

CLIMATE CHANGE

Impact on water supply and sanitation

Adaptation is the process which can be created as well as practiced with indigenous or semi-technical heuristic knowledge of community to reduce adverse impacts of climate change on their health, well-being, livelihood and existing ecosystem. Adaptation and structural measures could be fruitful to sustain water supply, sanitation and public health in Bangladesh.

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BDANGLADESH is exposed as one of the most vulnerable countries in terms of adverse impacts of climate change due to its geographical location, hydrological influence of monsoon and regional flow patterns, high rainfall during monsoon while little in the dry season, extreme temperature with scanty rainfall, saline water intrusion, catastrophic natural disasters, etc.

However, water supply and sanitation are projected to be in peril under the impacts of climate change. Safe drinking water is likely to become an acute problem particularly in the coastal belt and in the north-western part (drought-prone areas) of the country for salinity and decline of groundwater, respectively. Intermittent and unexpected annual rainfall as well as

very low water flow in the major river system badly affect the recharging process of the groundwater. It is noted that, only groundwater is used for safe drinking and irrigation purposes in Bangladesh. As a result, groundwater is being polluted by hydro-geologic process that affects, especially women and children, in terms of human health and well-being and safe drinking water.

The impacts of climate change on water supply and sanitation directly affect sustainable development of the country and put at risk poverty reduction, mother and child care, overall public health as well as existing ecosystems. Water supply and sanitation are to be crucially affected by climate change in many ways in Bangladesh. Some are given below:

Rainfall: Since the variation of rainfall will be sensitive in terms of geographic



locations, many areas will endure water logging, turbidity as well as sedimentation problems in the country. Availability of fresh water will decrease due to salt water intrusion and regional rainfall patterns. Occurrence of water-borne diseases will increase while water treatment and water supply infrastructure will face challenge.

Rainfall is one of the most major components for recharging groundwater. Thus, water options could be experienced on seasonal water depth variations in terms of layer status.

Meanwhile, there is acute water stress in the high Barind tract regions, where surface water and groundwater have shown an alarming situation vis-a-vis irrigation and safe drinking water. Increased rainfall brings water borne infectious diseases from one place to another through runoff whereas scanty rainfall often leads to desertification in an area. A number of people will lose year-round access to safe drinking water and sanitation due to increased and irregular rainfall. Thus, recurrent costs for water supply, sanitation and public health will increase.

Temperature: Temperature is also predicted to rise by 0.7°C in summer and 1.3°C in winter by 2030 while it would be 1.1°C in summer and 1.8°C in winter by 2050. If the temperature increases according to the predicted scale, temperature of surface water will be increased and then evaporation will bring increased demand for irrigation. Meanwhile, a number of places are not getting adequate irrigation and drinking water during summer in Bangladesh. Due to these decreasing parameters, public health will be in danger. Increased temperature can be one of the most important reasons for decrease in

soil humidity, top soil degradation, constraint for seed germination as well as overall agriculture that would aggravate livelihood and public health.

Drought: Land degradation has been an ongoing process in the north-western part of Bangladesh where soil fertility, soil nutrients, humidity as well as overall agricultural production are much lower than that in other areas. Drought reduces availability of surface water, leads to over extraction of groundwater, causes decline in recharging processes of groundwater. Moreover, drought leads to low productivity of agriculture that affects livelihoods.

Flood: Flood would be one of the most adverse impacts of climate change in the context of Bangladesh since about 80% of its total area is virtual floodplain. The flood frequency will lead to reduced water quality and increased scarcity of safe water. Risks will be higher for water treatment and supply infrastructure. Symptom of skin diseases, cholera and diarrhea as well as water borne infectious diseases will be exposed and increased. Sources of water points and sanitation could have been extinct, since flood destroys them, and recurrent costs will be higher in this regard.

Sea level rise and salinity intrusion: Global sea level rise due to ice melting induced by global warming is aggravating the uniform cycle of climate of Bangladesh. It is predicted that, the sea

level may rise by 30 and 50 cm by 2030 and 2050, respectively. Such impact will lead to displacement and resettlement of approximately 6-10 million people by 2030 and 20 million by 2050 in the coastal region as climate refugees. The coastal area covers about 20% of the country. Sea level rise and salinity intrusion will reduce fresh water options where already 53% of the area has been affected by salinity. This could increase expenses for water treatment mechanism. Saline water intrusion into groundwater will be increased due to low elevation as well as hydraulic structures. In turn, access to safe drinking water options can be dramatically reduced. This changed physical environment will affect public health issues and coastal livelihoods.

Adaptation is the process which can be created as well as practiced with indigenous or semi-technical heuristic knowledge of community to reduce adverse impacts of climate change on their health, well-being, livelihood and existing ecosystem. However, adaptation and structural measures like integrated water resources management, health, hygiene, and behavioural changes of community could be fruitful to sustain water supply, sanitation and public health in Bangladesh.

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Biodiversity for development and poverty alleviation

Human beings are integral part of nature; our fate is tightly linked with biodiversity. It makes our life soundly possible on Earth, maintaining ecological balance, creating innumerable opportunities for economic well-being, boosting development and alleviating poverty. Biodiversity loss threatens to increase poverty and undermine development.

MUHAMMAD SELIM HOSSAIN

DEVELOPMENT processes and biodiversity are somehow inter-linked (McNeely, 2002). Ecosystem services can shape the development paths of a country, region, or locality e.g. whether it chooses to pursue agriculture, timber production, fishing, tourism or any combination of these or other productive sectors. The world economy and national and sub-national economies are largely dependent on biodiversity. Many developing countries rely on the export of natural resources such as agricultural commodities, raw materials and ecotourism services. In developing countries biodiversity, the natural capital, is estimated to be a quarter of total wealth as compared to 13% in middle income countries and 2% in high income OECD countries.

Agriculture: Biodiversity plays an essential role in supporting crop production. Soil, animals and microbes, together with plant root systems, contribute to maintaining soil structure, and facilitate nutrient cycling particularly important for crop production. Natural pest and disease control through parasites, predators benefits food security, rural household incomes, and national incomes of many developing countries. Insect pollinators are often essential for fertilization of crops species.

Fisheries: There is an estimate that the first-sale value of global fisheries (marine and inland) is US\$ 91.2 billion. Freshwater systems have a large economic value with tropical rivers and inland fisheries estimated to generate \$5.58 billion annually while the goods and services derived from wetlands have an estimated value of \$70 billion per year (Ali, 2002). Recreational fishing is an increasingly important source of revenue.

More than 3 billion people depend on marine and coastal biodiversity for their livelihoods particularly in developing countries where fishing is a main subsistence and commercial activity. A study estimated that one billion people, mostly in low-income countries, depend on fish as their primary source of food. According to an estimate about 38 million people are employed directly by fishing (Ferdinand et al. 2007).

Forestry: Forests are vital to economies, both directly through revenues, value-added and employment provided by the forestry sector, and indirectly through their provision of services such as water supply to agriculture and to industry. Number of people in the world who rely on timber and non-timber forest products is 1.6 billion.

Tourism: On a global scale, tourism accounts for 10% of the job market. Tourism is particularly important for women as they compose 46% of the global tourism labour force. Many of the developing countries rich in biodiversity such as South Africa, Peru, Mexico and Brazil are popular tourist destinations receiving over five million international arrivals per year (UNEP, 2008). National parks, coastal areas, mountains, forests and other ecosystems are tourist attractions. Tourism is one of Rwanda's largest sources of foreign exchange, earning US\$ 42 million in 2007. Namibia's protected areas contribute 6% of GDP in tourism (Hasem et al. 2006).

Ecotourism is a growing sub-sector of the tourism industry and is becoming an attractive livelihood option for rural com-

munities.

Medicines: Biodiversity can help alleviate the national costs of supplying medical provisions in many developing countries. The contribution of biodiversity to pharmaceutical sector is about 20% to 50% worldwide that is derived from genetic diversity. There is also a very large and expanding commercial trade in medicinal plants, involving an estimated 2,500 species (World Bank, 2005).

The widespread reliance of the poor on natural medicines is met largely through the use of locally harvested plant extracts. Traditional medical systems are important globally, and particularly for the world's poor, who have restricted access to formal medical care. An estimated 2000 tonnes of herbs are used annually in India. Many countries, such as Thailand, Sri Lanka, Mexico, and China and India, have integrated traditional medicine into their national health care systems. Percentage of people in Africa estimated by WHO to rely on traditional medicines (plants and animals) as the main source of their health care needs is 80.

Poverty alleviation: For poor countries like ours, it is absolute poverty that always drives our concern. About 70% of the world's poor, particularly in rural areas, depend on biological resources for as much as 90% of their needs, including food, fuel, medicine, shelter and transportation, health, nutrition and for crop development. The urban poor over the world depend on water provision and purification performed by forests and wetlands. For the 1.1 billion people living in extreme poverty, maintaining ecosystem goods and services is critical for daily survival (Kieth, 2000).

When properly managed and governed, biodiversity based assets can yield significant economic benefits, ensure that "the rich do not turn poor", and help pave the way out of poverty. This is the reason why facing the challenge of increasing poverty Zambia has given protecting biodiversity a top priority.

Supporting food and employment: Agriculture is central to the livelihoods of the rural poor and it is the largest economic sector in terms of employment. In Burkina Faso, 92% of the active work force is employed in agriculture. It is also the sector where the majority of the world's poor and extremely poor is concentrated.

Species of crops and livestock and their genetic diversity are the basis of agriculture.

Conserving biodiversity: We need action by all concerned to arrest the loss of biodiversity. And there are things we all can do:

- Knowledge is power. The more we know about the causes, consequences and how to prevent biodiversity loss, the more power we will have to act. Also, our actions will be more efficient and focused. So, biodiversity issue should be incorporated from the very beginning in our formal and informal education systems.
- As we learn more about biodiversity, we need to let others know as well that biodiversity conservation is worth pursuing. We can discuss it among groups we belong to. We can write letters, features in newspaper.
- We all do things every day which directly or indirectly affect biodiversity by putting pressure on our natural systems. We can reduce such pressure by being aware of species at risk and taking action to protect their populations or habitats, creating habitat for them on our own property, avoiding pesticides, herbicides and chemical fertilizers and reducing energy use in homes, businesses, institutions and vehicles.
- Let politicians at all levels know that biodiversity conservation is a critical issue that the government needs to do more about.
- Another important area of action is the establishment of protected areas. It has been estimated that conserving 20-30% of global oceans through a network of Marine Protected Areas could create a million jobs, and sustain a marine fish catch worth \$70-80 billion/year. A study of 80 countries found that fish populations, size and biomass all dramatically increased inside reserves, allowing spillover to nearby fishing grounds. The area of land and sea that is protected has grown substantially in the past years. Still there is a need to extend protected areas, particularly to ecosystems that are currently under-represented or not represented at all. Bangladesh has 18 protected areas to conserve country's biodiversity.
- Sustainable tourism factoring in biodiversity can contribute to



biodiversity conservation and the growth of local economies. For example, tourism is a major source of revenue and support for protected areas and surrounding communities. Public policies and governance involving local and business actors are instrumental in making existing tourism more biodiversity-friendly.

- Agricultural development, based on intensification, globalization, and rapidly improving technology, is a primary factor in poverty reduction and enlarging biodiversity conservation areas. Sustainable agriculture provides food security to the poor and small-holder farmers, offers trade opportunities for developing countries, and restores and improves ecosystems, breeding grounds for biodiversity.
- Community participation is instrumental in conserving biodiversity. Ensuring community participation and management rely on encouraging local people to organise and provide efficient and effective stewardship at low cost.
- Large environmental NGOs, focused on biodiversity and species conservation, need to broker compacts between foreign aid donors from high-income countries and governments of low-income countries pursuing poverty reduction and biodiversity conservation.
- Traditional biodiversity related knowledge has the potential to play a key role

in ensuring the sustainable use of biological resources, ultimately leading to biodiversity conservation. This knowledge is based on the long and close association between indigenous peoples and their traditional biological resources, in many cases maintained over thousands of years.

• Today climate change is a crisis throughout the world. Biodiversity is a root factor in this current crisis because biodiversity both affects and is affected by climate change. So, development strategies and choices need to recognise and systematically include biodiversity conservation in order to achieve economic development and significantly reduce world poverty.

Concluding remarks: Succinctly speaking, Human beings are integral part of nature; our fate is tightly linked with biodiversity. It makes our life soundly possible on Earth, maintaining ecological balance, creating innumerable opportunities for economic well-being, boosting development and alleviating poverty. Biodiversity loss threatens to increase poverty and undermine development. So, biodiversity conservation in a comprehensive way is a must. No more delay! It is time to take actions, direct actions against the continued loss of biodiversity.

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GM CROPS

Contribution to environment, economy and food security

MD TARIQUL ISLAM

GENETICALLY Modified (GM) foods are derived from genetically modified organisms. Genetic modification involves the insertion or deletion of genes. GM crops are also known as biotech crops. The first commercially grown genetically modified crop is tomato (1994). Currently, there is a number of genetically modified food species. Some biotech crops along with their traits are: soyabean (herbicides tolerance, oil content), cotton (insect resistance), maize (herbicides, insects), canola (herbicides, fertility restored, oil content), rice (herbicides, insects, vitamin A, B1), wheat (herbicides, insects and virus resistance), tomato and melon (delayed ripening), papaya, squash, sweet pepper and plum (virus resistance), linseed, sugar beets and alfalfa (herbicides tolerance), sugarcane (insecticides, high-sucrose), rose, petunia and carnation (modified flower colour), tobacco (herbicides tolerance, nicotine reduction).

Global hectareage

GM crops contribute to meeting some of the major challenges facing global society: Food self sufficiency (increasing production and productivity per hectare of national food crops) and food security (enough food for all), more affordable food, sustainability, alleviation of poverty and hunger. The biotech crops are grown in 50,000 hectares, or more in 15 biotech mega-countries: USA, Brazil, Argentina, India, Canada, China, Paraguay, South Africa, Uruguay, Bolivia, the Philippines, Australia, Burkina Faso, Spain and Mexico. The other biotech crop planting countries are Chile, Colombia, Honduras, Czech Republic, Portugal, Romania,

Poland, Costa Rica, Egypt and Slovakia. They produced biotech crops in less than 0.1 million hectares of land. Global hectareage of biotech crops reached 134 million hectares in 2009.

Consistent and substantial economic, environmental and welfare benefits have been generated from biotech crops over the last fourteen years. Millions of large, small and resource poor farmers in both industrial and developing countries continued to plant more hectare of biotech crops in 2009 than ever before. Soybean, cotton, maize and canola were the four major biotech crops. More than three-quarters (77%) of the 90 million hectares of soybean grown globally were biotech; for cotton, almost half (49%) of the 33 million hectares were biotech; for maize, over a quarter (26%) of the 158 million hectare grown globally were biotech; and finally for canola, 21% of the 31 million hectares were biotech.

Contribution to environment

Conventional agriculture has impacted significantly on the environment and biotechnology can be used to reduce the environmental footprint of agriculture. Progress in the first decade includes a significant reduction in pesticides, saving on fossil fuels, and decreasing CO2 emissions through no/less ploughing, and conserving soil and moisture by optimizing the practice of 'no till' through application of herbicide tolerance'. The cumulative reduction in pesticides for the period 1996 to 2008 was estimated at 356 million kilograms of active ingredient -- a saving of 8.4% in pesticides, which is equivalent to a 16.1% reduction in the associated environmental impact of pesticide use on these crops (Brooks and Barfoot, 2010).



The important and urgent concerns about the environment have implications for biotech crops. It can contribute to a reduction of greenhouse gases and help mitigate climate change in two principal ways. First, permanent savings in carbon dioxide emissions through reduced use of fossil-based fuels. Associated with fewer insecticide and herbicide sprays in 2008, this was an estimated saving of 1.22 billion kg of carbon dioxide (CO2), equivalent to reducing the number of cars on the roads by 0.53 million. Secondly, additional savings from conservation tillage (need for less or no ploughing facilitated by herbicide tolerant biotech crops) for biotech food, feed and fiber crops led to an additional soil carbon sequestration equivalent in 2008 to 13.2 billion cars off the road, or removing 6.41 million cars off the road.

GM crops benefit the environment and conserve natural habitat for wildlife. Biotech crops have played an important role in boosting the productivity of existing farm land enough to allow for the protection of at least 400 million acres of prairies, forests and other natural areas

from cultivation over the past decade. These areas provide food and shelter for wildlife and preserve biodiversity.

Economic growth: Potential contribution

The largest increase in the number of beneficiary farmers in 2009 was in India where an additional 0.6 million more small farmers planted Bt cotton which now occupies 87% of total cotton, up from 80% in 2008. The increased income from biotech crops for small and resource-poor farmers represents an initial modest contribution towards the alleviation of their poverty. During the second decade of commercialisation, 2006 to 2015, biotech crops have an enormous potential for contributing to the Millennium Development Goals (MDG) of reducing poverty by 50%. Initial research in China indicates that up to 10 million more small and resource-poor farmers may be secondary beneficiaries of Bt cotton in China.

Rice is the most important food crop in the world. Bt rice can deliver estimated benefits of US\$4 billion per year to up to

110 million rice households in China alone. Increased yield and farmer income from Bt rice can contribute to a better quality of life and a safer and more sustainable environment due to less dependency on insecticides.

In the absence of agricultural growth, national economic growth is not possible in the agriculture based countries. The 2008 World Bank Development Report concluded that, using agriculture as the basis for economic growth in the agriculture-based countries requires a productivity revolution in small holder farming. In summary, biotech crops have already demonstrated their capacity to increase productivity and income significantly.

Food self-sufficiency and food security

During the 2008 price crisis when key food exporting countries, like Thailand and Vietnam for rice, and Argentina for soybean and maize, blocked food exports, trust in the international rice market by importing developing countries eroded. Hence they are now negotiating directly with individual exporting countries; importantly, they are now also engaging in actions that will increase their own productivity and self-sufficiency in the major food staples. Philippines the world's largest importer of rice, aims to produce 98% of its rice in 2010. India, Malaysia, Honduras, Colombia and Senegal have declared similar strategies to achieve self-sufficiency in major foods.

International regulatory standards

Using well-established, internationally accepted standards of risk assessment, regulatory authorities worldwide have reviewed all biotech crops now in the

market and determined that they pose no more risk than crops produced through traditional breeding methods. A proven 13-year history of safe use supports the conclusion that the regulatory process has been successful. Experts estimate more than one trillion meals containing ingredients from biotech crops have been consumed with no reliable documentation of any food safety issues for people or animals. Twenty-five Nobel Prize winners and 3,400 prominent scientists have expressed their support for the advantages and safety of genetically modified foods and crops as a 'powerful and safe' way to improve agriculture and the environment.

Future prospects

Crops are the principal source of food, feed and fiber globally, producing approximately 6.5 billion metric tons annually. History confirms that technology can make a substantial contribution to crop productivity, to rural economic growth, food security and the alleviation of hunger, malnutrition and poverty and of course to protection of environment.

Nobel Peace laureate Norman Borlaug opined that over the past decade, we have been witnessing the success of plant biotechnology. This technology is helping farmers throughout the world achieve higher yield, while reducing pesticide use and soil erosion. The benefits and safety of biotechnology have been proven over the past decade in countries with more than half of the world's population. The Green Revolution and now plant biotechnology are helping meet the growing demand for food production, while preserving our environment for future generations.

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