly 60% of employment in transport, and a section of the rural poor earn their livelihood by plying country boats. This is nearly three times more than the employment in all mechanised modes taken together (Jansen *et al.*, 1989). Water control structures on rivers and canals obstruct boat transport. The movement of country boats is also hindered when the water in many small rivers and canals becomes shallow or dry in the arid season due to irrigation by low-lift pumps. As a result of flood control, drainage and irrigation projects, many boatmen have lost their livelihoods (Halcrow *et al.*, 1998). Hunting (1992) reported that in half of the 17 flood control, drainage and irrigation projects investigated, water control infrastructures had seriously impeded boat transport. After a thorough study of 66 projects in the north-east region, Shawinigan Lavalin (1993) found that 19 had major and 14 had medium-level negative impacts on boat transport.

The Master Plan of Bangladesh Inland Water Transport (DHV, 1989) considers the flood control polders as the main cause of deterioration of waterways due to siltation in rivers in the south-west and south-central regions. Dredging of waterways is incurring a huge cost on the navigation sector. The National Water Policy (Ministry of Water Resources, 1999) declares that minimum stream-flows will be maintained in designated rivers and streams for navigation, after diversion of water for drinking and municipal purposes.

Disruption of rural water supply

Shallow aquifers perform an important public health function in Bangladesh by supplying drinking water through hand tube-wells in rural areas. Access to safe and sufficient water is essential for the sustenance of human wellbeing and is a basic human need. Meeting basic human needs is an equity requirement. The situation analysis report on water supply and sanitation (Ministry of LGRDC, 1994) observes that an increasing number of hand tube-wells for drinking and domestic purposes are unusable for two to three months of the year towards the end of the dry season because of excessive lowering of groundwater

levels due to the expansion of shallow and deep tube-wells for irrigation. The impact on rural domestic water supplies of seasonally-lowered water tables due to groundwater irrigation is a concern for water management (WARPO, 2001a).

Environmental impacts of water resource development

This section examines how water resource development projects overlook environmental considerations.

Disrupting the hydro-morphologic features of floodplains

The concept of flood control is aimed at protecting floodplain agricultural lands from floods so as to reduce the damage to *Aman* (monsoon rice) and encourage landowners to adopt more productive transplanted varieties of rice instead of broadcast rice. However, the benefits of floods are overlooked in water management projects (Box 3). The ecology and traditional settlements around a river basin adapt themselves naturally to inundation. They depend largely on the annual hydrological cycle. Normal annual flooding provides numerous benefits such as common access to the large natural floodplain fishery, deposition of fertile loam on agricultural fields, and flushing of stagnant water in low-lying areas (Sultana and Thompson, 1997). After a detailed study of the hydrological, morphological, ecological, social and environmental impacts of flood control, drainage and irrigation projects in Bangladesh, Chowdhury *et al.* (1997) concluded that the goal of water resource development cannot be achieved without giving due consideration to the hydro-morphological features of floodplains and the socio-economic conditions of rural people.

The water regime is also affected by activities over which water managers do not have control, for example deforestation, hill cutting, inappropriate road alignment, wetland filling, river and canal encroachment, unplanned urbanisation and industrial waste disposal. Roads constructed across floodplains cause a backwater effect and increase the duration, frequency and extent of flooding upstream (LGED, 2008). Appropriate restrictions need to be imposed on these activities in order to prevent adverse impacts on hydrological cycle and water regime.

BOX 3. THE IMPORTANCE OF FLOODPLAINS

Rivers with extensive floodplains are a characteristic landscape feature in Bangladesh. Floodplains perform an important hydrological function by storing floodwater in flat topography, allowing floodwater to drain slowly to the sea. Thus, floodplains moderate flood flow by acting as detention reservoirs. Flood control projects prevent the flooding of agricultural land and urban areas located on floodplains. As flooding of the floodplain is checked, the storage space for floodwater is reduced, causing increased flood levels in adjacent areas. Hence, the flood risk is shifted to the adjacent area rather than reducing the overall risk. Pumped drainage of rainfall-runoff from the protected area also increases flood levels in the adjacent area. It is again usually the poor who suffer most from floods. Transfer of flood risk generates social conflicts, and can force the affected people to cut into the flood control embankments. Such forced cutting has been widespread in the north-west region (Alam and Franks, 1993).

Water logging due to coastal polders

Building embankments and irrigation canals without an adequate number of waterways obstructs the natural drainage. Alternate flooding and recession in tidal floodplains perform an important flushing function that is essential for the morphological stability of tidal rivers. Under the coastal embankment projects, flood control polders were constructed to prevent tidal flooding of the floodplain. The polders have reduced the storage area for tidal water that enters from the sea. A review of the coastal embankment project by Halcrow *et al.* (1993) considers that the polders have caused a rise in channel beds due to siltation. The rise in the beds of tidal rivers, in turn, has resulted in serious waterlogging of the adjacent area and has become a source of major environmental concern in the region, including increased salinity. Continued waterlogging has caused serious damage to agriculture, forestry, fisheries, livestock and physical infrastructure. It has forced many people to abandon their ancestral homesteads and livelihood activities, and this has generated widespread discontent. The development strategy of the NWMP considers it to be of utmost importance to rationalise coastal embankment schemes on the basis of environmental audit to avoid environmental hazards including waterlogging (WARPO, 2001a).

The risk to coastal people due to a lack of shelters

A burning example of the lack of social justice at the national level is the inadequate number of cyclone shelters constructed in the coastal region where loss of life due to cyclonic storm surge floods is a major concern. The existing shelters can accommodate only 27% of the population considered to be at risk in the NWMP (WARPO, 2001b). This low coverage by shelters, even after 37 years of independence, indicates an absence of equity consideration in national resource allocation. This is a major social injustice because poor livelihood groups form about 75% of the coastal population. The funds required for the construction of new shelters are negligible compared to those needed for providing infrastructure in urban areas.

Conclusions: a framework for preserving the environment and promoting equity in water management

Water is a basic resource for life and production and is essential for sustaining a variety of environmental and ecosystem services. Water resource development has been an important area of focus since the 1950s in Bangladesh, but given the growing conflict around the allocation of water to competing demands, as well as growing water stress due to changing climatic conditions, there is now a pressing need for ensuring social justice and equity in water resource development.

Our analysis has revealed that the focus of water resource development in Bangladesh has been biased towards flood control, drainage and irrigation in order to support the agricultural sector. This is generally achieved through structural solutions and a centralised

approach by professional engineers. Although this has facilitated agriculture production in favourable areas, the role of water in other sectors—such as domestic water supply and sanitation, fisheries, navigation, industrial use, hydropower, ecology and disaster management—has mostly been neglected. The result has been to create unintended negative impacts for society and the environment.

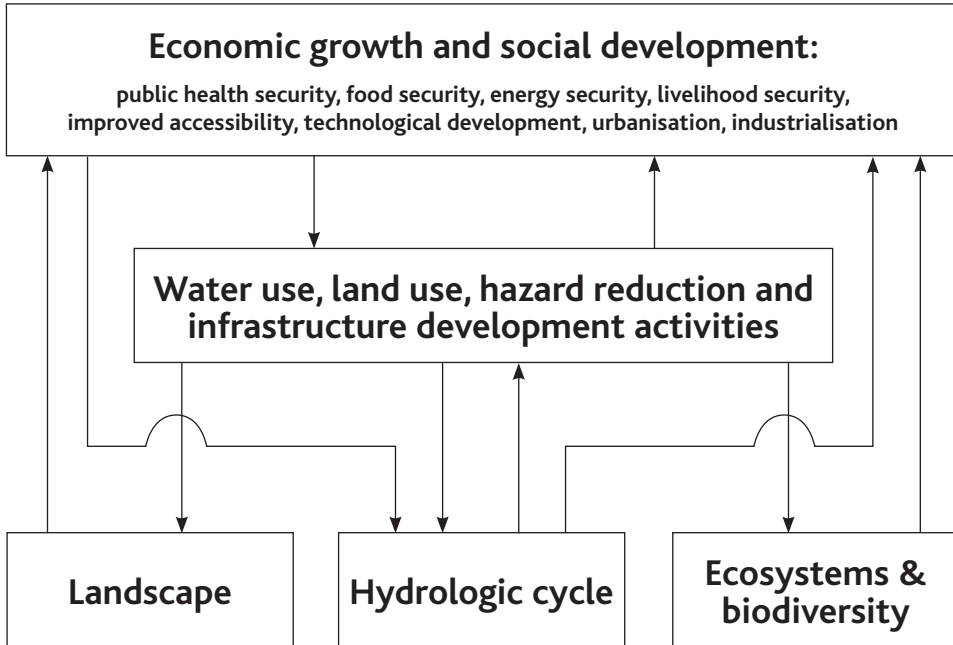
Although poverty alleviation and social equity have recently become goals of water resources development, they have not yet been translated fully into action, particularly at the programme and project levels. For example, many agricultural development projects are biased towards agricultural landowners, and bypass the landless. Few water resource development projects target the poor directly, even though they constitute a vast majority of the country's population (NWMP, 2004). Rich farmers themselves usually control the operation of the simple and relatively small flood control, drainage and irrigation structures. This is an example of public goods being used as private goods by the more powerful, and further skews the distribution of project benefits towards large landowners. As such, certain social groups are negatively affected by the lack of adequate consideration of social impacts at the planning stage.

To promote equity in water management activities, it should first be recognised that access to safe water is a basic human need and essential to public health and livelihoods. Equity and sustainable development require water resource management to balance the needs of a wide range of water users, along with the needs of the environment. Multi-objective and holistic water resources planning is required to address the various needs of public health, agriculture, fisheries, ecology, river morphology, salinity intrusion prevention, navigation, industry and hazard reduction. Appropriate provisions need to be made for the poor, who cannot afford to pay for service infrastructure.

In this final section we outline a broad framework for preserving the environment and promoting equity in water management. We hope that this will help to increase the social dimension in Bangladesh's national water management plan and in the country's approach to water management. However, this framework is generic and should not be considered comprehensive.

- *Ensure multi-objective planning.* For water management to be equitable, planning needs to encompass the multiple water users and purposes, water rights and associated vulnerabilities. Decisions about water management should aim at poverty reduction, public health security, vulnerability reduction, environmental protection, ecosystem sustenance, economic growth and social prosperity. This requires multi-objective water resources planning that can address the needs of public health, agriculture, fisheries, ecosystems, navigation, industry and water-related hazard reduction. The approach requires interactions among the planned water management intervention with components of water resource systems and socio-economic systems. It also requires good understanding of the livelihood systems of the rural poor, as well as the linkages among natural and socio-economic systems (Figure 2) and the interdependencies and interactions among system components and water users.

FIGURE 2. INTERDEPENDENCIES AMONG LAND, WATER, ECOSYSTEMS AND SOCIO-ECONOMIC DEVELOPMENT



- *Prioritise public health security:* Access to safe water and sanitation is a basic human need and essential to public health. It should be ensured in all rural areas.
- *Maintain ecosystems, protect livelihoods and provide multi-functional infrastructure in rural areas:* A large proportion of rural livelihoods depend directly on healthy ecosystems. Many rural livelihoods depend on the existence of favourable conditions in rivers, *khals* and wetlands. The subsistence activities of socio-economically vulnerable groups should not be undermined by water-use and land-use activities. Infrastructure needs to be eco-friendly and consistent with the water regime. It also needs to be multi-functional so that the needs of agriculture, open-water fisheries, navigation and ecosystems are satisfied. Ecosystem maintenance criteria should be included in the operating rules for water control structures so as to benefit the livelihoods that are dependent on ecological resources. Efforts should be made to avoid relocating poor households due to land acquisition for infrastructure construction.
- *Form water and ecosystem-based local management zones:* Community associations can be organised for each zone in order to facilitate effective community participation and ecosystem maintenance, provide an enabling environment for resolving conflict among different livelihood groups and creating conditions for sustainable livelihoods by using local knowledge.
- *Ensure public participation:* Community participation in the identification, planning, implementation, operation and maintenance of water management projects is essen-

tial for promoting equity and transparency and the development of sustainable solutions to water management problems. Stakeholders at all levels of the social structure should be able to participate in decision making so that all relevant interests are taken into consideration. All stakeholders, both inside and outside of the area of the proposed project, should have access to all information related to the project. Public participation also helps planners to acquire all the relevant social information and indigenous knowledge in order to develop creative solutions. It also results in public acceptance of the decisions.

- *Implement multi-criteria decision making:* An important task in the decision-making process is the evaluation of various options for water management interventions. In order to make the most equitable decision, one has to consider as many options as possible and evaluate the interventions on the basis of their hydraulic, environmental, ecological and socio-economic consequences. Decision making should not be based on economic justification alone, and social justice regarding social costs and benefits should be a prime criterion. This can be achieved by using a multi-criteria decision-making framework that adheres to equity principles and is able to account for factors like hydro-morphological, ecological, environmental, economic, social, water-dependent subsistence activities, indigenous knowledge, and livelihood opportunity. Options should be selected based on the assessment of their contribution to national development goals and on their ability to ensure equitable distribution of social costs and benefits.
- *Formulate regulations governing equity and the environment:* Regulations, standards and guidelines are necessary to protect the water regime, water quality, water rights, fish migration and navigation routes, ecosystems and biodiversity and to ensure community participation in decision-making processes. Flood management, surface water use and land-use activities should follow appropriate procedures so that the hydrological, landscape and ecological functions of alluvial floodplains and hilly watersheds are not disrupted. Restoration of wetlands is essential to reduce environmental degradation and social suffering; measures need to be taken to achieve this.

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