

DHAKA WEDNESDAY FEBRUARY 25, 2009

Adaptation

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design criteria for drainage infrastructure are other adaptation options that can be pursued.

Adaptation to Salinity Problem

Specific physical adaptations for the salinity problem should focus on increasing surface water flows from upstream, re-excavation of river networks, construction of cross dams/embankments to prevent saline water intrusion and increasing local storage of fresh water in the area.

Institutional adaptations for salinity include maintenance and operation of sluices and regulators, groundwater management, land use practice, extension services, and water saving techniques. The first two are management options. Improving maintenance and operation of sluices and other regulators to hold water in areas that are

under increased stress from salinisation is high in priority. In Bangladesh, there still remains a tendency to consider water as a common property. Groundwater management and regulatory operations should therefore incorporate and make use of the difference between the dry and wet seasons in Bangladesh.

Providing incentives to change agricultural practices so that agricultural demand for fresh water goes down can influence land use practice. Therefore, a cohesive approach is necessary with an intensification of extension services to promote changes in land use and farm management techniques. For example, there could be a door-to-door service in providing access to, and information of weather extremity tolerant crops to the farmers and change of cropping pattern in the coastal zone.

Adaptation to Increased Morphological Dynamics

Physical adaptations to the threat of increased erosion would include provision of mangrove greenbelts, cross dams and/or river training works. Mangrove greenbelts in the foreshore areas and along the coastal embankments, and cross dams at the same time enhance accretion. River training works, e.g., through bank protection or strong-holds are confined to the estuarine river branches. All these measures are effective. Cross dams and river training works and their long-term maintenance are basically costly. The high effectiveness and feasibility of mangrove greenbelts are well acknowledged. GOB has undertaken social afforestation program to restore the ecological balance and

to mitigate environmental hazards in the coastal areas. Presently this is found very effective and community participation in this program is very high.

Institutional adaptations would aim at protecting the wetlands & mangroves and land use arrangements (including land tenure laws) & policies. The value of growing mangrove greenbelts is closely related to the effectiveness, feasibility and sustainability of protecting mangroves in existing forest areas (through a combination of enforcement of existing legal provisions, and awareness raising among the coastal population). Protection of wetlands is assessed in a similar way, and wetlands can serve as a buffer against coastal storms and erosion. Another promising approach may be found through community-based adaptation where the community decides on how to share the limited common resources.

Although loss of land and the accretion of new lands are common phenomena in Bangladesh, at present, taking accreted land into culture for either forestry or agriculture falls under the jurisdiction of different ministries. The loss of land and relocation of displaced people needs to be addressed seriously. The mangrove belts could be managed in a much more flexible way. Reform of land tenure laws and policies, would give a sustainable adaptation base to climate change.

Adaptation to More Intense Natural Disasters in the Coastal Zones

It includes construction of new infrastructure such as cyclone shelters, coastal embankments and raised platforms, improved road communication networks, and improved technology of warning and signaling systems and mangrove greenbelts along the entire coastal zone. In addition to cyclone shelters for people, adequate provisions should be made for livestock, food grains and other perishable items. In the past, cyclone shelters for coastal cyclones have helped mitigate risks from cyclones. The size and adequacy of the shelters should be re-examined in the light of increased number of people at risk and the increased cyclone intensity as well. In recent years, over two thousand multipurpose cyclone shelters have been built in the coastal zones. Cyclone shelters are the safe heavens for the people during storm surges and for other period these are used as schools and health/community centers. For livestock and other perishable items, raised platforms (Land fill above the flood levels) of adequate numbers should be built, that can also be used on a multipurpose basis as play grounds, village markets etc.

Embankments need to be maintained on a regular basis. Actual maintenance of the existing coastal embankments is insufficient. A sizeable proportion of the existing coastal embankments is in bad condition, and is already being breached. Therefore

maintenance of embankments is very essential. Under CERP (Coastal Embankment Rehabilitation Project) BWDB recently completed the construction/renovations of about 700 km sea-facing embankments (mechanically compacted). These embankments are found very effective against erosion due to wave rush-up and rush-down. The embankments are maintained well with community participation. For its role in saving lives and property, this has been slotted as a high priority future incremental action. For quick evacuation of people and livestock to the shelters and other safe places from the vulnerable areas during storm surges, road networks need to be improved. In considerations of climate change situation, drainage networks and structures are to be improved and new ones need to be constructed to drain out rapidly the surge water from the polders. It has been found that mangroves and forest belts act as effective barriers against winds and storm surges and facilitate accretion. New mangroves and forests in the fore shore areas, sides of embankment and around the homestead areas should be build. Such activities in Bangladesh need to be streamlined by ensuring people's participation in maintaining and benefit sharing.

Institutional adaptations include improving monitoring, forecasting and warning systems and evacuation procedures, adapting appropriate land use & development policy, and maintaining existing and future coastal infrastructures (embankments, drainage structures, cyclone shelters etc.). These responses relate to an improved emergency preparedness for cyclones and storm surges etc., and could reduce risks to health and property.

Improvement of the monitoring and warning system of tropical cyclones and prediction of the associated storm surges would give more reliable advance warning about the landfall of cyclones. The research on these aspects should be strengthened. Dissemination system of the warning should be improved to alert the coastal residents about the severity of storms. The cyclone preparedness program may be further strengthened and the vulnerable people should be provided with appropriate training for self and community preparedness to face the disasters.

Besides, the forestry and fisheries sectors will suffer severe impacts due to future scarcity of water and reduction of surface and ground water and soil moisture. The high floods and storm surges will wash out the fish and shrimp ponds. The biodiversity will be seriously affected by high temperature, drought as well flood conditions, more stronger cyclones and higher storm surges. From the above discussions, it may be concluded that the impacts of climate change have already knocked at our door and we must wake up and resist these impacts with all of our resources and give our best

efforts to this end. The climate change and future impacts should be studied thoroughly to save our valuable lands, environment and ecology and

keep our country suitable for living.

Dr. Md. Azizur Rahman is Water Resources Expert, DDC Ltd.

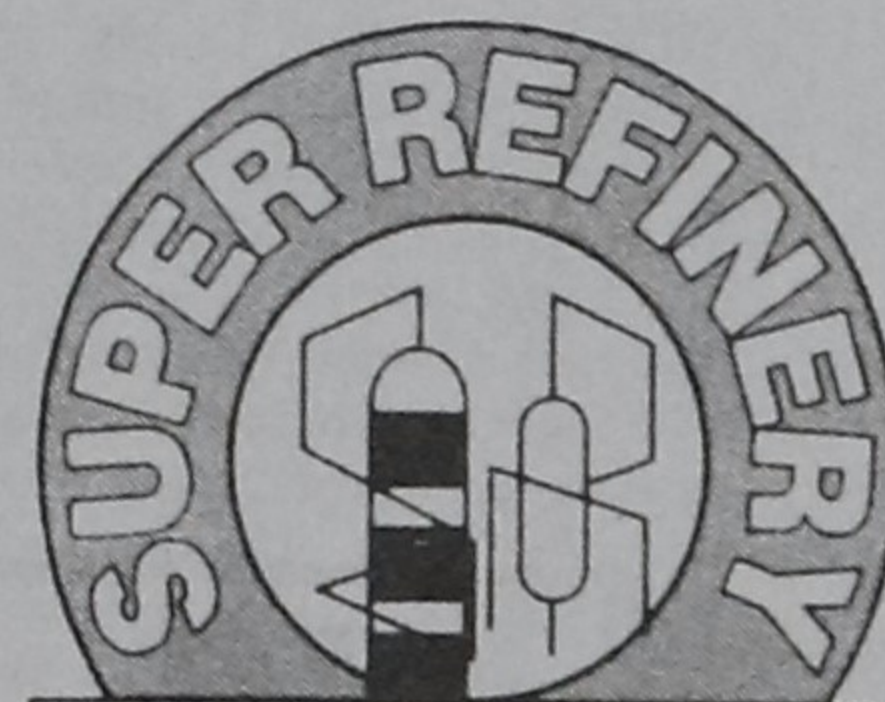
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