Feature — Environment

Global Warming in Asia-Pacific Region

by Karar Mahmudul Hassan

GLOBAL climate is changing because of the build up in the atmosphere of carbon dioxide (CO_2), methane, nitrous oxide (N_2O), the CFCs (powerful greenhouse gases as well as destroyers of stratospheric ozone), and other greenhouse gases produced by fossil fuel burning, by deforestation and by producing food for the rapidly increasing global population. The possibility of a rise in mean sea level due to global warming (or Greenhouse Effect) has caused considerable interest amongst the international scientific community for some time and more recently amongst scientists, government officials and the general public in Bangladesh. The interest in sea level rise as a consequence of the Greenhouse Effect has coincided with a major concern about environmental issues in general in Bangladesh which was triggered by the devastating floods of 1988 and Cyclones of 1988 and 1989.

Bangladesh being a very densely populated (approximately 115 million people) low lying area of only about 144,000 square kilometres on the delta of three major rivers of the world namely the Ganges, the Brahmaputra and the Meghna, is one of the countries most vulnerable to the effects of global climate change, particularly sea level rise.

Possible Scenario

According to a group of experts who convened in Villach in 1987 (WMO 1988), by middle of next century the Greenhouse gases will warm the humid tropical region by 0.3 to 0.5 c and the major effects of climate changes would result from:

Rising water level along coasts and rivers, resulting from a combination of increasing sea-level, greater chance of tropical storm surges and rising peak runoff. These will result in larger areas being subject to flooding and risk of salination. Also:

- Changing spatial and temporal distribution of temperatures and precipitation with effects on industry, settlement, agriculture.
- Grazing lands, fisheries and forests.
- Increase in rainfall in the range of 5-20 per cent, largely through increases in rainfall intensity. This will increase the chances of major floods.
- Since warming will increase the potential evapotranspiration there could be a tendency towards more drought stress.

As Bangladesh has humid tropical climate, the above assumptions have been given due weightage and available data analyses to verify the validity of the above predictions.

Sea-level Change

According to recent estimate, due to global warming the sea-level rise may be about 200 cm by 2030 this could be as much as 1 m by the end of the next century depending upon the future control of greenhouse gas emission. The sea-level change along specific coast will depend on regional and local geological movement as well as global sea-level rise.

Effect of sea-level change in coastal areas: One metre sea-level change will inundate about (22,889 sq km) of existing coastal land which is about 15.8 per cent of the total area of Bangladesh. About 401,600 hectares of mangrove forest along with its wildlife will be lost. The inundation of 2.915 million acres of net cropped land will cause production loss of more than 2.00 million tons of rice, 13,000 tons of wheat, 214,000 tons of sugarcane, 404,000 tons of vegetables, 10,000 tons of jute and 97,000 tons of pulses. The total loss of assets and production in the small and cottage industry sector are Tk 1078 million and Tk 981,553 billion respectively.

- About 10 per cent of country's 115 million population (about 2.05 million households) will be displaced and will not have any option but to migrate to unaffected urban areas and live in perpetual poverty.
- The loss to housing and physical infrastructure will be extensive about 1.9 million houses, 8300 schools, 180 health centres, 1470 km of railways, 10,3000 bridges and culverts, 700 km of metalled roads, 375 food/fertilizer godowns and 1760 markets will be lost. Output loss is estimated to be about 13 per cent of GDP and loss of assets of circa Tk 450 billion (US $14 billion) at 1984-85 prices. These estimates are based on 1988 condition.

Effect of sea-level change in mainlands: Due to back water effect, the sea-level rise will cause rise in water levels in various rivers and streams. The surface water simulation study for 1 m sea-level rise indicates that the water level of Ganges and Jamuna rivers will be affected. As a result, this rise of water level due to sea-level rise, the flood plains and low-lying areas of another 20 per cent and areas of Bangladesh will be inundated and considerable amount of cropland now suitable for transplanted Aman will be lost. Moreover, both the duration and extent of flooding in these areas will be increased.

Effect of sea-level change on mangrove forest: With 1 m sea-level change, the entire 401,600 hectares of mangrove forest (Sundarbans) as well as 36,000 hectares of newly established mangrove forests along the coast will be gradually destroyed. Already, the western part of Sundarbans which have been subjected to a progressive decline of fresh water supply (mainly due to diversion of substantial amount of Ganges water by the Farakka Barrage) has resulted in increase in salinity, which in turn reduced the regeneration rate of sundari in approximately 17 per cent of the stem of *sundari* (One of the two major species) are moderately or severely affected by top-dying. Some 300,000 wood cutters fishermen and others who find a living there at various season of the year, will lose their employment.

As a habitat for wildlife, Sundarban is unique. The forest and the numerous waterways by which it is dissected together support wide range of mammals (including royal Bengal Tigers) birds, amphibian, fish reptiles and crustacean. With 1 m sea-level change most of these animals will lose their habitat and will become extinct.

Effect of sea-level change on salinity intrusion: During the dry season the stream flow of the three major rivers and their tributaries diminish greatly. Their is substantial inland penetration of salinity in the coastal areas through the complex estuarine river systems. This salinity intrusion limits opportunities for irrigation of Rabi and pre-monsoon crops in the coastal fresh water areas and damages the same crops by flooding during high tides.

With sea-level change there will be further penetration of salinity inland.

At this stage, it is extremely difficult to assess the extent of high salinity penetration with reasonable accuracy, however, a very rough assessment indicated that with 1m sea-level change, area of high salinity intrusion will increase from existing area of 13 per cent of Bangladesh land area to 31 per cent. In fact, entire south and south western part of Ganges-Padma-lower Meghna river system will be affected by high salinity penetration. This will reduce the crop-yield substantially in the affected areas.

Damage to coastal structure

The coastal embankment project in Bangladesh is mainly flood control and drainage project comprising of 58 polders. The project features include embankments, drainage cum flushing sluice with change, the water level outside the polders will rise proportionately and consume either part or whole of the free board. This might affect the project in the following ways:

- Embankment height will need further raising to provide necessary free board. The embankment will also need further strengthening to withstand additional hydrostatic and seepage pressures.
- Extension, addition and renovation of the existing structures might be required.
- In case of inundation of polder embankment, culverts and bridges may have to be shifted.

The cost of the above work will require about Tk 18.26 billion (USD 562 million) at 1984-85 price.

Rainfall trend and variability in Bangladesh

The occurrence of series of wet and dry years and their great importance raises the question as to whether identifiable trends and changes in intensity of rainfall and variability exists. Such fluctuations have implications to water resources and agriculture developments. It may be noted that a variation in rainfall will have an effect on runoff change. Hence, the rate of change is likely to be critical. Rapid change in rainfall due to global warming will have very serious implications.

By analysing more than 85 years rainfall data, the results indicate that there is a change in spatial and temporal distribution of rainfall. However, it was not possible to prove whether those changes were due to global warming or not.

But this change in spatial and temporal distribution of rainfall is likely to have short term effect on agricultural productivity through (a) variation in seasonal crop yield, (b) season to season yield variability (c) winter season yield variability (d) variation of yield quality (e) variation of yield responsiveness to fertilizer, (f) carry-over effects from a previous season and (g) combined impact on more than one system that may induce a non-linear response on agriculture output.

Changes in climate is also likely to have long-term effect on agriculture through (a) change in mean yields that are positively related to average seasonal precipitation (b) change in level of crop yield dependability (c) concurrent effect on soil fertility. In addition to the effect of change in rainfall on agriculture productivity of a given location change in spatial and temporal distribution of precipitation will change short-term and long-term shift in the spatial pattern of agricultural potential and risk.

Effect of climate change on natural disaster

Above analysis of the rainfall data indicate that (a) annual rainfall in the western part of Bangladesh is about 1400 mm and if it is more than 500 mm is the northeast region of Bangladesh (b) the amount of rainfall is increasing in the wetter areas and decreasing in the drier areas (c) the co-efficient of variation of rainfall is more in the drier areas as well as during pre and post-monsoon period (d) change in the magnitude of rainfall is mainly due to change in intensity of rainfall (change in frequency of heavy rainfall) (e) on an average about 80 per cent of the rainfall occurs during four months from June to September (f) duration of monsoon period is shortage (about three months) in the western part of Bangladesh than that in the northeast (about 5 months).

Decrease in rainfall, higher co-efficient of variation of rainfall and shorter monsoon period in the already drought-prone western part of Bangladesh is likely to increase both frequency and intensity of drought stress. In all probability drought-prone areas will also extend towards south and south-central region of Bangladesh. Recent trend of floods in Bangladesh appears to indicate that frequency of more floods is increasing. The area affected by the major floods during last 33 years have increased from 50,000 sq km in 1955 to 90,000 sq km in 1988. Moreover, it seems that both magnitude and intensity of rainfall is increasing in the north eastern region of Bangladesh. Although there is lack of access to rainfall data of north eastern part of India, Nepal and Bhutan, it is quite probable that the rainfall in these area have similar increasing trends like that of north east of Bangladesh. If that is the case, it is likely that both intensity and frequency of a higher peak in Brahmaputra will increase.

Storm surge associated with tropical cyclone is one of the serious problems in the coastal areas of Bangladesh. The average annual frequency of tropical cyclones in the Bay of Bengal ranges between 12 and 13, out of which 5 attain cyclonic strength (wind 35 knots). A comparative study of monthly frequency of tropical cyclones in the Bay of Bengal for the period 1891 to 1960 against subsequent 14 year period (1961 to 1974) clearly indicate that monthly frequency of tropical cyclone during latter period (1961-1970) is significantly greater than that of 1891-1960 period. Although monthly frequency during 1975-1988 is slightly less than 1961-1974 period (except for the month of November), but it is higher than the period 1891-1960.

Response strategies and policy recommendations

The possible response strategies to global warming falls in two categories: adaptation strategies which will help to reduce the consequence of global warming and limitation strategies which will enable us to control or stop growth of greenhouse gas emission. Obviously, a prudent response would be to consider both the strategies. While formulating appropriate response strategies it is necessary to consider the following key issues along with possible impact of global warming.

- Population pressure is already intense and will mount further. Thus, dramatic increase in food production is required for which more secure environment is essential.
- Enormous hydropower potential exists in the mountainous upstream of both Ganges and Brahmaputra river systems which should be developed and used regionally.
- Ganges and Brahmaputra river carry more than a billion tons of sediment every year and only a small part is now deposited in the flood plain. Experience shows that this natural sedimentation process can be speeded up with appropriate human intervention. Present practice of flood control by embankment prevent supply of required soil-moisture for the Rabi-crops, recharging of *beels* and ground water, supply of nutrients and the prevailing process of land build up in the low-lying flood plains and depressions.
- Recent study indicates that only 39 per cent of the land which are suitable for forestry, have tree cover. In the Sundarbans between 1959 and 1983, the standing volume of two main species, Sundari and Gewa have decreased in the order of 40 per cent and 45 per cent respectively. Moreover, village forest groves which supply 80 per cent of fuel wood, 85 per cent timber and 90 per cent of bamboo are being gradually depleted.

As the effect of floods, cyclones and tornadoes are more visible than droughts, normally we are more concerned about three types of natural calamities. But to reduce the effect of drought on agriculture more stress should be given to development and introduction of drought resistant crops and more irrigation facilities in drought-prone areas.

For controlling floods in Bangladesh, the upstream stored water would reduce the flood stages in the river flows across the flood plains. Water storage is a powerful tool that can serve winter irrigation and hydropower generation as well as flood control. For short and medium term the construction of embankment with a provision for controlled flooding seems to be the most effective way to achieve flood control.

Koala Conservation

by Chng Soh Koon

Project executant Neil White looking for koalas in the Bremen River catchment area.

FIRST a spot of myth shattering: the koala is not a bear. It closest relative is the wombat, the world's largest burrowing animal, and it has that indispensable marsupial accessory, the pouch.

Last March, the koala was included in New South Wales' first list of threatened, vulnerable, and rare species. Though not considered endangered, koalas in New South Wales and other areas could easily be phased out by habitat loss. The move marks a proactive trend in conservation. Why wait for a crisis before you protect an animal?

Starting in 1989, WWF-Australia funded a koala study project that ended this April. The results form the foundation for a long-term koala conservation management programme now being planned. Using radio tracking devices, the project monitored some 40 koalas in the Bremen River catchment area, 100 kilometres from Brisbane, to study their social systems, breeding habits, susceptibility to diseases, and habitats.

"The main threat to the koala is habitat destruction," says project executant Neil White, who is writing the koala management plan. "There is still a major drive to open up the country and make it productive with crops and cattle."

One ideal koala habitat White had chosen as a study site was cleared for cattle grazing before he could start work.

White believes that with better farmland management a balance can be struck between agriculture and koalas. — WWF

Koala Facts

Name: Phascolarctos cinereus
Family: Marsupial
Homeland: Southeast Australia

Appearance: Thick fur insulates them from temperature extremes. In the north, they have short brown fur and weigh up to six kilograms. In the south, they have long, ash-grey fur and can reach 13 kilograms.

Diet: Not only eucalyptus leaves, as most people believe. They happily eat acacias, kapok, and native cherry leaves, among others.

Social: Koalas sleep and lounge 19 hours a day. They eat between dusk and midnight and move mostly at night. Koalas lead solitary lives, meeting other koalas only to mate, care for young, and defend territory.

Breeding habits: Females produce one offspring a year. Gestation period is about 35 days. At birth, the koala is a hairless, half-gramme, peanut-size thing and lives in its mother's pouch for seven months.

To keep the koala safe, protection needs to start now.

Environment : "Acting" Locally?

by Dr Mohiuddin Farooque

THE topical concern with environment evolved as a consequence of two evils representing inconsistencies of extremes of human life, i.e., too much and too little. The interface of these polarized situations defaced life and its institutions. Some have too much wealth, luxury, technology, power — others too little; some talk too big but translate too little into action; some change tones in tune with place, people and time. In short, the total scenario seems full of inconsistencies that often breed conflicts.

The famous UN slogan on environment is: "Think Globally, Act Locally". Being motivated, we began to "travel globally" while "acting" locally. The big talks are not being materialised and the few visible performances are often misleading, incompatible and unsustainable. Often we race for the pride of signing international treaties which are not ratified to ensure enforceability.

It is clear that no activity can be sustained unless carried on within a sustainable framework. This pre-condition requires a sustainable regulatory regime that signifies realistic and consistent policy direction, strategy, legislations and the institutional mechanism, where one component supports the other for achieving the target. Unfortunately, in Bangladesh, a component is changed without making adjustments in other related components, and thus, the target to be achieved is often frustrated.

The situation is virtually crippled by the legacy of institutionalised colonial traditions. The cheapest means are usually deployed in governance as eye-wash in the name of achievements. Sincerity of leadership is frustrated by the often unaware incompatibility in the regulatory regime. As such, many expensive activities are undertaken in ad hoc style although their impact may be perpetual or irreparable.

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There are many examples. Take the case of afforestation, reforestation or tree plantation campaign. Firstly, a wrong impression has emerged nationwide as if environment means or significantly implies to tree, and chopping it is tantamount to killing a relative! Secondly, the tree plantation campaign is the same wine in old bottle with a new label. The common households are still the largest forest producer. So, such campaign must be directed primarily towards those responsible for the destruction of our public and traditional forest resources. Thirdly, the present Forest Policy as well as the Environment Policy are incompatible to private and participatory forestry, yet the campaign inconsistently continues. Finally, the existing legal framework is excessively restrictive and vests almost arbitrary authority on concerned administration in dealing with forestry and forest produce. Although there is a Private Forest Ordinance, 1959, the State Acquisition and Tenancy Act, 1950 (SAT) declared that all "lands consisting of forest" are non-retainable under private ownership and as such must vest with the State. Then why is that Ordinance? Will the people loose ownership of their lands if they succeed in generating forests?

The 1927 Forest Act does not empower the Forest Department (FD) to adopt the current participatory forestry programme called, Thana Afforestation and Nursery Development Project. Its legal sanction is ambiguous and one may question under which provision of the law the FD has formulated the sharing-contract models which are being used or misused.

Similarly, many of the non-government initiatives on afforestation may suffer due to the limitations of the prevailing regulatory framework including the socio-legal status of the lands and strips on which these have been undertaken. Worth mentioning that most of the rural earthen roads have been constructed on private lands not acquired by law.

Sometimes the lease period of the land does not match with the rotation period of the planted species. Another crucial issue is the sustainability of the NGOs who almost act as the institutional and psychological guarantees for the local participants in relation to other partners. What would happen if the parent NGO institutionally collapses?

There are many other examples like the eloquently expressed concern about the wetlands which are legally defined either as waste land if not been cultivated consecutively for certain years or used as fisheries. The Constitution envisioned radical rural transformation through "agricultural revolution" as a fundamental state policy which requires that every inch of land be brought under agriculture! The Wild Life (Preservation) (Amendment) Act, 1974 still stray around as an orphan. The public institutions dealing with environment are themselves denuded with too many odds. Enforcers are often the law breakers — who would enforce against them? And for the illiterate 80 per cent of the population, "ignorance of law is no excuse" — what a travesty!

Time is running out fast for Bangladesh. Procedural changes in human and institutional behaviours are essential to sustain the preaching and deeds within an effective framework. For that everyone has to be persistently consistent in preaching and performance without pretence and prejudice. It is a folly to treat environment as a "saving monkey". Let's mean it, do it and manage it together because environment is like democracy where everyone has a role: either as a protagonist or a villain.

The Forest Killing Fields

War-ravaged Cambodia was also witness to an environmental massacre. **Bala Chandran** of Inter Press Service reports.

CAMBODIAN officials discovered more 'killing fields' while flying over the country's western region recently. But this time, the victims were not people, but Cambodia's trees.

The severely denuded forests in the country's western provinces are witness to the indiscriminate chopping of trees during Cambodia's decades of war.

Although the Indochinese kingdom still has one of the largest forest blocks in Asia, the United Nations has warned it could lose most of its forests in five to ten years.

Environment Minister Mok Mareth, a French-trained biologist and agronomist, laments the "environmental catastrophe" in the country's west, where large tracts of land have been stripped bare through logging and gem mining by Khmer Rouge guerrillas.

The Khmer Rouge, who had reneged on the agreements of a peace pact that led to the formation of a new Cambodian government this year, is said to have raked in several hundred million annually from secret deals with Thai loggers and precious stone traders.

The guerrilla group intensified their logging activities late last year in an effort to beat a UN deadline on timber exports that took effect last Dec. 31.

About 1.5 million cubic metres of Cambodian timber found their way out of the country in 1992. The UN Development Programme (UNDP) puts the stump extraction value at just over US$90 million, and the international market value at about US$165 million.

But even before the Khmer Rouge went into a logging frenzy, Cambodia's internal strife that began in 1970 had already taken a heavy toll on the country's environment.

Two-thirds of Cambodia had been covered by dense rainforests almost 30 years ago. Now, less than half remains, and only a quarter is primary forest.

Forestry experts contend much of the wartime deforestation took place during the four-year reign of the Khmer Rouge in the late 1970s. The guerilla group had then tried to turn the whole country into one big rural commune.

Instead, it turned Cambodia into massive killing fields, causing the death of more than one million of its people and destroying much of the country's environment.

These days, massive deforestation is silting up the Tonle Sap Lake, with devastating effects on the region's fishing and farming sectors.

Measures to avert the damage came too late. Even the UN ban on Cambodian timber exports proved almost impossible to enforce because the country's four rival factions, including the Khmer Rouge, held control over their own areas.

Although all factions agreed to the ban, they continued to violate it to raise badly needed funds to finance their own political and military activities.

Neighbouring Thailand, Laos and Vietnam, while officially supporting the UN ban, continued to buy Cambodian timber. Japan also clandestinely imported logs from the country.

Now that three of the four factions are part of the new coalition government, its has become a little easier to deal with the problem. But talks with the Khmer Rouge, which dropped out of the peace process before the UN-organised elections in May, have made little progress. Thus, the government must now look for other steps to keep the nation whole and protect its forests.

Mok Mareth says a total ban on logging is the best solution, but the country needs wood as a source of revenue and energy. "We need wood to cook our rice. We do not have any other source of energy," says the environment minister.

His problem is confounded by the fact that environmental protection is an entirely new concept for the government and the people of Cambodia. "A good part of our population does not even know the Khmer word for environment," he says.

But the new government, headed by re-installed King Norodom Sihanouk, has tightened logging contracts with the help of United Nations agencies.

"Until now, contracts with foreign logging companies consisted of a few pages," says Mok Mareth. "Now they are thick as a book."

But the minister knows this is not good enough. "Not even the best legislation can protect our environment. It all depends on our leadership to actually enforce it."

The Ministry of Environment has the clout. It was formed on the orders of then Prince Sihanouk in July to advise the national leadership on environmental policies. But, says Mok Mareth, "We don't want to be just an advisory body. We can only be effective if we are very close to the leadership."

His ministry is now working closely with the ministries of finance, industry, mines and energy, transport, agriculture and health to formulate the policies.

It has also imposed stricter policies in dealing with violations of logging rules. Says Mok Mareth: "A single breach of conditions and the contract will be annulled within 24 hours."

He also stresses the importance of public cooperation,and has asked some 200 specialists in fields ranging from hydrology to mathematics to help in a massive education campaign on environmental issues, starting with primary schools.

The environment minister says Cambodia hopes rich countries will contribute funds and expertise to help stop the massacre of its trees.

CAMBODIA'S MASSACRED FORESTS