

SEA LEVEL RISE

Local action for global challenge

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THE broad objectives of the Fourth World Water Forum of the world leaders and water professionals organised by the World Water Council, a think tank, in Mexico are (a) to actively promote the participation of all stakeholders, (b) to reinforce the conviction that local actors facing main water management and implementation challenges, (c) to actively seek to remove the barriers obstructing local action, and (d) a regional scheme in order to foster regional debate geared at addressing regional challenges. The known challenges of the day that indeed began in encounters for survival on earth are many but the first amongst the equals is the sustainable utilisation of natural resources. The forum has given more emphasis on the local actions for meeting the global challenges.

The First Forum together with the government of Morocco was held earlier in March 1997. The Marrakech Declaration described how the Council aims to develop the vision as " building on past international efforts and relying on the collective wisdom and resources of the global community, the process leading to the Vision will include research, consultations, workshops, print and electronic publication and many other means for absorbing, synthesizing and disseminating knowledge. At the conclusion of this process, fully aware of the pitfalls along the way, the Vision will offer policy relevant and region and country-specific conclusions and recommendations for action to be taken by the world's leaders to meet the needs of future generations". The follow-up in March 2000 in The Netherlands, the Hague Declaration at the Second World Water Forum to achieve water security defined the challenges as meeting basic needs, securing the food supply, protecting ecosystems, sharing water resources, managing risks, valuing water and governing water wisely. The third one in Kyoto, Japan in March 2003 identified (i) safe drinking water and sanitation (ii) water for food and rural development (iii) water pollution prevention and ecosystem management (iv) disaster mitigation and risk management, and (v) water resource management and benefit sharing as the issues concurrently with a view to achieving sustainable development, building upon achievements

at the World Summit on Sustainable Development (WSSD) held in Johannesburg. Along the journey the climate change issue is seen moving forward from forum's fringe to centre.

The Earth in its 4.5 billion year life has experienced many changes. These changes have always been adapted in itself by the Earth. Human beings on this planet have coped with numerous forms of climate induced impacts and disasters but not particularly with the warming of planet at the speed and scale that is currently occurring and is expected to increase over the next decades. The Kyoto Protocol in order to prevent climate change threats has been in force only recently in February last year and shall terminate in 2012. Two countries of which USA that did not ratify the protocol pretends the climate change is not a reality and the other, Australia, reconfirms that atmospheric temperatures are increasing, oceans are becoming warmer, sea levels are rising, and rainfall patterns are changing. Again, the Millennium Ecosystem Assessment conducted by 1,360 experts from 95 countries concluded that about 60 per cent of the ecosystem services that support life on Earth are being used unsustainably. An unsustainable utilisation of natural resources is the cause of the climate change. The climate change accordingly has become a major and long-term environmental threat for Asia due to its high vulnerability, limited adaptive capacity and relatively poor institutional and human capacity. The design of a country's climate regime, therefore, will have significant implications on realising the vision and efforts of a sustainable utilisation of natural resources.

No country may however escape the impacts of climate change. Increasing numbers of people will be affected by flooding. The number of people already affected by floods annually has risen from seven million in 1950s to 150 million now. Most of the two billion people vulnerable to increases in floods due to climate change and population growth by 2050 will incidentally be in Asia. The World Health Organisation estimates that climate change is responsible for killing 150,000 people every year across the world. FAO estimates agricultural land loss due to climate change could cost as much as \$56 billion per year. The same organisation

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Melting glaciers, rising sea level: Hard time ahead.

has recently warned that climate change will increase world hunger. Climate change in another word is the monster black-shadowing the earth's surface.

The main threats associated with climate change are: (i) increasing temperatures, (ii) rising sea level, (iii) more acidic ocean, (iv) changing patterns of rains in the dry and wet seasons, and (v) changing intensity of tropical cyclones. According to the Inter-governmental Panel on Climate Change (IPCC)'s 2001 estimate, the global sea-level rose by 10 to 20 centimeters over the last century. It further estimates that a 1.4-5.8 degree Celsius warming by

century's end would raise sea levels by 88 centimeters, changing coastal settlements. Rising sea levels will rise further. Eventual dwindling flow will reduce hydro-electric power generation and disable irrigation, impacting world food production. The changes in the pattern of precipitation rates will also result in more frequent droughts and floods. The low-lying deltaic regions will immediately face two consequences: first, structures located unprotected will permanently be inundated, and second, the rise in sea-levels will intensify the erosion rates risking further the foreshore and back shore structures. Global warming

is thus termed as global warning.

Hydro-morphologically dynamic and aggressive but resourceful coast of the deltaic Bangladesh in South-Asia is at high risk of climate change impacts. Research carried out by the Meteorological Department revealed that from 1961 to 1990 the annual average increase in temperature is 0.0037 degree Celsius. During these 30 years, increase in annual average rainfall has been 4.9323 mm. From 1990 to 2000, the rate of increase in temperature is comparatively higher, i.e. 0.0072 degree Celsius, while the average annual rainfall during this decade has decreased remarkably. Rise in sea level by 7.8

mm per year on the south-eastern coast has also been evidenced in the study. The world forums have not led to actions on prevention of climate change sufficient to change this trend because the regional and local leaders are perspiring at home with problems of priorities. So is in Bangladesh.

Nevertheless the people are experiencing nature's strange behaviour. The loss of non-mangrove forestry in Kuakata on the south-west to the Bay is one example. The landward expansion of sea water irrigation in the salt farms and shrimp fields in Teknaf in recent times is another indicator of sea level rise. By thumb rule the sandy shoreline will retreat about 100 meters for every meter rise in sea-level, which clearly signals huge submergence and loss of country's land mass. At least four million coastal populations will be subjected to saline flooding and more two million already living in the flood plains will simply multiply the degree of insecurity to their lives and properties. Sandwip, Hatya, Kutubdia, Moheshkhali and Bhola islands including many other stretches of shores are under continuous erosion with the rising sea level that triggers poverty.

The sea defence system developed across the northern tip of the Bay of Bengal over the last 50 years that pushed the bay past its limit raising confrontation between human and nature has now become vulnerable to sea level rise. The backshore is currently protected from minus-climate induced hydraulic events by this 654-km sea-facing embankment beached between the high and the low tide lines. The coastal settlements are protected by a cluster of 123 polders and nearly 2000 shelters supported by a proven effective system of disaster management under limited conditions. A

broader view of the multiple stresses on coastal waters shows that there is a need and an opportunity to address simultaneously the current adaptation deficit and to incorporate adaptation to reduce future stresses due to sea level rise. Imaginable adaptive measures for Bangladesh are sea walls, water drainage, relocation, afforestation and, overhauling of the existing coastal infrastructures including altering agro-economic practices; albeit not all of them are within affordable means.

Keeping in relevance with the sea level rise, local action consisting of several engineering trials on redressing the saline embankments was taken up for its adaptability to sea level rise. Over the years 2000 till 2004 trials have been implemented to investigate the effectiveness of low cost designs with regard to adapting to sea level rise and corresponding erosion. In carrying out this, a bottom up approach was applied: learning lessons from a trial, improvements were introduced to acquire knowledge and confidence. The technical design of two ultimates have been such that it has now been able to stop erosion of the sea-side slope of the embankment and in future it can also be geometrically adjusted to adapt to with the increasing sea level.

The blanket of interlocked hollow octagonal concrete units laid over the sloping soil with toe-shoe was found effective to protect soil particles from taken away by the rush-ups and the rush-downs. It has been learned that propagations of toe erosion, unlike the slope failure, are the gouging of embankment fills by the erosive forces of tidal waves. The in-place version of the design of the embankment is flexible and compatible to hydraulic events resulting from the rising sea levels. Such intervention has reduced the annual operation and maintenance cost by its distribution over a period of at least 20 years. Bangladesh has no option of any retreat from its current line of coastal defence rather withhold at the same location to protect the nation's coast from the impacts of sea level rise. Compared to the traditional hard protection using concrete blocks or stone boulders with geo-textile filters the cost ratio is 1:10. Further

research may bring in an improved version of the composite technical design of the embankment.

Adaption to changes in the coastal zone in the past has all along been a demand driven effort by private and public initiatives. Accelerated changes in the global climate have now led to double-stress upon the local action for adaptability. The local action for adaption to sea level rise is primarily obstructed by the very mindset of the water engineers feared of shift from traditional concepts to innovative ideas. The top policy and decision making process is indifferent to research oriented innovative actions that bring benefits only in the long run. Public investments therefore are routinely directed towards what can achieve the immediate political gains. Private initiatives are poverty driven agro-economic based social practices availing of the opportunities from and coping with the adversities of the sea level rise. Despite inadequacy of understanding, awareness, realisation, capacity and, largely, the limitation of resources, the local actions may redesign the ongoing efforts tailored to adapting sea level rise based on lessons learned -- what may eventually partially circumvent the negative effects.

The initial step may be identifying the location, type, nature and degree of erosion and then group-mapping in order for relative ranking to fix the priority in terms of its severity, management capacity and resource availability. Water professionals may so start recognising the sea level rise and draw up a long term plan for initiating appropriate actions for meeting the global challenge.

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