The World Bank
Investment Note 8.2 - Investing in Flood Control and Management

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In flood management and protection, structural and nonstructural measures need to be balanced in a basin context. The measures often involve sensitive tradeoffs that require well-structured discussion between the main players. The development and sustainability of flood management plans presupposes buy-in by stakeholders, including the poor, and reinforcement of the institutional clout of units favoring nonstructural measures.

Floods affect more people—140 million in an average year—than all other natural and technological disasters put together. From 1998 to 2002, 683 flood disasters were recorded, with most people affected in Asia (97 percent) and the remainder largely in Africa (OFDA/CRED database—see References Cited). Exposure to floods will increase as more people respond to population growth by moving to areas prone to flooding such as floodplains and deltas and as global climate change increases heavy runoff and reduces infiltration.

In many areas, floods are not only hazards, but also sources of groundwater recharge and renewal of soil fertility. Cyclic floods improve water quality, maintain aquatic ecosystems, and sustain inland fisheries. In poor regions, floods are the main source of irrigation water. Investment in improved flood management and preparedness can reduce vulnerabilities and improve the positive effects of floods.

Investment Areas

A broad repertoire of flood management measures is required to reduce the negative impact of floods and improve their positive impact. Structural measures such as flood embankments and storage reservoirs have their place, but absolute protection from flooding is often impossible, unaffordable, or simply undesirable. In many cases, a combination of structural and nonstructural measures and water management improvements offers the best value for money. This combination is summarized as integrated flood management, the process that integrates land and water resources development in a basin, aiming at trading off the benefits from using floodplains and utilizing flood flows against minimizing losses from flooding (WMO/GWP; see References Cited).

Water retention measures improve the capacity of river basins to retain unusual rainfall. In many basins, the original retention capacity has changed, and often diminished, because of deforestation, river training, development of stormwater removal systems, increase in metallic surfaces, blockage of natural drainage patterns, and conversion of natural depressions. Catchment protection, afforestation programs, and mountain stormwater systems slow down runoff and attenuate flood peaks. In West Africa, efforts to integrate road planning and water management, using road levees as barriers, impeded runoff and improved infiltration. In plains, drainage systems play a crucial role in water retention. Drainage systems create soil storage capacity to buffer excess rainfall and runoff. They can slow down stormwater runoff, control water tables, and improve soil chemistry. The benefits of such controlled drainage systems are twofold: improved flood management and increased agricultural production.

Other water retention measures utilize runoff and flood water for irrigation. With measures such as gully plugging, contour bunding, trenching, and recharge wells, monsoon rainfall is controlled in the upper catchments and used to improve soil moisture and recharge shallow aquifers. These programs often trigger individual or small group investments in tanks and wells. Watershed programs in Andhra Pradesh, India, established payback periods of five years or less (Wassan 2004). Water harvesting in high rainfall areas slows down erosive sheet flow and increases shallow groundwater tables, enhancing the reliability of rain-dependent paddy cultivation. In Northeast India such investment had short payback periods (CDHI n.d.)

Spate irrigation systems also use runoff and flood flows. Small and medium-scale seasonal floods from ephemeral rivers are diverted for irrigation. Investments in civil head works have complicated the management of the sedimentation processes and shifted control over the flows to upstream land owners, creating substantial social problems. Different and often cheaper modalities merit preference. Support in the shape of earthmoving equipment to build smaller “traditional” systems is often more effective.

The same argument applies to inundation canals and flood recession cultivation, where a rising perennial river overtops its banks and inundates the banks and plains alongside the river, allowing farmers to grow crops on the residual moisture. Water productivity in flood recession agriculture can be high (box 8.2) and, in several dams in Africa, controlled flood releases are part of the operating procedures to continue capturing this benefit.

Box 8.2 Northern Nigeria: The Floodplain of the Hadejia-Jama'are Basin

At the confluence of the Hadejia and Jama'are Rivers lies a large floodplain. After construction of the Tiga and Challawa Gorge Dams upstream, this floodplain decreased from 300,000 hectares to less than 100,000 hectares. Net economic benefits from the floodplain (agriculture, fishing, fuelwood) were about US$32/1,000 cubic meters of water, whereas return from crops grown in the Kano River irrigation scheme was less than US$2/1,000 cubic meters of water.

Source: World Bank 2003.

Even greatly enhanced retention and storage does not offer absolute protection from flooding. *Measures to mitigate flood impacts and reduce susceptibility to damage* offer scope for complementary investments. They include floodplain regulation, design and location of facilities, building codes and flood forecasting, and availability of controlled overflow areas. They may be supported by robust flood forecasting and warning systems. Disaster preparedness will further reduce the impact of flooding—with coordinating and control mechanisms, supported by information campaigns, the construction of safe shelters, and the establishment of coordinated emergency response mechanisms (box 8.3). The challenge is to maintain rigor during periods when there are no major floods.

Box 8.3 The Orissa Disaster Management Project

In the wake of the catastrophic Super Cyclone of 1999, the Orissa disaster management project introduced flood and disaster preparedness measures in 10 coastal subdistricts in India. The following was achieved:

- Community contingency plans were prepared in 1,600 villages, starting with participatory risk assessment and mapping. The plans called for the construction of school buildings that would double as shelters, installation of raised tubewells, construction of storage for nets and dry fish, road and embankment repair, and alternative building technologies. Mock drills tested the contingency plans.

- The community plans were integrated into subdistrict disaster management plans.

- Local task force groups were created and given training in first aid, rescue evacuation, water and sanitation, shelter management, and carcass disposal.

- A ham radio system was developed for use during emergencies and control rooms were established in the subdistrict centers.

The project was completed in 18 months on a slim budget of US$211,000 thanks to volunteer input. The preparedness measures were successfully activated in the 2001 floods and the 2002 near-cyclone. The challenge is to maintain alertness in years without threats.

Source: Victoria 2002.

Flood protection measures such as dikes, levees, and flood embankments are justified in areas with high population densities, historical heritage, and costly assets and infrastructure. An example is the Sfax Flood Protection project (2289-TUN), which protected Tunisia's second largest city. The year before the project, the city suffered a severe, 1-in-130-years flood that caused US$80 million in damage. This project extended a dike, dug a belt canal around the city center, and rehabilitated natural drains at a cost of US$27.7 million and a postproject economic rate of return (ERR) of 23 percent.