



## Climate change, agriculture and food security challenges



DR M. ASADUZZAMAN

*Dr M. Asaduzzaman is a former Research Director in BIDS, has a long career in research in agriculture, rural development, food safety, nutrition, environment, water resource management, renewable energy and climate change. He was Deputy Chair of the International Commission on Sustainable Agriculture and Climate Change under CGIAR and a co-recipient of the Nobel Prize given to the IPCC for his contribution as a lead author to the Second Assessment Report. He was also for some time Chair of the Consultative Group of Experts under SBI/UNFCCC*

Bangladesh is one of the countries most vulnerable to climate change and its impacts. Agriculture, which is dependent on human management of natural and ecological factors is particularly vulnerable to such changes. And that in turn jeopardises food and nutrition security of people in the country. On the other hand, many of non-agricultural activities depend on agriculture. These activities thus indirectly ensure food security for those employed and earning income in the related non-agricultural sectors. This general picture of the food security and food system, has for quite some time been under threat from climate change.

### CLIMATE CHANGE AND FOOD SECURITY AT RISK

Climate change primarily consists of two natural phenomena, trend rise in average temperature and uncertain rainfall. Rising concentration of mainly three gases, called Greenhouse Gases (GHGs), carbon dioxide, methane and nitrous oxide, due to various human systems and actions, is the main reason for rising global temperature. The higher release and higher concentration of the three gases are mainly due to human actions and factors, such as burning of fossil fuels (coal, petroleum and its derivatives, natural gas) for industries, power generation and transport which release carbon dioxide and also various other human actions releasing methane (from deep water rice crop production, livestock enteric fermentation and improper waste management) and nitrous oxide due to unbalanced application of synthetic nitrogenous fertilizer in crop agriculture as well as other activities.

Once the average temperature rises and rainfall patterns change temporally over years and between seasons and across global and national locations, many natural processes begin to change, mostly for the worse. Two main natural resources are immediately affected: water—its availability and quality—and biodiversity. Water, in particular, is the key resource whose availability, form, and quality largely determine the first-round natural impacts of climate change.

Floods (including flash floods), river erosion, drought, sea level rise and salinity, cyclones and storm

surges, and landslides are all related to excess or scarcity of water, its timing and spatial occurrence, and their impacts on the economy and society. These disasters are expected to become far more frequent and intensive under climate change, with much greater adverse impacts on human systems. Biodiversity, both plant and animal, is also affected by rising temperatures and changes in water availability and quality. One clear manifestation is the warming, acidification, and deoxygenation of the Bay of Bengal, which has already led to biodiversity decline in marine fisheries and other aquatic resources.

to around 40 mn mt during the last three years. Boro rice cultivated during mainly dry period and wholly dependent on irrigation accounts for 53-54 per cent of total rice output. Aman rice the growth period of which coincides with the rainy season but harvested in subsequent drier months accounts for around 40 per cent of total production. Aus has dwindled to insignificance and accounts for about 7-8 per cent of total rice output.

At least three types of issues have to be considered to understand the impacts of climate change on crop, particularly rice output. First, while

average annual rainfall is much less than in other places in the country drought, particularly prolonged drought during the rainy season is likely to make irrigation (both surface and ground water irrigation) difficult and costly. In fact, even without drought, because of the rise in average temperature due to climate change, higher evapotranspiration necessitates more frequent irrigation than usual which also raises costs of production. In case of the N-E districts, not so much drought but early and higher occurrence of flash floods, a far more likely event under climate change, can damage much

Consider now aman rice. As much of its growth period falls within the rainy season, and given that rain floods, sometime heavy ones, are common in one or other part of the country almost every year which also cause river erosion, aman area and output are likely to fall more and more over time under climate change. Furthermore, if rains fail or drought conditions prevail, this may also create problems of water shortage, particularly during the flowering period around October when rains are much less. Then again, these are the months when cyclones and storm surges including higher water salinity, particularly in the S-W districts in Khulna and Barisal divisions are likely with their occurrence and intensity to be no less under climate change over time than at present. In fact, with rising sea level these adverse impacts are likely to be more intensive. Quite obviously, such trends bode much worse situation in future for people's livelihood including agricultural activities, because of permanent inundation of many parts in the coastal areas in general.

What awaits Bangladesh crop agriculture in terms of lower land productivity than at present over the future years (2030/2040/2050) may be summarised, according to a study, as follows:

Rice: 2.6, 4.0 and 5.3 percent; Wheat: 3.5, 5.1 and 6.4 percent; Vegetables: 2.9, 4.3 and 5.7 percent; Pulses: 4.2, 6.3 and 8.4 percent; Oilseeds: 3.1, 5.7 and 6.3 percent; and Jute: 1.4, 2.2 and 3.0 percent.

At the same time, due to higher temperature, labour productivity may fall up to 11 percent over time. Declining land availability and lower land and labour productivity will mean much lower output from domestic crop agriculture significantly threatening food and nutrition security in coming years unless proper remedial measures are undertaken right from now.



### WATER, BIODIVERSITY, AND CASCADING IMPACTS

The first-round physical climate change impacts consequently affect, mostly adversely, all the human systems including agriculture, industry, power generation, health and physical infrastructure (transport and building structures). Agriculture consists of four sub-sectors, viz., crop, livestock, fisheries and forestry. We concentrate mainly on the first three.

Crop cultivation in Bangladesh is dominated by rice, the staple food, which accounts for more or less 80 per cent of total cultivable land in the country. Over 4 decades, rice output has almost tripled from (13 mn mt

rice is cultivated all over Bangladesh, at present only 8 districts namely Mymensingh, Rangpur, Bogra, Rajshahi, Jashore, Sylhet and Chattogram account for nearly 80 per cent of total rice output indicating primacy of N-W, central as well as the N-E districts (particularly for boro rice). Hence what happens to much of rice output availability from domestic production, food security and prices depends on what happens in these areas during the various seasons.

Given that boro rice is cultivated during the dry season, irrigation is absolutely essential for its cultivation. That means in the N-W districts where

of boro output before or during harvest. As 18-20 per cent of domestic boro rice output comes from Sylhet division districts, such a situation may create major food crises in the country as well as in the region. It may also be noted that as a lot of agricultural labourers from other parts of the country temporarily migrate to these N-E districts during boro harvest, their food security and livelihood will also be affected adversely if such disasters happen.

