

ENVIRONMENT

Climate change and development risk: Local perspective

M. AMINUL ISLAM

CLIMATE change is already happening. Glaciers are melting, sea levels have risen, and cyclones, tornados, floods and droughts are becoming more frequent as well as intense. With rising carbon emission levels, climate change is likely to get worse before it gets better. The anticipated climate change impacts in Bangladesh would be manifested in two ways in two contrasting regions such as (i) the southern part towards the sea will experience drainage congestion due to higher water and river bed levels, salinization of soil and water resources due to lower river flows, sea level rise and more intense disasters including cyclone and storm surges with higher risks because of higher water and (ii) the other part of the country in the north-western region will be subject to scarcity of water leading to drought condition and aridity with lesser rainfall and higher temperature. Tropical cyclones, tornado and Nor'western which strike the country periodically and annually and create untold misery and loss of life, property and ecosystems, are likely to increase in frequency and intensity under climate change. Against this adverse climate change scenario the people have been striving for their livelihood which has already fallen into serious vulnerable category.

Climate change and its variability already emerged as a serious challenge to development in general and poverty reduction in particular. This year, Bangladesh has experienced unnecessary loss of lives due to climatic factors such as (i) too frequent danger signals in sea and communication gap in weather warning system to sensitize the fishermen in the Bay; (ii) land slide in Chittagong due to torrential rains on degraded hills. This country also experienced low crop yield due to unfavourable climatic factors. Current damages are already extremely high. For these not the last but the least reasons, people in Bangladesh need strategic policy and programme for climate resilient sustainable development.

Bangladesh is the most densely populated deltaic country in the world with low lying coastal zones. The coastline of Bangladesh is about 710 km long and coastal zone covers about 23 percent of the country and is critically vulnerable due to sea level rise and salinity intrusion. Such a low lying country, funnel shaped coast exposing the land to cyclones, storm surges, seasonal flooding and drought, salinity intrusion, widespread poverty, large population base and

poor governance have made Bangladesh most vulnerable to climate change. In developing Bangladesh Programme of Action for Adaptation to Climate Change and its consequences, (NAPA), following climate change scenario has been estimated based on available scientific figures as agreed by the experts engaged in NAPA formulation during 2004-6.

Climate Change Scenario for Bangladesh

Year	Temperature Change (°C)			Precipitation Change (%)			Sea Level Rise (cm)
	Annual	Dec-Feb	June-Aug	Annual	Dec-Feb	June-Aug	
2030	1.0	1.1	0.8	5	-2	6	14
2050	1.4	1.6	1.1	6	-5	8	32
2100	2.4	2.7	1.9	10	-10	12	88

Bangladesh will face the following critical challenges: (i) change in spatio-temporal pattern of rainfall with more intensity in south-east region and rainfall scarcity in the north-west region. Bangladesh will experience flooding in wet season and scarcity of fresh water due to less rain and higher evapotranspiration in the dry season; (ii) drainage congestion due to higher water levels in the confluence with the rise of sea level, (iii) river bank erosion, frequent floods and prolonged and widespread drought, wider salinity in the surface, ground and soil in the coastal zone. The mean tidal level at three locations along the coast line of the Bay of Bengal such as Hiron Point, Char Changa and Cox's Bazar has shown an increasing trend of about 4, 6 and 7.8 mm per year, respectively.

Key Impacts

Although globally averaged surface temperature increase and sea level rise are the most certain of the IPCC projections, other effects can be also projected with some confidence. About 20-30 million people live in the coastal areas within 1 meter elevation from the high tide level and these people are in the frontline of the consequences. Over the last three decades since 1973 about 0.17 million hectares (20.4%) of new land has been salt affected. As per IPCC, average precipitation in Bangladesh is projected to increase in the June-August period by up to 12.5 percent in the 2020s and 20 percent in the 2050s. However, variability of temperature and rainfall pattern as experienced this year exhibit early signals of climate change.

This trend of climate change will in turn affect the food security and agricultural production from the perspective of temperature variation leading to change in crop sensitive evapo-transpiration, soil moisture and change in hydrological regime as well as salinity intrusion. Bangladesh scientists estimated that approximately 40 percent of crop yield will be reduced by

The impact of climate change will increase competition for scarce resources in Bangladesh leading to create uncongenial situation placing more stress on the issues of gender equality and women empowerment. Female-headed households, particularly those with little livelihood options, will be subject to tremendous pressure to keep body and soul together due to climate-related disasters.

2050 due to climate change variability. A rise in temperature is

likely to reduce yields of the HVV rice varieties and may cause diseases in wheat. There will be no wheat production in Bangladesh if the temperature increases by 20°C. Crop production is also restrained by excessive water or the lack of it. Various models have been used to predict the crop production. All models predict a reduction, especially, wheat. On the other hand in the carbon di-oxide fertilization will increase the boro paddy production, but at the same time moisture stress will affect this increase. Overall the crop production is likely to decrease endangering food security.

The impacts of such extreme events on human welfare as well as natural ecosystems could be significant. Climate change is likely to have wide-ranging and mostly adverse impacts on human health. The projected increase in the duration and frequency of heat waves is expected to increase mortality rates as a result of heat stress. Climate change is also expected to lead to increases in the potential transmission of many infectious diseases, including malaria and dengue. Decreased availability of potable water will be responsible for increased illness and death cases. All of these factors could lead to increased child mortality, reduced maternal health, and undermine the nutritional health needed by individuals to attain healthy life for sustainable livelihood.

The impact of climate change will increase competition for scarce resources in Bangladesh leading to create uncongenial situation placing more stress on the issues of gender equality and women empowerment. Female-headed households, particularly those with little livelihood options, will be subject to tremendous pressure to keep body and soul together due to climate-related disasters.

The NAPA and the Initial National Communication revealed the fact that a weak economy and

widespread poverty in Bangladesh have contributed to low adaptive capacity to withstand the adverse impacts of climate change. This scenario is further aggravated due to the high dependence of a majority of the population on climate-sensitive sectors, such as agriculture, forestry and fisheries, coupled with poor infrastructure facilities, weak institutional mechanisms and lack of financial resources.

The cumulative factors will lead to retarding the rate of national economic growth. A recent World Bank Study revealed the fact that about 4 percent of GDP is eroded by environmental degradation in Bangladesh. Further changes would push the people now living in coastal, flood plains and dry areas to become climate refugees, vulnerable to extreme poverty and hunger.

Strategies

The core challenge is to prepare an adaptation road map for the government and demonstrate possible strategic interventions in and across sectors, so that a comprehensive action plan of adaptation to address the vulnerability to the impacts of climate change, including variability can be developed which is under active consideration of the government.

The above climate change scenarios are likely to manifest in two types of impacts on Bangladesh. The deltaic topography in the southern region is likely to be vulnerable to sea level rise and resultant effects such as salt-water intrusion threaten agricultural land. In contrast, the drier northern regions of the country are likely to experience increasingly arid conditions and drought which could in turn lead to the displacement of human settlements. This could cause environmental refugees and lead to tension over remaining land and resources. This could contribute towards political and social instability, curbing the ability of the country to feed the population. Other manifestations such as more frequent and severe extreme climate events (including cyclones, storms & floods) will place added pressure on more than a million people who are currently in need of emergency support on an annual basis.

Despite the recognition of adverse climate change impact scenarios, adaptation has not been adequately addressed in



Bangladesh. There is limited progress towards implementing appropriate policies and programmes to integrate climate change concerns into development planning.

The IPCC, as well as the recently concluded NAPA process, highlight a number of issues that must be overcome in order to successfully implement policies and programmes that promote climate change adaptation. They include:

(i) National capacity at policy and programme levels for climate change adaptation yet not build up; (ii) lack of climate risk assessment at different levels as well as comprehensive implementation plans; (iii) inadequate preparation for climate-resilient agriculture and sustainable livelihood options in vulnerable areas; (iv) lack of climate resilient water resource management technologies; (v) need for developing community-based adaptation capacity; (vi) incomplete and un-coordinated (institutional) management systems with overlapping roles and responsibilities; (vii) limited capacity of staff in key local agencies, particularly the analytical, planning, monitoring and evaluation skills; (viii) weak knowledge management infrastructure as well as usage in planning processes; (ix) limited awareness of stakeholders and population on long-term planning frameworks to address climate change concerns and (x) limited development of economic instruments including insurance and other emergency preparedness measures as tools to facilitate improved preparedness for enhanced climate induced events.

These findings are also in line with the on-going National Capacity Self Assessment for Global Environmental Agreements to implement the three MEAs (UNCED, UNFCCC and UNCCD). The above constraints suggest a need to adopt a holistic approach in building Bangladesh's adaptive capacity to climate change.

Climate (variability and) risk assessment at local level shall be realistic to treat risks. As such climate risk assessment at local level using climate impact modelling on one hand and community perceptions on the other shall be instrumental in devising an action plan for adaptation to climate resilient development (variability and) change. The trends of hazards occurring in the area, projected climate impact through climate impact modelling, community perceptions regarding risks, livelihood analysis linking with the climate parameters, vulnerability of the population shall locate risks over time and space. Participatory climate risk assessment and adaptation action plan shall be developed blending scientific information and local knowledge. Organized community at local level involving local government, local level government officers of line agencies, CBOs, NGOs, formal and informal organizations and civil society shall develop the action plan. Coordinated implementation of the action plan shall be through i) community (CBOs), ii) line agencies, iii) NGOs, iv) private sectors and community at large. For example, raising household tubewell above flood thresh-

old could be carried by the community while digging a canal shall be a function of the BWDB, introducing short duration rice variety shall the responsibility of DAE and soon.

Climate resilient development planning shall be demonstrated with the partners in line with the NAPA priorities. Thus climate concerns shall be embedded in the process of government development planning and become mainstreamed. To achieve this, the following broader areas shall be addressed:

Partnership development with relevant line agencies, research institutions, specialized organizations (related to climate information) NGOs, private sectors shall be instrumental in raising awareness, orientation, skill development and most of all ownership by the partners necessary to carry forward climate risk management and adaptation as an integral part of the national development planning process. Focal points established under climate change cell shall be the vehicle to partnership development.

Education, research and training to introduce climate change issues at different levels of the educational system as an ongoing process will ensure a continuity of the process, the development of research activities, and a greater awareness of the citizens. Training will address different stakeholders involved in management of resources sensitive to climate (variability and) change (soils, water, etc.) who will need to understand the nature of climate (variability and) change as well as potential adaptation options. This programme will bring added value to the initiative of Climate Change Cell to facilitate and support building a knowledge management system into their respective organizations to address climate issue in their development planning. This effort shall also facilitate and promote the establishment of a training centre for climate risk management and adaptation.

Knowledge management and social communication shall be continued to support climate risk management functions by all stakeholders at government, NGOs, private sectors and the community at large. Knowledge management shall include knowledge needs assessment to deal with climatic issues, data collection, analysis, synthesis, assimilation, achieving, transactions, knowledge gap filling, and communication at all levels, dissemination and outreach. User driven knowledge management systems shall act as a linking pin to develop desired partnerships among the stake-

holders. This programme will also establish link between climate information providers with the community at risk in pilot cases.

Climate risk assessment shall initiate the process of adaptation. To locate the climate risks over time and space, impact modelling initiated under the climate change cell shall be instrumental. It has to continue to support the development process providing projections of the hazards at a local user level. The hazard scenarios of a defined area developed through modelling overlaid on the livelihood calendar considering vulnerable groups shall pin point the risk to adapt with. Scientific information generated through the modelling shall be validated by the local community and a participatory climate risk assessment and adaptation action plan shall be prepared at local level (district), sectoral level (e.g. water), multicultural (e.g. coastal) and special area based (e.g. EPZ). In the process models of good practices could be replicated as a proven means of adaptation to climate (variability and) change.

Public awareness campaigns: With the growing feeling and evidence that climate (variability and) change is already occurring, there is a need to raise awareness and disseminate information in order to have the stakeholders involved and concerned. These campaigns must also give the opportunity to understand what the perceptions and views of the public on climate (variability and) change and adaptation are. Finally, users networks could be established to ensure the follow up and exchange of experiences between different stakeholders.

Pilot (a) insurance development: Contrary to developed countries that have a good insurance system, developing countries are far behind. However, in developed countries, there is a recent trend for insurance companies just to withdraw coverage rather than work to further reduce risks. Such measures could contribute to the involvement of the private sector in adaptation strategies; (b) pilot demonstration on hydroponics -- floating agriculture in water logged area / wetlands and (c) watershed management.

Strengthening of existing policies, emphasizing the importance of anchoring climate (variability and) change policies on existing coping mechanisms and on the necessity of mainstreaming and adjustment in the institutional arrangements shall be necessary to smoothen the process.

M. Aminul Islam is Sustainable Development Adviser, UNDP, Bangladesh. The views expressed do not necessarily represent the employer.

Conserving natural resources: Biological importance

DR. M.A. BASHAR

IN analysis of ecological studies, it is found that human activities are altering ecosystem on four basic point: (a) selectively destroying species; (b) importing new species; (c) destroying habitats; and (d) introducing xenobiotics. But conservation of natural resources especially bio-resources appears most important in the present world. Conservation of natural resources is essential not only for maintaining natural balance but also for maintaining the economic soundness all over the world.

All natural resources are taken into two types in their category. One is renewable another nonrenewable. The nonrenewable resources are the sources that can be used up completely, or depleted, used up to the point that it is no longer economically feasible to obtain them. The most important nonrenewable resources are fossil fuels -- coal, natural gas, petroleum. These fuels change life dramatically. The resources that are replaced by natural processes or essentially inexhaustible in their uses are called renewable resources. All animals and plants in the planet are renewable resources. Different trophic levels in any ecosystem stand as bio-resources in the nature in different forms. Identification of the resources and the technology-use depend on human intelligence and technology innovation. For example, the main resources for agricultural societies are wood, sunlight, streams of water, and draft animals. Though here sunlight and streams are abiotic factors but they are renewable resources also.

Biological resources in nature can be taken under the heading of forest resources, genetic resources, wildlife resources, and aquatic resources (marine, riverine and estuarine resources).

Forest resources

Forest shows its various resource in different ways. As resource, services of forest are important. Among the range of services the most significant ones are ecotourism, watershed protection, protective and habitat functions of mangroves, carbon sequestration and biodiversity conservation.

Forest is highly demanded for its non-wood forest products (NWFPs). The NWFPs comprise an important, though generally poorly monitored, aspect of forest products. Forest is the source of wood energy. Woodfuels are a basic need for more than 2 billion people in the Asia-Pacific region alone. While woodfuels share in total energy use is declining, the absolute volume of woodfuels used continues to increase. Besides this, in many countries wood energy is still largely considered a traditional "poor people's fuel."

The forest is also used as the source of industrial products-trading. In the region of Asia-Pacific alone nearly about 280 million cubic metres of industrial roundwood is produced annually. Besides all the above, the forest is also directly used as "forest and tree resources" under different headings. They are different types of services of forests, socio-cultural roles and nature-based ecotourism, agricultural services of forests and trees, watershed services of forests, carbon sequestration, conservation of wildlife habitats and biological diversity values, and services of mangrove ecosystems.

Genetic resources

Genetic resource is the key functional point and ethics of origin of all natural and modified bio resources. Man plays a great role on the genetic-flow. Genetic resources are used in the field of variation and variability to protect biodiversity as well as environment by utilizing biotechnological application. The subject biotechnology and its application are not new, but changes in the application are. Biotechnology based on biological systems still plays a dominant role in enhancing the quality of life and livelihood. Recent developments in the biotechnological tools and their application have opened up wide opportunities to boost agriculture, medicine, livestock production, forestry, fisheries, health and nutrition as well as management and protection of environment. Bangladesh has not yet been able to use this opportunity to considerable extent. But this frontier technology can provide substantial benefits to the society in a wide range of sectors for improving the quality of life.

Conservation is the optimum rational use of natural resources and the environment, having regard to the various demands made upon them and the need to safeguard and maintain them for the future. It is the protection, improvement and use of natural resources according to principles that would assure their highest economic or social benefits.



Typical forest full of natural resources (Tangabati, Chittagong)

Wildlife resources

Wildlife resources are important natural bio-resources. Wildlife may be defined as the community of the non-domesticated species of plants, animals and microbes growing under wild conditions, excluding those who have been recently introduced. The wildlife management is the science and art of making decisions and taking actions to manipulate the structure, dynamics and relations of populations, habitats and people to achieve specific human objectives by means of the wildlife resource.

The concern for wildlife is, however, the concern for man himself. All forms of life -- human, animal and plant -- are so closely interlinked that disturbance in one gives rise to imbalance in the others. Decomposers release the energy back into the ecosystem, completing the cycle. Producers, consumers and decomposers are linked together in food chains. Various food chains are again joined at different trophic levels forming complicated food webs.

Description of any particular link in the chain of different strands in the web may lead to imbalance

which may threaten the existence of man himself on this planet. Nature maintains this vast diversity of animals and plants in a complex organization in which various life processes of production, consumption and disposal of waste are maintained in well balanced cycles. Plants and animals constitute the world's living resources and the various food chains and cycles constitute life support system essential for their survival, including survival of man.

Aquatic resources

Water is essential for life on Earth. Within organisms, water provides medium in which the complex metabolic processes necessary for life take place. Organisms simply cannot function without water and if deprived would rapidly die. Streams and rivers provide us with water, electric power, agricultural soil, waste disposal, and valleys that are convenient routes for highways. The stream-sites in many tropical regions act as the breeding ground for aquatic animals including the fishes.

The ocean fuels the water cycle, which provides us with fresh water. It supplies oil, minerals, energy, much of oxygen, and 15 per cent of



Tribal people collect natural water without any contamination just at the base of hills; (Mirsarhai, Chittagong).

our dietary protein. The foundation of the ocean's food chain is phytoplankton. They produce their own food by photosynthesis. The world's major fisheries lie on continental shelves that receive minerals washed down the rivers. Other fisheries lie in parts of the open ocean where upwelling currents carry minerals up from the bottom. Wherever phytoplankton occurs, we also find zooplankton. Fish and similar large animals in the ocean make up the nekton.

Coral reefs are among the most productive of all ecosystems, and they have a diversity of life forms rivaled only by the tropical rain forest. A reef is an area where a rocky out-crop rises from the sea floor. Many prized commercial fishes are inhabitants not of the open ocean but of reefs. Rocky shore supports much more life than a sandy shore.

In some parts of the world, the ocean's tide may rise and fall far up a river or in a coastal marsh. These areas where the ocean penetrates are the coastal wetlands, important for their ability to absorb and disperse pollutants from the land and because many organisms breed in them. Coastal wetlands include

mangrove swamp, found in tropical and subtropical regions, and salt marsh. These wetlands are hatcheries and nurseries of many important species of marine life. In the United States, it is estimated that half of the commercial harvest of the Atlantic Ocean and Gulf of Mexico depend on the coastal wetlands and estuaries. From the worldwide seafood catch, it is found that, in 1950, 21 million tons of fish, shellfish, crustaceans, and mammals were harvested from the sea. Thereafter, the harvest increased by about 7 per cent each year to 70 million tons in 1970, a rate of growth faster than increases in farm production on land. Most experts believe that the oceans could sustain an annual harvest of 100 million tons, but this would require better management than we have so far achieved.

The coastal area of Bangladesh is estimated as 710 km long on the basis of the geomorphological conditions and hydrological feature of the country. This area has been broadly divided into three distinct. These are the eastern, central and the western. Our country has 25.151 sq km of internal water up to baseline. The territorial

water of Bangladesh is 9,065 sq km from base line. The Bangladesh's Exclusive Economic Zone (EEZ) is 14,091.55 sq km. The estimated total marine water area is 1,66,066 sq km. Bangladesh is uniquely endowed with a wide variety of economically important coastal resources. Bangladesh has a vast network of rivers numbering about 230 -- about 24,000 km in length and covering an area of 9,380 sq km (6.5% of the total area of the country). Most of the major rivers have linkage with the estuary and finally meet the Bay of Bengal. Fish is the most important fauna of these rivers and considerable number of fishermen community depend on river fishing for their livelihood. Bangladesh has one of the largest mangrove eco-systems in the world. Mangrove ecosystems also provide a valuable physical habitat for a variety of important coastal species. Waterfowl, shore birds are well known and highly valued inhabitants of wetlands, as are alligators and muskrats. Equally important are crabs, shrimps, sport fishes along with numerous other fish and invertebrates.

Conservation of resources

Conservation is the optimum rational use of natural resources and the environment, having regard to the various demands made upon them and the need to safeguard and maintain them for the future. It is the protection, improvement and use of natural resources according to principles that would assure their highest economic or social benefits. In ecology, conservation includes those measures concerned with the preservation, restoration, benefaction, maximization, reutilization, substitution, allocation and integration of natural resources. In the present time, the term conservation has become an integral part of our everyday vocabulary. The term conservation absorbs principles from multiple directions of basic science and social sciences. This theme includes conservation of history, environmental trends, environmental ethics, ecological economics, policies for conservation, management of natural resources, culture and development and conservation of biodiversity.

Why bio-resource conservation

in Bangladesh is urgent and essential? The answer is very important and significant both for environmental and economic considerations. In Bangladesh, bio-resource is characterized by 'species richness' and 'population-size shortness' features. The population-size per species is very low at present almost in all the cases. If we can go quick for conserving species and their population size, still there is possibility of keeping the ecosystems 'rich in biodiversity'. Then the value of biodiversity could be utilized for the benefit of the nation.

Bangladesh is rich in wide variety of flora and fauna as compared to the rest of the world: Five thousand flowering plants; 199 mammals; 567 birds; 120 reptiles; 734 amphibians. Besides, we have large number of unidentified flora and fauna. Bangladesh is uniquely endowed with natural resource. So, it is highly necessary to conserve both renewable and non-renewable natural resources for the sake of present and future generations. So the management of both renewable and non-renewable resource has to be given top priority. Under the circumstances, any one may like to suggest the following:

1. Comprehensive survey needs to be made to know the exact status of the natural resources. This will help in management of the resources and in promoting environment friendly activities in development intervention.

2. Preserving, protecting and developing the natural resource are the main tools for sustainable development. As such promoting participatory, community based environmental resource management and environmental protection (considering the poor access, equally as well as gender issues); ensuring active participation activities; strengthening the capabilities of public and private sector to address environmental concerns; conserving non-renewable resources and sustaining auto eco-generation of renewable resources; promoting sustainable environment management in pursuit of quality livelihood and alleviation of poverty are needs of the hour.

Dr. M.A. Bashir is Professor, Department of Zoology and ex-Dean, Faculty of Biological Sciences, University of Dhaka.