ADB

WATER for ALL SERIES 11

Floods and the Poor

Reducing the Vulnerability of the Poor to the Negative Impacts of Floods

By Ian B. Fox

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Note: In this publication, $ refers to US dollars.

Abbreviations

ADB	Asian Development Bank
IWRM	integrated water resources management
LGED	Local Government Engineering Department
PRC	People's Republic of China

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ADB's Experience

Water disasters, including floods and drought, have serious economic implications in the Asian region, both for individual households and national economies—to the extent of creating severe budgetary and balance-of-payments difficulties. At a micro level, water disaster vulnerability and poverty are interrelated, and poor households are particularly vulnerable to floods.

Until the mid-1980s, the Asian Development Bank's (ADB's) disaster-related lending was predominantly for large-scale mitigation projects financed through normal lending procedures. At least 14 loans were made for investment in disaster mitigation, and 28 technical assistance and 3 regional technical assistance grants were extended for various aspects of disaster response and management. From the mid-1980s, ADB also provided loans for rehabilitation assistance after disasters.[1] More than 27 rehabilitation assistance loans totaling over $879 million have been provided.

ADB's flood mitigation projects have tended, in common with other similar projects implemented throughout the world over the same period, to follow a standard, top-down, predominantly engineering approach. This reflects the commonly held conception that the impacts of floods are almost wholly negative and that significant investments in large-scale flood control measures are required to prevent damage to valuable assets, including important urban centers and also agricultural land. Swamps, lowland, and other unoccupied flood-prone land were sometimes converted to more productive uses (though high value was placed on the environmental benefits of wetlands under ADB-financed projects and these were generally excluded from "reclamation").

Universally, the rationale for flood control projects is based on economic considerations linked to avoidance of both direct and indirect losses (including such intangibles as injury, illness, malnutrition, interference with income-earning activities and other opportunities foregone). The projects have sound economic rationales supported by strong arguments linked to protecting peoples' lives and well-being. Little account has been taken of the beneficial impacts of floods, including the rejuvenation of wetlands as breeding grounds for aquatic plants, fish and animals (vital sources of income and food for the poor), enrichment of soil by river-borne sediments and nutrients beneficial to agriculture, and replenishment of reservoirs and groundwater tables as reserves against dry season water shortages.

[1] Two disaster-lending facilities were approved in the late-1980s and subsequently revised in 1995: Rehabilitation Assistance to Small DMCs Affected by Natural Disasters (Operations Manual Section 24) using Asian Development Fund resources, and Rehabilitation Assistance After Disasters (Operations Manual Section 25) using ordinary capital resources.

Within ADB's recent flood control/protection projects, structural measures are combined with nonstructural measures, including variously

- upper catchment land use improvements (e.g., soil and water conservation to reduce erosion and replenish surface and groundwater reservoirs);
- conservation or restoration of wetlands and low-lying areas as temporary flood storage areas;
- flood hazard mapping with land use and building controls in flood-prone areas;
- flood forecasting and flood warning, backed up by improved communication systems and community awareness programs;
- means of evacuating persons and livestock from flooded areas;
- emergency flood shelters;
- flood proofing of houses and other essential infrastructure; and
- improved coordination among different ministries (e.g., to harmonize flood control standards for roads, railways, and other essential infrastructure).

Project completion reports and postevaluation audits have concluded that the objectives of disaster mitigation and rehabilitation assistance projects have been achieved and that they have been generally successful. However, various factors are contributing to increased hazard vulnerability in the region, including environmental degradation, urbanization, industrialization, and overall economic development. Such trends are not inevitable. With the exception of the longer-term consequences of global warming, changes in the incidence of disasters in recent years are largely attributable to socioeconomic change and the impact of human activities on the environment.

Evolution of Approaches to Flood Control

Part of any successful coping strategy involves the construction of flood defenses in various forms.

For many thousands of years people have chosen to live in areas subject to flooding. This reflects the fact that floodplains represent a valuable resource providing livelihood, food, and wealth to communities. For example, in the People's Republic of China (PRC), about 840 million people (more than 66% of the population) live in flood-affected areas and these areas account for 80% of the country's gross domestic product. It is inconceivable that development be excluded from such zones, not only because of the scale of such an action, but also because the losses would far outweigh the gains.

People the world over have accepted the risk of living with floods and there are many examples of communities which have adapted their way of living to cope with floods while deriving economic and social gain. In such communities, for example, houses are built to allow for flooding during the wet season, people use boats to travel when roads are impassable, and the whole cycle of planting and cropping is linked to the rise and fall of rivers.

Part of any successful coping strategy involves the construction of flood defenses in various forms. Such structural barriers need, however, to be planned and implemented with care. Low flood protection embankments along a river can effectively provide protection against frequently occurring small floods, thereby prolonging the period of the year during which crops can be planted.[2] These small-scale works have mostly

[2] In this paper, the term "embankment" is used for all artificial structures designed to contain floods within the river corridor. Other terms, such as "dykes" and "levees," are common in the literature.

minor negative impacts on the river system; they can be built to withstand overtopping by larger floods and, when they are overtopped, little damage results to the flood defenses.

Unfortunately, the success of minor flood protection embankments has led many communities to attempt to control much larger floods by constructing ever bigger structural flood control works. Potential gains in terms of unrestrained economic development based on newly created flood-free land in floodplains are often irresistible to decision-makers. Hence, the reclamation of wetlands for settlement and farming, the in-filling of natural drainage channels, and the development of extensive communication networks to serve rapidly growing towns in the flood-protected areas went hand-in-hand with proliferation of structural flood control works.

It has been postulated that control of nature is a basic human desire. However, there are possibly as many convincing reasons to state the opposite, that humans in their desire to live with nature, try to reduce the impacts on their lives of nature's unruly extremes. Whichever is the case, the struggle to contain floods has at times taken on epic proportions, as can be seen in many examples such as the attempts to control the Mississippi river in the United States (US) and some of the large rivers in the PRC. Both the US and the PRC have abandoned the goal of *total flood control*, but only after having spent enormous amounts of money on elaborate structural flood control measures. To their great disappointment, they have learned that structural measures provide a false sense of security and encourage unimpeded development in areas where devastating floods will nevertheless inevitably occur.

Consider, for example, the dangers of progressively increasing the height of flood embankments. While low embankments prevent spillage of small frequently occurring floods onto the floodplain, they nevertheless cause a significant rise in water level within the river channel. High embankments magnify this effect such that a minor flood, which would have caused some inconvenience over a broad area, becomes a serious flood in terms of the depth of flow in the river. Elevated flood depths are

Bridge destroyed by flash flood in Inner Mongolia (1998)

The potential gains in terms of unrestrained economic development based on newly created flood-free land in floodplains are often irresistible to decision-makers.

translated over a large length of the river, sometimes for hundreds of kilometers, and thereby place the flood defenses of other remote areas and important towns under threat. The higher the target design period (or design standard) of the embankments, the higher their risk of failure during even moderate floods. Once the goal of total flood control has been set and high flood embankments have been installed along both sides of the river, the conditions are ripe for catastrophic flooding because

- the quality of construction of such embankments is never uniformly good, and the embankments themselves deteriorate with time due to erosion by rainfall, interference by humans (e.g., cutting through embankments to allow for passage of irrigation water in the dry season), burrowing of animals, and road or other traffic along and across the structure; and
- given that the hydraulic design of flood control embankments is not an exact science, a standard freeboard is normally provided to allow for errors in calculation: this means that the actual design standard of any part of the embankment system is not known and the point of least resistance (i.e., where the embankment would first overtop in a larger-than-design flood) often cannot be calculated beforehand.

Protective spurs along the Yellow River flood control embankment (1999)

Flood Management, Not Crisis Management

In many river systems where extensive flood control embankments have been installed, the handling of large floods becomes a process of crisis management because of the uncertainty surrounding the ability of control works to withstand the flood. Not knowing where or when flood embankments may overtop or fail, river basin authorities are forced into a state of constant alert, with large reserves of manpower and machinery kept on hand in case an embankment failure becomes imminent. At any time, a major disaster could be unleashed. Such situations occur with apparently increasing frequency.

There is now a growing realization that the predominantly engineering approach to flood control has not provided its intended benefits in terms of protection from floods. In spite of huge investments in flood control works, some countries are faced with the apparently anomalous situation in which both the flood risk and the damage caused by floods are increasing.[3] This is partly a result of the success of earlier flood control measures, which removed, at least up to the limit of their design standard, the risk of flooding in formerly flood-prone areas. This encouraged further investment and development within the floodplain which, in turn, required ever-larger flood control works to safeguard the investment. When an exceptional flood occurs, as is inevitable, the scope for damage is accordingly huge.

Deficiencies in the predominantly engineering approach relate to its failure to fully integrate (i) means of assuring the safe passage of larger-than-design floods through the river system; (ii) considerations of risk in relation to the flood control embankments, dams, and other structural measures themselves (e.g., risk of overtopping or failure); (iii) considerations of the beneficial impacts of floods; and (iv) the possible effects on flood magnitude and frequency of climate change. In addition, experience has shown that few river basin authorities have the organizational capacity and means to maintain flood control works in a condition of excellence, even when the original construction was of an adequate quality. There has thus been a tendency in developing countries to rely on external funding for reconstruction of flood-damaged infrastructure.

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To overcome the spiraling costs of flood control works and damage caused by floods, many countries have adopted a philosophy of flood management (incorporating the concept of "living with floods") in place of flood control. A good discussion of flood management is provided by the Global Water Partnership's associated program on flood management that was launched in 2001:[4]

> "Flood management is a broad concept that focuses on reducing flood hazards through a combination of policy, institutional, regulatory and physical measures, while recognizing that floods can never be fully controlled. This takes into account the beneficial uses of floods, which are … difficult to quantify in human and economic terms but which sustain natural systems that also have economic, social, cultural and ecosystem values and functions. Consequently, when managing floods within IWRM, it is essential to minimize human suffering and

[3] The Global Water Partnership (GWP) reports that the number of flood victims has increased nearly 7 times between 1993 and 1997—from 19 million to 131 million. Economic losses from flooding during the 1990s were 10 times those of the 1960s in real terms.

[4] The program is a joint initiative between the World Meteorological Organization and GWP. Its mandate is to promote flood management initiatives within the context of integrated water resources management. The program's implementation phase commenced in April 2002.

property damage while maximizing the efficient use of the resources of the river basin. Therefore, trends in national flood losses are not the only guide to the success or failure of the national flood management strategy and for this reason flood management must be considered as part of IWRM and of all the socio-economic decisions related to floods."

Two important concepts are captured in this definition—the realization that floods can never be fully controlled and that floods are part of the natural resources to be considered within the scope of IWRM.

ADB's Water Policy

ADB adopted a water policy[5] for the first time in 2001, reflecting the urgent need to formulate and implement integrated, cross-sectoral approaches to water management and development. IWRM in a river basin context is at the heart of the policy. In terms of flood protection and control, ADB's water policy has the stated aim to

- continue to help member countries reduce economic losses from floods (and implicitly from other natural disasters) and to rapidly restore economic infrastructure and social services after such disasters;
- increase its understanding of the effects of El Niño and La Niña events on climatic patterns (to be able to help ADB's developing member countries anticipate natural calamities and minimize economic and social damage); and
- adopt a proactive approach to reduce the severe economic and social costs of natural disasters by promoting the use of combined structural and nonstructural approaches to flood protection, including flood risk insurance.

The policy promotes the use of combined structural and nonstructural measures of flood protection. In practice, the distinction between structural and nonstructural measures may be somewhat artificial. A more useful way to classify measures could be to consider the impact they have on the flow regime within the river channel and their potential for increasing the risk of failure. Terracing of farmland, for example, is a structural measure whose impact is benign in terms of river flow. Similarly, provision of evacuation roads, flood proofing of houses, raising of the land on which villages are built, and construction of flood retention (or off-stream storage) basins are structural measures having beneficial impacts on the flow regime. Flood mitigation reservoirs help to reduce the volume of water to be conveyed in the river corridor and may (depending on their environmental impacts) be considered benign. These structural measures are distinct from works designed to keep water within the river corridor and which therefore have potentially serious negative impacts in terms of the safety of persons living in protected areas.

The impetus for flood control and for striving to achieve ever-higher levels of flood protection is most likely to come from the more influential members of the community.

However, engineers and project planners do not easily abandon a reliance on the structural measures they have so labored to provide. In spite of this natural resistance to new approaches, the case studies presented at the regional consultation workshops have demonstrated a remarkable evolution of approach to flooding across many parts of the Asian region (see section on *Managing Floods in Asia*), showing willingness to learn from experience and to experiment with new approaches.

[5] ADB's water policy is available for downloading from http://www.ADB.org/documents/policies/water/.

Village located within the "inner" floodplain adjacent to the Yellow River flood embankment (1999)

The Yellow River near Zhengzhou where the width is about 20 km (1999)

Managing Floods in Asia

In 2001, ADB adopted a water policy reflecting the urgent need to formulate and implement integrated, cross-sectoral approaches to water management and development.

Bangladesh is flooded annually over much of its area, and severe floods inundate as much as two thirds of the country. The three major international rivers passing through its territory (the Ganges, Brahmaputra, and Megna) have a combined catchment area equal to 10 times the total area of the country itself. During the regional consultation workshop held in Dhaka from 22 to 26 September 2002, the Local Government Engineering Department (LGED) stated that "total flood control in Bangladesh is neither feasible nor desirable." This lesson was harshly learned from the loss of life and severe devastation caused by the floods of 1988 and 1998 that tore through flood control embankments and swept over vast tracts of the countryside. LGED further stated that "the people living in the flood-prone areas of Bangladesh have long been practicing flood proofing to safeguard their houses and properties.... for Bangladesh flood proofing is the appropriate approach to mitigate the flood." From 2000 to 2002, the Japan International Cooperation Agency assisted LGED in preparing a master plan for rural development focusing on flood proofing. The adopted project includes small-scale flood control works complemented by training and social support systems to generate new means of producing income; and improvement of living conditions through better primary health care, promotion of self-reliance, local participation in community decision making, and flood proofing of houses. Poverty alleviation is an integral part of the project that builds on the participatory approach to introduce self-managed savings and credit programs, cost sharing, and institutional building.

The **People's Republic of China (PRC)** is home to some of the world's largest rivers, including the Yangtze River with a catchment area of 1.96 million square kilometers (km^2) and a total length of 6,300 km. Second to this is the Yellow River which drains 0.8 million km^2 after traveling 5,460 km. Vulnerability to floods of epic scale and severity has made the management of water resources a central preoccupation of the country for thousands of years. Although investments in flood control have increased steadily over the last 2 decades and the number of deaths caused by floods has declined due to better flood warning and evacuation, the damage has steadily increased. In 1998 floods in the Yangtze and Songhua rivers caused about $7.3 billion direct damage and more than 3,500 deaths. The PRC has nevertheless come to the realization that "total flood control is not possible," as stated by the State Office of Flood Control

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and Drought Relief during the national consultation workshop on the Impact of Floods, Drought, and Other Water Disasters on the Poor, held in Beijing from 9 to 11 January 2003. The PRC now promotes reduced reliance on structural flood control measures, increased use of nonstructural measures (including flood damage insurance) and greater use of detention basins and wetlands. Recent and current projects are converting farmland, which had been reclaimed from wetlands, back to its former functions. The China Institute of Water Resources and Hydropower Research stated that "China is now updating its concept from flood control to flood management."

The case study on Design and Operation of Flood Detention Basins on the Major Rivers of China illustrates the potential for reducing the cost of flood control measures while also enhancing environmental conditions and the safety of poor people living in flood-prone areas. During the past 50 years areas set aside as flood detention basins have been given over to agriculture, aquaculture, and many other types of rural development. Along the Yangtze, Yellow, Huai, and Hai rivers, the Government is currently reconverting 98 of these to their intended flood detention functions. The detention basins cover 35,000 km^2 and can temporarily store up to 98 million cubic meters of water. The major problem facing the Government is the disruption caused to the lives of the 18 million people currently living within the basins. The Government is slowly winning the confidence of the people in its ability to mitigate flood risk while also improving the capacity of households to cope with controlled flooding within the flood detention basins.

The **Mekong River,** with a total length of 4,880 km, flows through six countries (Cambodia, Lao People's Democratic Republic, Myanmar, PRC, Thailand, and Viet Nam). Floods, which occur annually in the Lower Mekong Delta, support a highly productive freshwater ecosystem. In Cambodia alone, the annual freshwater fish production is about 400,000 tons, accounting for up to 10% of Cambodia's gross domestic product as well as providing 70% of the animal protein consumed by its population. On the other hand, floods in the last 3 years have affected 1–8 million people, through evacuation, loss of crops and livestock, and loss of work opportunities. Regional cooperation for integrated and sustainable management of the Mekong's resources is being led by the Mekong River Commission (MRC), which finalized a flood management program for the Mekong River in November 2002. This plan builds on the premise that "people have increased the risk of river flooding due to hydraulic interventions, intensive building activities, and the use of flood-prone areas." The MRC's flood management and mitigation strategy has the following overall objective: "people's suffering and economic losses due to floods are prevented, minimized, or mitigated, while preserving the environmental benefits of floods."

Viet Nam's Agriculture Minister Le Huy Ngo stated in 2002 that "floodwaters have inundated the area for the past three seasons—this is a long enough period to review our approach." Farmers in the delta provinces now plant the summer-autumn crop earlier to avoid floods and have developed new models of shrimp and fish breeding suitable for flooded areas. To help reduce the loss of life of children, provinces are setting up childcare centers and programs to raise parental awareness of the extreme vulnerability of children during floods. The case study on Living with Floods in the Lower Mekong River Basin of Viet Nam illustrates the benefits of low-tech measures and traditional coping techniques to enhance safety and improve incomes in a large population of mostly poor people. They experience annual flooding lasting several months. Low-cost loans have enabled many households to raise their houses on piles to be above the highest water level. For deeply flooded areas, landfill is brought in to create elevated flood-free platforms for whole villages. Evacuation roads are included to ensure access during floods and as escape routes. To reduce their risks and improve income diversification, local residents have developed ways of taking advantage of floods for fish breeding and harvesting of aquatic plants for food and shelter. They have voiced a strong desire to create a self-reliant, community financed and managed fund for disaster relief and recovery, rather than to depend each year on donations of relief assistance from the government and charitable organizations.

Insurance helped raise people's awareness of flood risk and the need to manage floods for the greater safety of the community.

Flood Management: For Whom and By Whom

The following table highlights the negative impacts of floods and the persons most likely to suffer these impacts. The table shows that the poor are disproportionately affected by severe impacts including loss of life. They are also more likely to lose their homes, possessions, livestock, and livelihoods as a result of flood disasters. They are also vulnerable to high incidence of waterborne diseases during and after floods.

Such impacts sometimes result from failure of flood control embankments and other man-made factors. The poor, however, are the least likely to be included in any decision-making process relating to flood control and flood management. The impetus for flood control and for striving to achieve ever-higher levels of flood protection is most likely to come from the more influential members of the community, particularly those whose economic activities are threatened by floods. The poor who stand to lose the most are not included, and yet the consequences of decisions made by others are extremely severe on their lives.

Flood Insurance

As a means of protecting the assets and livelihoods of persons living in flood-prone areas and as a tool to discourage unreasonable levels of investment in such zones, flood insurance has enormous potential. The PRC has been experimenting with flood insurance in the Yangtze river basin, where the limits of flood control have been exhausted and the use of flood detention basins had become problematic.[6] Flood control on the Yangtze River is based predominantly on embankments backed up by detention basins designed to be brought into operation when flood levels become dangerously high. Unfortunately, the flood detention basins incorporate highly fertile agricultural land as well as sizable towns and villages. Since operation of the basins for temporary flood storage is infrequent, there is considerable resistance among the affected persons to pre-emptive release of floodwaters into the basins.

Realizing that it is unreasonable and uneconomic to depend solely on structural measures to solve flood problems, and that flood damage losses are too great to be borne by the community alone, a crop insurance program for inundated areas was jointly implemented on a trial basis, from 1986 to 1996, by the Ministry of Water Resources, Ministry of Finance, Ministry of Civil Affairs, People's Insurance Company of China, and Anhui provincial government in flood diversion and detention basins in the Huaihe river basin. Participation was compulsory—the central and provincial governments bore 70% of the cost of premiums and the affected persons the remaining 30%. Following a trial period of operation, in which it was found that the government-backed insurance helped overcome the residents' resistance to utilization of the basins for flood detention, the cost of the scheme was spread more equitably by including beneficiaries living outside the detention basins as contributors.

Insurance helped raise people's awareness of flood risk and the need to manage floods for the greater safety of the community. Compulsory payment of premiums and inclusion of a cap on the amount of compensation that insurers are required to pay also act as disincentives to investment in high-risk areas. Given the difficulty of

[6] The National Flood Control Act of the People's Republic of China stipulates that the Government should encourage and assist in the implementation of flood insurance.

Impacts and Primary and Secondary Causes of Floods

Threat or Negative Impact	Primary Affected Persons	Immediate or Apparent Cause	Other Causal Factors	Potential Solutions
Death or severe injury	- Poor persons living near rivers subject to flash flooding (rural and urban context)	- Intense rainfall for sufficient duration to cause local flash flooding, riverbank collapse, mudslides, collapse of buildings, washouts of roads and bridges	- Failure of flood control embankments - Accidental dam breaks - Deforestation in the upper catchment, construction of extensive paved areas, loss of vegetative protection - Sudden excessive release of water from reservoirs (e.g., to ensure dam safety or for hydroelectricity generation) - Canalization of riverbed (i.e., hard paving)	- Provision of temporary off-stream storage (e.g., detention basins or runoff capture within urban subdivisions) - Provision of flood mitigation reservoirs - Provision of strengthened and well designed flood containment embankments - Provision of better engineered roads and bridges - Provision of flood diversion channels - Provision of flood warning and alert systems - Program of reservoir safety monitoring and strengthening
Death or severe injury	- Poor persons living in floodplains (rural context)	- Intense local rainfall coinciding with arrival of flood peak in the main channel of the river, leading to unusually deep flood levels and possibly accompanied by embankment failure and collapse of buildings, roads, and bridges	- Accidental dam breaks or failure of flood embankments (sometimes both together) - Deliberate rupture of flood embankments - Rapid flood recession leading to collapse of riverbanks and flood embankments	- Restoration of wetlands and provision of other off-stream flood storage or retention areas within the floodplain - Flood proofing of houses and villages - Provision of better engineered roads and bridges - Provision of flood mitigation reservoirs and flood diversion channels - Provision of flood-proof evacuation roads - Provision of flood warning and alert systems - Program of reservoir safety monitoring and strengthening
Death or severe injury	- Poor persons living in low-lying coastal areas (e.g., southern part of Bangladesh)	- Sea level rise and inland movement of waves caused by cyclonic depressions with strong winds	- Clearing of coastal mangroves and other protective vegetation - Failure of embankments protecting against storm surge	- Provision of safe havens (e.g., elevated platforms) and flood-proof evacuation roads - Provision of well-designed and maintained embankments to protect against storm surge - Storm surge warning and alert systems
Homelessness and loss of possessions, crops, livestock, means of livelihood	- Poor persons living near rivers (rural and urban context) and in floodplains (rural context) - Poor persons living in low-lying coastal areas	- Prolonged or deep flooding (less severe than that described above)	- All of the above	- All of the above - Provision of flood insurance
Increased incidence of water borne diseases	- Poor persons living near rivers (rural and urban context) and in floodplains (rural context) - Poor persons living in low-lying coastal areas	- Contamination of wells and other sources of drinking water	- Prolonged presence of contaminated flood water - Spoilage of food and animal feed stocks - Proliferation of pests and vermin in unsanitary conditions following flooding	- Provision of safe drinking water supplies - Provision of food and seed storage facilities above flood level - Public education and provision of emergency medical services during and after floods - Provision of health insurance
Interference with major economic activities	- Owners of large commercial interests in floodplain (direct significant impact) - Regional and national economy (indirect significant impact)	- Large floods causing overtopping of flood embankments and/or damage to buildings, roads, bridges, and other infrastructure	- Accidental dam breaks or failure of flood embankments (sometimes both together) - Deliberate rupture of flood embankments	- Restitution of wetlands and flood retention basins - Implementation of building and land use controls based on flood hazard mapping - Compulsory use of flood insurance

The use of flood control embankments should be accompanied by provisions for releasing excess water.

estimating actual crop losses and property damage occasioned by release of water into detention basins, compensation is paid according to the policy limit of each participant. This eliminates the need to make time consuming and contentious estimates of flood damage following each event.

Experience in the US highlights certain preconditions for successful flood insurance: (i) insurance coverage should be reserved for communities that have undertaken floodplain management programs (including construction licensing, implementation of flood-proofing, introduction of laws prohibiting building in floodways, etc.); (ii) premium rates should be determined in such a way as to provide incentives for appropriate levels and types of development in floodplains; (iii) subsidization of premiums should only be provided for house insurance; and (iv) participation of all affected persons and entities should be compulsory.

Getting ADB's Water Policy to Work

In terms of flood management and putting ADB's policy into practice, it is suggested that the best approach is one that seeks primarily to reduce the risk to human life. This means using the minimum standard of flood control (through construction of flood control embankments, for example) that a community can live with, socially and economically.[7] The use of flood control embankments should be accompanied by provisions for releasing excess water—provisions determined on the basis of hydraulic analyses and selection (in consultation with the affected communities) of predetermined breakout zones. Such zones can be included in the embankments as long overflow spillways, designed to discharge excess water from the river when a flood exceeds a safe level. Alternatively, they could be "fuse plugs" that wash out when flood levels become dangerously high.

The preservation of life and the protection of the welfare of households should be given the highest priority in the design of flood protection works.

Using this approach, a river basin authority no longer needs to adopt a process of crisis management during floods, but rather to monitor and oversee the unfolding operation of safety valves. The specter of unpredictable catastrophic failures would be removed and the community would develop a high level of confidence in such a system. Of course, people do not readily accept the idea of using their land as the emergency flood storage or flood conveyance facility, and this is where the real challenge lies in the introduction of flood management. The use of flood insurance deserves special attention in this context.

ADB's guiding principles for effective flood management are as follows:

- The preservation of life and the protection of the welfare of households should be given the highest priority in the design of flood protection works; flood proofing and emergency evacuation measures should accompany all structural interventions.
- All stakeholders, including both administrators and the general population, which benefit economically, socially, and culturally from the water resources of a river basin, must have a say in how these resources are to be used and conserved. Both must also have a say in how floods should be managed to minimize their adverse impacts while also maximizing their beneficial impacts.

[7] For urban agglomerations, complete flood control may be the only acceptable option. Hence, a suitable solution may involve the use of "fortress" embankments to provide a protective wall encircling the entire urban area. In rural areas, however, much lower standards of flood control are generally acceptable and preferable, enabling farmland to benefit from the regenerative properties of floods.

There is scope in many parts of Asia to make houses less vulnerable to floods, to provide shelters from storm surges and unusually deep floods, and to establish a network of evacuation roads for people and livestock.

- Effective flood management requires a comprehensive approach that balances flood mitigation, environmental conservation, and sustainable utilization of available water resources for the benefit of all people of a nation.
- The conception and design of flood protection should be based on careful analysis of risk so that the passage of greater-than-design floods can be managed in a predictable and safe way.
- Capacity building of the organizations responsible for managing river basins and the raising of public awareness through better education are to be incorporated as effective means of reducing risks and loss of life from floods.
- Flood containment to a high standard of protection is recommended for urban and other densely populated areas where the potential for ever larger losses is increasing due to population growth and large investments in infrastructure and community services.
- To safeguard against catastrophic failure of flood control embankments, particular attention is to be given to construction quality and maintenance, and "fuse plugs" or other means should be included to release excess water before floods reach unsafe levels.
- Many communities have developed traditional means of coping with frequent, low-intensity floods; and flood mitigation projects implemented by governments should incorporate these traditional means where possible to minimize the adverse impacts of floods.
- There is scope in many parts of Asia to make houses less vulnerable to floods, to provide shelters from storm surges and unusually deep floods, and to establish a network of evacuation roads for people and livestock. Similarly, in some parts of Asia, there is scope to use flood forecasting and warning systems. Where appropriate, such low-cost or low-impact flood mitigation measures should be adopted.
- There is also potential in parts of Asia to develop effective and affordable flood damage insurance for crops and property, and this should be used where suitable geographical and socio-economical conditions exist as a means of discouraging unreasonable levels of investment in flood-prone areas and of protecting the assets and livelihoods of persons living in these zones.

Floodwater frozen in place in the Songhua River basin (1998–1999)

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Floods and the Poor

Reducing the Vulnerability of the Poor to the Negative Impacts of Floods

Flood mitigation projects worldwide have tended to follow a standard, top-down, and predominantly engineering approach. This paper suggests problems with that approach, examines water-related disasters from the point of view of affected poor households, and proposes steps to help flood-prone communities prepare and cope more effectively.

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