

Full Length Research Paper

Impact of Climate Change in Bangladesh: The Role of Public Administration and Government's Integrity.

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Climate change is one of the most important issues to tackle this generation and possibly any generation in history. Bangladesh is a very low energy consuming country, it is pursuing a low carbon growth path, while building its resilience to climate change and reducing the risk of climate change, which represents national development. However, Bangladesh is one of the top 10 nations that are mostly vulnerable to climate change and by the end of the century, Bangladesh may be set to disappear under the waves. The government and non-governmental organizations have a key role to play. This study was carried out by employing a general review of literature on climate change, focusing on its effects in Bangladesh, and the results of specific research recently conducted by the author.

Key words: Poverty, population, migration, government's integrity.

INTRODUCTION

Climate change is the biggest global health threat of the 21st century and is increasingly recognized as a public health priority (WHO, 2009; Lancet, 2011; Young et al., 2002; Yongyut, 2009). Climatic variables are vital environmental factors, which establish ecological niches of tree species and their patterns of distribution (Avise, 2000; IPCC, 2001; Yongyut, 2009). Species-distribution models (SDMs), and forecasted global climate data, indicated that up to 43% of a sample of tree species in Amazonia could become non-viable by 2095 (Peralvo, 2004; Yongyut, 2009). The objective of this paper is the actual situation about the real impact of climate change and vulnerability to climate change and their negative impacts in public health, environmental resources, such as, water and air quality, temperature increase, poverty, natural disasters and other subjects, especially in Bangladesh. Outcome of the paper could be used as an important tool for actions in environmental/ ecological conservation by the government of Bangladesh.

Human induced climate change threatens ecosystems and human health on a global scale (IUCH, 2010). Climate change will have its greatest impact on those countries, who are already the poorest in the world, and it will deepen inequities, and the effects of global warming will shape the future of health among all peoples. Nevertheless, this message has failed to communicate

most public discussion about the climate change (The Lancet, 2011). During this century, earth's average surface temperature rises are likely to surpass the safe threshold of 2°C above preindustrial average temperature. Rises will be greater at higher latitudes, with medium-risk scenarios predicting 2 to 3°C rises by 2090, and 4 to 5°C rises in northern Canada, Greenland, and Siberia (Costello et al., 2011). The average temperature of today's world has already increased by 0.6°C from the middle of the 1800s. In the last century, average temperature of earth has increased by 1.5 to 4.5°C leading to melting of polar and mountain ice and thus sea level rise. It has also been shown that if climate change continues unabated, in the year 2050, production of rice will decrease by 8% and that of wheat by 32% (Daily Star, 2011u). An update on the IPCC's fourth assessment, identified that if there is no action to cut emissions, there is a potential for a temperature rise as much as 7°C by 2100. The fourth assessment report of the IPCC in 2007 also concluded that it was "unequivocal" that the Earth is warming and that human activities play a role in this change. Over the last 50 years, "cold days, cold nights, and frost have become less frequent, while hot days, hot nights, and heat waves have become more frequent." The linear warming trend over the last 50 years of, on average 0.13°C per decade, is nearly twice that for the

last 100 years. The total temperature increase from the period 1850 to 1899 to the period 2001 to 2005 has been 0.76°C (New Nation, 2011a). Hasnain (2000) and WWF (2005) mentioned in their studies that since the mid 1970s, the average air temperature measured at 49 stations of the Himalayan region rose by 10°C with high elevation sites warming the most (New Nation, 2011b).

A recent review, published in *Nature Geoscience*, suggests that with elevated atmospheric carbon dioxide levels, it has been anticipated that additional greenhouse gas emissions from soils, forests, and wetlands, leading to more warming (Global Change, 2011). According to the International Panel for Climate Change (2007), an increase in the average global temperature will lead to changes in precipitation, and atmospheric moisture due to the changes in atmospheric circulation, and increases in evaporation, and water vapor. It was further supported by two new studies published in the British journal *Nature* (New Age, 2011a). The ecological interaction of cities and their hinterlands is a recurring theme. Rapid urbanization and climate change have given it a new impetus and sense of urgency. Expected population growth and migration mean that urban expansion will be the most common and universal development challenge. However, urban expansion can take the form of urban sprawl; it is then costly, wasteful, and ecologically destructive (Anna, 2011). By 2050, the urban population of the developing world will be 5.3 billion; Asia alone will host 63% of the world's urban population, or 3.3 billion people. The UN predicts that there will be millions of environmental migrants by 2020, and climate change is one of the major drivers (Anna, 2011). Regardless of the specific causes and drivers, there is clear evidence that our climate is changing and that the pace and scale of that change is accelerating in many areas. The IPCC's fifth assessment will be released in 2013/2014, but already many teams of scientists claim the forecasts and scenarios of future climate change in the fourth IPCC assessment are being overtaken. A recent conclusion from the Snow, Water, Ice and Permafrost in the Arctic report of the Arctic Monitoring and Assessment Programme (AMAP), mentioned that there is likely global sea-level rise of close to 1 m or more by the end of the century as a result of, for instance, faster melting of the Greenland ice sheets. This compares with the 0.18 and 0.59 m forecast by the IPCC four years ago (New Nation, 2011a).

Climate change is taking a toll on not only the ecology of nations around the world, but also their political, economic and social stability, with the poorest nations and the poorest of the rich nations being the worst sufferers (Daily Star, 2011b). A one-meter rise in sea level could, for instance, flood 17% of Bangladesh's land area; threaten large parts of coastal cities such as Lagos, Cape Town and elsewhere and overwhelm, along with storm surges, small island developing States from the Maldives to Tuvalu. A World Bank study has estimated that a one-meter sea-level rise would affect 84

developing countries alone. Recent studies have found that up to 12% of the world GDP is already at risk from existing climate patterns. For example, the value of GDP exposed to tropical cyclones alone more than tripled from US\$525.7 billion in the 1970s to US\$1.6 trillion in the first decade of the 2000s (New Nation, 2011). The Global Sustainability Panel, recently set up by UN Secretary General Ban Ki-moon, is an attempt to bring a holistic approach to bear on issues, such as climate change, food, and water security, and development. However, it is felt that sufficient experience is lacking with how to connect dots, how to bring together concepts like climate change, and poverty eradication, climate change, and food security, and climate change, and access to water. Ultimately, if climate change is not being solved, then poverty eradication, food security, access to water cannot be solved either (Global Change, 2011). Secretary-General of UN, Ban Ki-moon affirmed that climate change was an "unholy brew" that could create perilous security vacuums, and that we must address a clear danger that not only exacerbated the threats but was itself a threat to international peace and security (Daily Star, 2011k).

The problem

Firstly, there is a massive gap in information, an astonishing lack of knowledge about how we should respond to the negative health effects of climate change. Secondly, since the effects of climate change will hit the poor hardest, an immense task before us to address the inadequacies of health systems to protect people in countries most at risk. Thirdly, technologies do have the potential to help us adapt to changes in climate. But these technologies have to be developed out of greater research investments into climate change science, better understanding about how to deliver those technologies in the field and more complete appreciation of the social and cultural dimension into, which those technologies might be implanted. Fourthly challenge is political creating the conditions for low carbon living. And finally there is the question of how we adapt our intuitions to make climate change the priority it needs to be (The Lancet, 2011).

Identifying urgent and immediate research needs for evidence based action is another important step in reducing the health risks of climate change. Filling these research gaps requires a sustained process to mobilize resources and update objectives as need change (Lancet, 2008) and crucially important is to build interdisciplinary research capacity, with a focus on the low income countries that are the most vulnerable to the health effects of climate change and have the weak research base (Diarmid et al., 2011). But the challenges are complex and daunting, and require continuous engagement and effort at all levels. A security of

interrelated phenomena unfolding in our times is making the issues of human ecology and urbanization a matter of urgency (Anna, 2011).

Natural disasters around the world

According to the United Nations High Commissioner for Refugees (UNHCR) in 2010 about 42 million people around the world were forced to flee their homes because of natural disasters. What is alarming is that the number of internally displaced people because of natural disasters almost doubled between 2009 and 2010. The UNHCR report also pointed out that climate change is the most important factor contributing to natural disasters, and that the international community must recognize this fact, and do more to help the suffering humanity. The number of internally displaced people in 2010 was 42 million is equal to the entire population of Argentina and almost 50% more than the total population of Canada. The Internal Displacement Monitoring Centre of the UNHCR noted that 'mega disasters' like the floods in China and Pakistan, and the earthquake in Chile, and Haiti were responsible for the massive increase in the internally displaced people from 17 million in 2009 to about 42 million in 2010. It also noted that weather related hazards like floods, and storms were responsible for more than 90% of the disaster displacements (New Age, 2011b).

Among the IPCC's other findings in 2007 was that storms and cyclones have become more intense over the past 30 years and that droughts, especially in the tropics and sub-tropics, have become more frequent with implications for food security. Thermal expansion of the oceans is contributing to sea-level rise of on average 1.8 mm a year since the 1960s. Since 1978 satellites show that the extent of summer Arctic sea ice has fallen by 20% (New Nation, 2011a). A developed country like USA, also realized the effect of climate change. Brian Holland, director of climate programs atICLEI-Local Governments for Sustainability, USA says that It is a new field. His organization recently launched a Climate Resilient Communities program to help cities study effects of climate change and finance ways to adapt (USA Today, 2011). Almost 600 local governments, which is one-fourth of the U.S. population, have signed on. Due to extreme weather continues to sweep the nation, and Americans struggle to deal with heat waves and flooding, Holland mentioned that majority people are convinced that they need to act. "We're already seeing consequences of climate change," he says, "and those will only intensify" (USA Today, 2011).

METHODOLOGY

Information was retrieved from documents available mainly in electronic database, and on the websites of specialized agencies,

using the terms 'Climate Change', and 'Bangladesh' with other researchers work was undertaken, including 4 leading Bangladesh daily newspapers also analyzed. 85 documents were retrieved from the database (websites) of several national, and international agencies were browsed. The most important being online collection from different journals on climate change related issues. These sites housed a number of reports on quantitative and qualitative studies, estimates of climate change cases, policy analysis of the existing climate change-situation and reducing the vulnerability due to climate change in Bangladesh and government strategies. This paper also looked deeper at the sectoral issues and policy.

The paper tried to contribute to the existing literature, in the form of new findings and in the form of critical interpretation of existing ones. Histological observations were carried out and a cross-sectional prevalence study of climate change and Bangladesh was also held. A scrutiny of the abstract revealed that some presentation posted on the websites, which was presented in international conferences and few other presentations were published in journals. Collected documents were skim read to cases, whether they contained information on Bangladesh in conjunction with climate change.

Definition of climate change

Climate change is identified as an average weather condition of an area characterized by its own internal dynamics and by changing in external factors that affect climate (Trewartha et al., 1980). United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as the change resulting from long term direct and indirect activities that induces changes in the compared time which are much more than the natural change (Daily Star, 2011u). On the other hand, the weather is a set of all the phenomena occurring in a given atmosphere at a given time (IAC, 2011).

BANGLADESH

Geographically, Bangladesh is located in the tropical region (FAO, 2011). Natural disaster is a common phenomenon and till today Bangladesh is facing several disasters, and climate change is the main reason behind it (Daily Star, 2011a). Bangladesh lies on a deltaic plain with five major river systems: the Jamuna-Brahmaputra, the Padma-Ganges, the Surma-Meghna, the Padma-Meghna, and the Karnaphuli. Although altitudes up to 105 m above sea level occur in the northern part of the plain, most elevations are less than 10 m above sea level; elevations decrease in the coastal south, where the terrain is generally at sea level. These geographical features make Bangladesh vulnerable to natural disasters, such as floods and cyclones, and the high levels of poverty increase the enormity of the challenges that the country is likely to face from climate change (ICDDR B, 2011a) (Figure 1).

Bangladesh is one of the most densely populated nations on Earth. It has more people than geographically massive Russia (Envoinfo, 2011). Bangladesh ranked fifth most vulnerable country to climate change and hunger in an Action Aid research report. In the World Risk Index 2011, jointly conducted by United Nations University (UNU), Germany and the Institute of Environment and Human Security said that Bangladesh ranked sixth among countries that are most vulnerable to natural disasters, while second among the Asian countries (Daily Star, 2011z). Bangladesh is a very low energy consuming country, and it is pursuing a low carbon growth path, while building its resilience to climate change and reducing the risk of climate change, which shows national development (Daily Star, 2009a). Bangladesh is projected to be 0.5 to 0.2°C warmer than today by the year 2030. The 30 years mean summer temperature in Bangladesh is 27.5°C and the mean

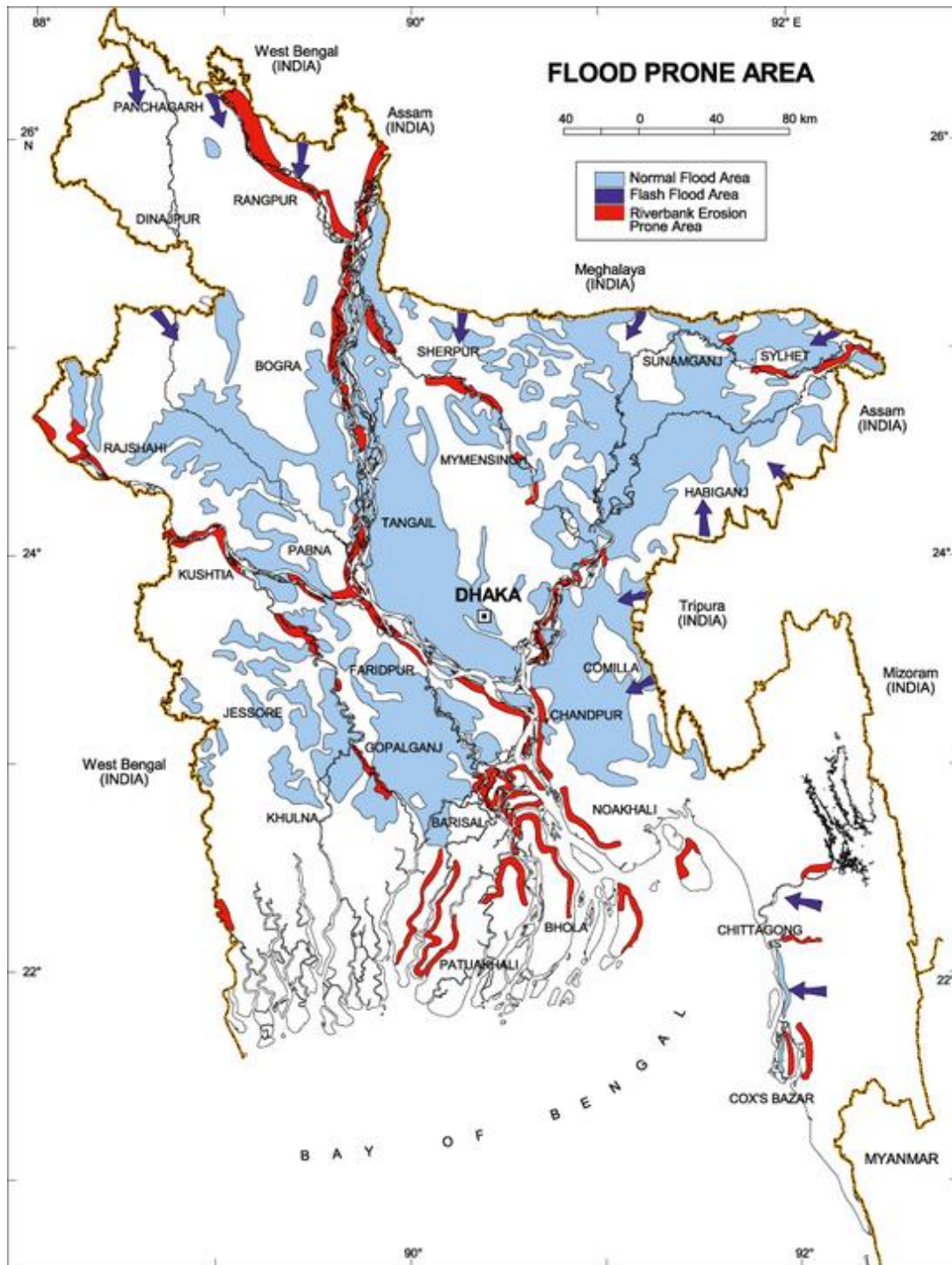


Figure 1. Areas in Bangladesh and their vulnerability to flooding. Source: http://www.banglapedia.org/httpdocs/Maps/MF_0103A.GIF

summer temperature is relatively higher during the monsoon than during winter. Winter is the driest season in Bangladesh. The 30 years mean winter rainfall amounts to about 64 mm with a variability of around 53%. By 2030, the best estimate projection is for monsoon rainfall to increase by 10 to 15% and winter rainfall by 5 to 10% (Kafiluddin, 2005).

Population

The country's population now stands at 16 crore (Daily Star, 2011j), which is 1.8 crore more than a decade ago- leave behind almost unimaginable ecological footprints. Bangladesh is the third most populated country in South-East Asia after India and Pakistan,



Figure 2. Climate threat and the impact from calamity, Monpura, Bhola.

which have 121.45 crore and 18.48 crore people, according to United Nations Population Fund. Its population now is higher than the combined total of Thailand, Myanmar, Sri Lanka and Singapore. The number of people living in every square kilometer is 964, compared to 834 in 2001. Currently, household size is 4.4 persons, compared to 4.8 in 2001 and 5.5 in 1991. The number of people living in every square kilometer is 964, compared to 834 in 2001 (Daily Star, 2011f). In the year 2050, when population of Bangladesh will likely have zoomed to 220 million and then to decline. This is the first time that a formal report has predicted a decline that will start at mid-century' (ICDDR,B, 2011), and a good chunk of its current landmass could be permanently underwater. That scenario is based on two converging projections: population growth and a possible multfoot rise in sea level by 2100 as a result of climate change. Such a scenario could mean that 35 million people along the southern coast would be displaced as IPPC warned (Planetizen, 2008,) and will face 'safe water crisis' (Climate adapt, 2011) and 'religious conflict' (Envoinfo, 2010), forcing Bangladeshis to crowd even closer together or else flee the country as climate refugees, a group predicted to swell to some 250 million worldwide by the middle of the century, many from poor, low-lying countries. A recent study of 136 port cities found that those with the largest threatened populations will be in developing countries, especially those in Asia. Worldwide, the two cities that will have the greatest proportional increase in people exposed to climate extremes by 2070 are both in Bangladesh: Dhaka and Chittagong, with Khulna close behind (Envoinfo, 2010).

Dhaka is the capital of Bangladesh and is overcrowded, even every park and footpath has been occupied by the homeless. Thousands of people arrive in Dhaka each day, fleeing river flooding in the north and cyclones in the south. Many of them end up living in the slums of Dhaka, where hundreds of thousands of such migrants already colonized. Dhaka is in no shape to take in new inhabitants. It is already under pressure to provide the most basic services and infrastructure. (Envoinfo, 2010). The population

of Dhaka is growing at a rate of 4.4% per year, one of the highest in the world. Around 500,000 people, almost the population of Washington DC, move to Dhaka and the banks of the river Buriganga annually. Almost 90% of the rural migrant population is absorbed in the four major cities -- Dhaka, Chittagong, Khulna and Rajshahi (Daily Star, 2011r). In the slums tens of thousands of people take shelter in huts made of cardboard with polythene roofs. There is no running water or sanitation. With 13 million residents, up from 3,440,000 only 30 years ago, Dhaka is considered the most populous urban centre on earth (Daily Star, 2011e). Displacement from natural disasters such as *Aila* resulted into large exodus of rural people to urban people. This migration results into an unbearable pressure on urban utilities such as water and sanitation services. Climate change is believed to affect Bangladesh river system badly as the melting of Himalayan glaciers will result in higher flow of water in the river, which in turn will result into flood and water logging in huge urban areas. The water supply of Dhaka city will face a great crisis as its source of water will not remain sustainable and people will not be able to get sufficient safe drinking water (Daily Star, 2011c).

Coping with climate change

More than 259 extreme natural events hit Bangladesh during the period 1991 to 2009. More than 80% of the deaths occurred in 1991 in Bangladesh. In 1991, a total of 140,000 people died in Bangladesh and the number significantly fall in next year's, which can be seen as partial evidence, which is possible to better prepare for climate threat and prevent larger scale impacts from catastrophe (Daily Star, 2010a).

Since 1970, according to a statistics, about 39 million people have been displaced by major natural calamities like flood and cyclone in the country till 2009. Experts warn that about 6-8 million more people of Bangladesh could be displaced due to increase in global



Figure 3. River erosion, Lalmohon Vola.

temperature and sea-level rise by 2050 (Daily Star, 2011) (Figure 2).

RESULTS

Bangladesh is set to disappear under the waves

Bangladesh is one of the top 10 nations mostly vulnerable to climate change, said German watch Global Climate Risk Index (CRI)-2011 report. By the end of the century, Bangladesh is set to disappear under the waves as mentioned by US government's NASA space agency. The International Panel on Climate Change (IPCC) predicted that by 2050, Bangladesh is on course to lose 17% of its land and 30% of its food production and as a result poverty will increase (Planetizen, 2008; The Independent, 2008). The country has already begun to feel the effects of the climate change as flood periods have become longer and the cyclones, droughts and earth quakes that hit the country cause greater devastation and adversely affecting the country's agriculture and land, and challenging water resources,

occupational dislocations, food, health, energy and urban planning (Chimalaya, 2011) (Figure 3).

The Healthy Center for Climate Prediction and Research (HCCPR) estimates that sea level in Bangladesh will rise about 40 cm (15 inches) by 2080 (Streatfield, 2008). Water level rises by at least 5.6 mm a year at Hiron point, 1.4 mm at Cox's Bazar and 2.9 mm at Khepupara, which was cited 2008 data from Bangladesh Water Development Board (ANN, 2010a). The climate models suggest that temperature will increase in Bangladesh during all seasons by approximately 1.0 to 15°C by 2030 (Kafiluddin, 2005). The Prime Minister of Bangladesh referred to the more extreme estimations that a one-metre rise in the sea level would submerge a quarter of Bangladesh's land mass (News Today, 2011).

Disappearance of Sundarban, the Bengal tiger and birds

It was mentioned that the mangrove forests of the Sundarbans, the Bengal tiger and hundreds of bird species may disappear (Daily Star, 2011). Bangladesh



Figure 4. Proximity of animals and humans. Shahapara- near Tista barrage, Chapainobabgonj.

and India shares important and sensitive ecological treasures, such as the mangrove forests of Sundarban and hill forests on Bangladesh's north and eastern border. These forests are rich in bio-diversity and they are also the areas, where members of many ethnic minorities live. It is the joint responsibility of India and Bangladesh to preserve and cherish these ecological treasures and to protect the rights of the ethnic minorities, who have been traditionally living there (New Age, 2011c).

Rising salinity threatens Sundarban

Decreasing flow of water through the rivers from upstream is destroying the ecosystem of Sundarban. Experts from home and abroad observed that alarming decrease in water flow down the rivers caused high salinity in both water and soil of Sundarban, causing a massive change in faunal composition of the forest. Sundarban, which lies across the outer deltas of the Ganges, Brahmaputra and Meghna rivers, is the largest mangrove forest in the world. The number of timber producing big trees such as Sundari is decreasing at the proportionate rate at the increase of salinity,' Abstract from a paper on 'Biodiversity and its Conservation in Sundarban Mangrove Ecosystem' by Indian scholars Brij Science journal also revealed the same result (New Age

, 2011d). The latest report of World Conservation Monitoring warned that a long-term ecological change is taking place in Sundarban due to the eastward migration of the Ganges, abandonment of some distributaries and past diversion of water and withdrawals for irrigation (New Age, 2011d) (Figure 4).

People are vulnerable to diseases

ICDDR,B- an International Centre for health and population forecasted that climate change would also make people in Bangladesh vulnerable to increased prevalence of diseases, such as cholera, dengue, cardiovascular, respiratory diseases, and malnutrition due to food scarcity and reduction in food production (ICDDR,B, 2011). In 2030, the estimated risk of diarrhoea will be up to 10% higher in some regions than if no climate change occurred (Kafiluddin, 2005). Climate change will also lead to poorer nutrition, putting people with perilous immune systems at more risk of dying of HIV, 'as well as contracting and transmitting new and unusual infections as mentioned by Prominent Australian HIV scientist of National Centre in HIV Epidemiology and Clinical Research, NCHECR (Daily Star, 2010b).

ICDDR,B also mentioned that the threat of prolonged flooding will also decrease the space available for the Gopal and Malavika Chauhan published in the Aquatic



Figure 5. Changes of sea level rise, ShunamGonj, Sylhet.

construction of residential buildings and the cultivation of crops and farming of animals, which eventually lead humans and animals in migration to urban areas, and beyond, which will 'bring further pressure on our densely-populated country (a growing number of people will be living in slums) and accelerate urbanization, which, in turn, will result in strong competition between urban people for access to social and economic opportunities (ICDDR,B 2011a; New Age, 2011) and, increase crime, which will lead to a social instability (Daily Star, 2011b). Between 35 and 77 million of the 165 million Bangladeshis, are at risk of drinking contaminated water. According to the British medical journal "The Lancet," up to 77 million people have been exposed to arsenic that can cause 200,000 to 270,000 deaths from cancer alone in Bangladesh (Daily Star, 2011k). Another source revealed in their research that climate change can upset the ecological balance between parasites, intermediate hosts, vectors and human, and thereby creating new unusual transmission cycle for infectious diseases. Changes in the infectious diseases transmission patterns are likely major consequences of climate change (Kafiluddin, 2005). ABC News found that the lake water of Karail - the biggest slum in Dhaka, is contaminated with *Escherichia coli* bacteria. The population density of Dhaka has risen to cramped housing in slums, where at a time 35 to 45% of the people suffer from diseases (Daily Star, 2011r).

Dr. Paul Epstein, an epidemiologist in the Harvard School of Public Health warns that climate change could have an impact on health in three major ways: (1) creating conditions conducive to outbreaks of infectious

diseases, (2) increasing the potential for transmission for vector-borne diseases, and (3) hindering the future control of disease. There are instances that this disturbing change has already begun, he added. The World Health Organization (1996) report states that at least 30 infectious diseases new to medicine have emerged in the past 20 years (Daily Star, 2011p).

Changes on sea level rise

Bangladesh stands at the forefront of climate change, with its coastal region witnessing dramatic sea-level rise over the last three decades. The resultant sea-water intrusion is increasing salinity in coastal drinking water with severe health consequences to surrounding populations (Daily Star, 2011b). About 53% of the coastal areas are affected by salinity. Millions of people in northern Bangladesh are threatened by riverbank erosion and severe droughts (Daily Star, 2011k). In the 21st century, climate change is expected to increase the risk of more recurrent and severe floods through higher river flows, resulting from heavier and more unpredictable rainfall in the Ganges-Brahmaputra-Meghna system during the monsoon and increased melting of the Himalayan glaciers. Its physiography and river morphology also contribute to recurring disasters. International Federation of the Red Cross and Red Crescent Societies in 2000 identified river erosion as the largest concern for Bangladesh (New Age, 2011e)(Figure 5).

Extensive scientific research reveals that the earth's

Table 1. Changes in climate parameters with respect to base year 1990.

Parameters	2030		2070	
	Winter	Monsoon	Winter	Monsoon
Temperature (oc)	2	0.65	3	1.5
Evaporation (%)	10	20	16	5
Precipitation (%)	-3	11	-37	28
Discharge (%)	-5	20	-67	51
FAP completion	60	60	100	100
Sea level rise (cm)	30	30	70	70

Source: Kafiluddin (2005).

freshwater is among the first and most depleted resources impacted by climate change. The International Panel on Climate Change, (IPCC, 2007), reports that groundwater, crop soils and many rivers are likely to become increasingly saline from higher tidal waves and storm surges as a result of climate change effects. Bangladesh's salinity intrusion threatens greater future incursion, for numerous reasons contentiously debated by scientists. These include reduced freshwater flows into the Padma River caused by the Farakka Barrage; climate change induced decreases of dry season rainfall, stronger and more frequent cyclones and sea-level rise; and intensified saltwater shrimp farming (Daily Star, 2011b). The consequent salinity will affect crops and require shifts to alternative land use (Streatfield, 2008).

Changes of temperature

The consequences of such a global rise in temperature are many which depend on the extent of temperature rise. Most notably, the mean sea level is expected to rise and local climate is expected to become more severe in nature. A summary of the expected changes of climate parameters with respect to the base year of 1990 for Bangladesh is given in Table 1 (Department of Environment, 2007) (Figure 6).

Green house effect

The atmosphere is under increasing pressure from green house gases that threaten to change the climate and from chemicals that reduce the ozone layer. Research team researched ozone, particulate Figure 7, carbondioxide and other pollutants from the combustion of fossil fuels, which create the greenhouse, affect the climate in coming decades. These pollutants also cause of premature death from asthma, heart disease and lung disorders (The Nation Health, 2001). The Arctic sea ice is disappearing has been known for decades. The



Figure 6. Salinity and changes of temperature. Dacope, Satkhira.

underlying cause is believed by all but a handful of climatologists to be global warming brought about by green house gas emissions. Yet the rate the ice is vanishing confounds these climatologists' models. These predict that if the level of carbon dioxide, methane and so on in the atmosphere continues to rise, then the Arctic ocean free of floating summer ice by the end of the century. At current rates of shrinkage, by contrast, this looks likely to happen sometime between 2020 and 2050. Gunner Myhire of the Centre for International Climate and Environmental Research in Oslo also believes that carbon dioxide is the main culprit. Figure 8.

Some meteorologists suspect unseasonal snow storms off the east coast of America in 2010 were partly caused by Arctic warming shifting wind patterns. One feedback loop that does seem certain, though, is that the melting Arctic will enable the extraction of more fossil fuel, with all that implies for green house-gas emissions. A warming Arctic will bring local benefits to some. The rest of the world may pay the cost (Centro per un Futuro Sostenibile, 2011). Dhaka has been identified as the second worst city to live for the second consecutive time, according to a survey of Economist Intelligence Unit (EIU) affiliated with the UK-based weekly Economist. The listing was based on 30 factors across five broadcategories: stability, healthcare, culture and environment, education and infrastructure (Daily Star, 2011). Air pollution has emerged as an acute problem in the city. Blackening of the city air and reduced visibility can be observed in some areas at times even. Occurrence of choking smells and irritating eyes are common (Khaliquzzaman, 1998). According to World Bank report by Paul Martin (a bank environmental

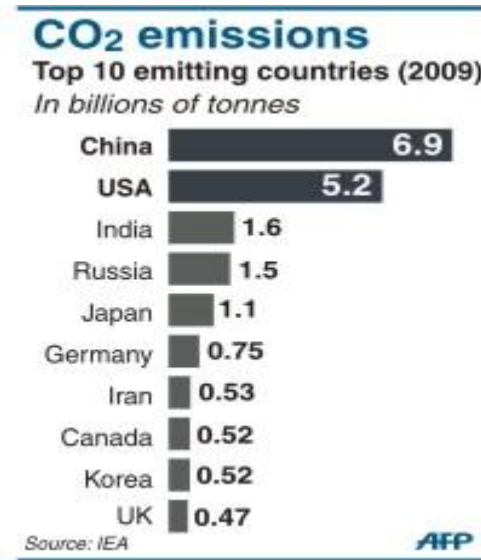


Figure 7. Green house effect. Source: <http://www.thedailystar.net/newDesign/news-details.php?nid=213792>



Figure 8. Huge numbers of brickfield pollute hill tracks weather (Bandarban).

specialist), air pollution kills 15,000 Bangladeshis each year (Mahmood, 2011). Leaders of environmental organizations recently urged the government to take necessary steps in controlling carbon emission in cities as urban living practices are, in many ways, responsible for climate change (Daily star, 2011t). Curt Stager is an ecologist who mentioned in his article that United States was the planet's largest emitter of greenhouse gases until China surpassed it recently (PA Times, 2011).

DISCUSSION

Surveillance and primary health information

Now is the time to push through both a vision and actions for a better, cleaner, and more sustainable world for us all. A key challenge is to improve surveillance and primary health information system in the poorest countries, and to share the knowledge and adaptation

strategies of local communities on a wide scale (Costello et al., 2011). Climate change needs top-down flow of information and communications. The people, in general, and the communities in the rural areas (including farmers, mountain enterprisers) in particular, need to be given the information and knowledge about the impacts of climate change and matters concerning the mitigation of the problem, adaptation of knowledge, and how successful practices can be replicated. So that they develop resilience to combat it and adapt themselves. There should be a disaster Management and National Calamities Department, fully equipped with modern equipments, information, long term training program, and dissemination of information to the people of the country, to keep them aware and alert about possible Natural Climate disaster or Climate Changes (Daily Star, 2010a).

International cooperation and SAARC

International cooperation is also essential to face the challenges of global warming. Various development players in Bangladesh need to aid them in communicating successfully. South Asian Association of Regional Cooperation, SAARC is also important and could be more effective for its geopolitical relationship with surrounding countries and emerge as regional strength.

Governments, international agencies, and non-governmental organization (NGOs)

Journalists have an important role in spreading the right message on climate change issues among others. A new advocacy and public health movement is needed urgently to bring together governments, international agencies, non-governmental organization (NGOs), communities, and academics from all disciplines to adapt to the effects of climate change on health. Any adaptation should sit alongside the need for primary mitigation: reduction in green house gas emissions, and the need to increase carbon biosquestration through reforestation and improved agriculture practices. And thereby slow down global warming and eventually stabilize temperatures. Second, action should be taken on the events linking climate change to disease. Third, appropriate public systems should be put into place to deal with adverse outcomes (Costello et al., 2011). Bangladesh government can take steps to prepare for a warmer earth. This involves limiting construction along low-lying coastal areas, building dykes to protect the coastal areas from flooding, developing new crop varieties which can grow in drier conditions, protecting wildlife and improving water storage to continue farming in drought condition (Daily Star, 2011d).

In addition to that it is the duty of the agronomists to help the farmers at field level and guide the policy makers

to achieve the desired yield of crops (ANN, 2010a). Moreover, all types of possible anti Natural Catastrophe steps should be taken now by the government (Daily Star, 2010a). The recently established 'climate change unit' under environment and forest ministry need to be made pro active. The bilateral treaty between India and Bangladesh, it did not address the issue of water diversion by India in the upstream areas (Daily Star, 2011h). Regional conferences are necessary as this can be a platform to reach a bigger audience. Referring to very little information available for the government, civil society members and experts of Bangladesh, sharing environmental/ecological data among the bordering countries is very necessary, as this is a question of life and death for the people (Daily Star, 2011h). Bangladesh Environmental Layers Association (BELA) and few other organizations and civil society bodies like Bangladesh Poribesh Andolan (BAPA) have now come forward to advocate on environmental/ecological issues. However, sustaining positive changes is still a challenge and involvement of local communities is fundamental to sustain changes brought through legal activism (Daily Star, 2011i).

However, The Bangladeshi government is taking the problem seriously, Bangladesh government has started taking measures to dredge major rivers, increase green belts in coastal areas and fortify embankments to cope with the rising sea level (Daily Star, 2009b). Recently, environmentalists and experts called for integrating natural resource management, conservation, and climate change into national planning and budgeting to ensure sustainable development in Bangladesh. They also underscored the need for improving environmental governance alongside launching sensitisation campaign among policymakers and mass people, so that best practices and success stories can be replicated and scaled up across the country (Daily Star, 2011m). The environment and forests ministry has already formulated national adaptation programme actions 2005 and 2009 and Bangladesh Climate Change Strategy and Action Plan 2008 and 2009. Now these plans should be integrated into a five-year plan and national budget and it requires more direct involvement of the Ministries of Finance and Planning (Daily Star, 2011m). With joint efforts, Bangladesh will certainly make progress and efficiently combat climate change.

Migration is an urgent priority

Government is considering climate change as one of the most vital topics for Bangladesh. However, migration resulting from climate change has not been incorporated in detail in the two most main documents, which are dealing with this concern, and these are the Bangladesh Climate Change Strategy and Action Plan and the National Action Plan of Adaptation. As several studies propose that climate change will move millions of people



Figure 9. Migration- People walking, where the initial Padma was located (Rajshahi).

in Bangladesh, it is essential that the climate change, dislocation and migration nexus is mainstreamed into the government's policy (CCCM, 2010). The World Bank study reveals that a total of 20 million people will be environmental refugees within next 100 years (Daily Star, 2011a). The experts on climate change and key stakeholders should be expected to explore ways in which migration issues can best be reflected in the Bangladesh Climate Change Strategy and Action Plan document (CCCM, 2010) (Figure 9).

Public funding

Public funding for investment in developing green technologies for poor markets will be essential (Anthony et al., 2011). The government of Bangladesh has set up an annual climate change trust fund of \$100 million with its own resources. Bangladesh is also expected to receive a large amount of money from development partners for the climate change resilience fund. Transparency International Bangladesh (TIB) will track the spending of the climate change fund to ensure its proper use (Daily Star, 2011q). As part of the accord produced at the United Nations Climate Change Conference in Copenhagen in 2009, nations of the developed world committed to a goal of \$100 billion a year by 2020 to address the needs of poor countries on the front lines of climate change (East asiaforum, 2010). The UN-led talks in Cancun in December 2010 agreed on a full accord to fight global warming, including the creation of a Green Climate Fund to help developing

countries. The funding would rise to 100 billion dollars annually by 2020, as experts warn that the world's poorest nations are already suffering the consequences of extreme weather triggered by climate change. According to the government estimate, it will have to spend at least \$2,081 million in ten years between 2010 and 2021 to help 30 million victims of the rising sea level (The Bangladesh Today, 2011). As Bangladesh is one of the most effected climate prone countries, we believe that the share would be appropriately distributed for Bangladesh by them.

Recently, Germany pledged to provide 10.9 million euro as grant to help Bangladesh implement climate change adaptation and mitigation programmes (Daily Star, 2011w). Climate change requires two possible conflicting actions. Carbon emissions must be reduced to avoid the worst outcome of climate change. Poor countries need rapid economic development so that no country, community, or individual is too poor to adapt to climate change. The concept of contraction and convergence, developed by the global commons institute, considers the need to pursue both these actions simultaneously (Global Common Institute, 2008). Contraction and convergence reduce overall carbon emissions to a sustainable level but do so according to an equal share of emissions per person globally. Industrialized countries would dramatically reduce their emissions whilst developing countries would increase theirs to allow for, and stimulate, development and poverty reduction (Costello et al., 2011). Below are brief recommendations mentioned by Costello et al. (2011) in regards to prevention on climate change:



Figure 10. Hope for new a life! Saint Martin, Coxes Bazar.

- 1) The most urgent need is to empower poor countries (like Bangladesh), and local government and local communities everywhere, to understand climate implications and to take action.
- 2) An agenda for developing countries must be developed through global cooperation.
- 3) Climate change should be integrated into the entire discourse of our present and should be taken into consideration for all governance actions.
- 4) Awareness of health risks can have important role in strengthening carbon mitigation debates and targets.
- 5) The move to a low carbon economy will have global health benefits from both a reduction in the health effects of climate change and improvement in human lifestyles, and these must be emphasized. There must be more research on win-win solutions.
- 6) Building low carbon and climate resilient cities (like Dhaka) in emerging economies that adapt to continuing rural-urban migration, driven both by economic development and climate effects, is important.
- 7) Investment on building interdisciplinary research capacity, with a focus on the low income countries (Bangladesh) that are the most vulnerable to the health effects of climate change and have the weak research base (Diarmid et al., 2011).

We can also accept Melbourne's principles of sustainability which state that: Cities can become more sustainable by modeling urban processes on ecological principles of form and function, by which natural ecosystems operate. The characteristics of ecosystem include diversity, adaptiveness, inter-connectedness, resilience, regenerative capacity and symbiosis. These characteristics can be incorporated in the development of strategies to make them more productive, regenerative,

and resulting in ecological, social and economic benefits" (Anna, 2011).

Future direction

Bangladesh should have an aim at building resilience of coastal communities along the Bay of Bengal by increasing their adaptability to prepare for and adapt to the impacts of hazards of climate change. There is a consent needed to control the climate changes among the countries of the world, which are main contributors of climate changes through emission of huge amount of greenhouse gases otherwise, nobody knows how much sorrows is waiting for us and for our environment in the near future, if this trend of climate changes is going on. Suitable infrastructural and institutional frameworks can provide a viable alternative, particularly for the urban poor. So it is needed to see, if there is any suitable structure in the policies set for our urban centers. Bangladesh Climate Change Strategy and Action Plan, 2009 considered urban sector only for the urban drainage. Many other important factors of urban areas are not considered in this action plan. Latest Bangladesh Health, Nutrition and Population Sector Program (HPNSDP) document though highlighted climate change and highlighted some points, it has not provided any clear guideline regarding how the government will go for these programs. So government, along with development partners, needs to plan ahead in terms of the effect of climate change in the urban context. Doing this will not mean forgetting rural people, rather doing something for the rural people as well, when that fateful moment of migration of rural people become inevitable, and natural disaster strikes the urban centers (Daily Star, 2011c). Affected communities would not only lose their homes, they would also stand to lose their identity, nationality, and their very existence, and in some cases, their countries (Figure 10).

According to Professor Beddington, to ensure that the migration was properly managed - otherwise, he said, it was likely there would be widespread humanitarian disasters on an unprecedented scale (Daily Star, 2011v). Environmental conservation Act was promulgated in 1995 even before the effect of climate change is widely known. One of the salient feature of this Act is that the government could declare Environmentally Critical Area depending on the status of degradation occurred in a particular area. It has been stated in Article 5(1) of the Act, "if the Government is satisfied that an area is in an environmentally critical situation or is threatened to be in such situation, the Government may, by notification in the official Gazette, declare such area as an ecologically critical area". Although the Ministry of Environment and Forests has already declared seven areas including Sundarbans as critical areas, reports of activities hazardous to environment in those areas still appears in the newspaper (Daily Star, 2011i). We need to create

scope for joint projects (both from India and Bangladesh) on scientific research on tigers and the Sundarbans ecosystem. However, recent agreement on biodiversity says none of the two countries will do anything that may have an adverse impact on biodiversity and ecosystem, which is one of the main obligations of the Convention on Biological Diversity, 1992. Both Bangladesh and India are parties to the convention that obliges them to maintain natural water flow in river catchment areas to conserve regional ecology and biodiversity (Daily Star, 2011n).

There are many transboundary rivers and ecological issues between Bangladesh and India that needs to be resolved. There is no doubt that, India, being the neighboring country, will also be affected if the ecology and economy of Bangladesh collapses under the weight of climate and environmental crises. It is therefore in the interest of both India and Bangladesh to work together in directions that will enable Bangladesh to withstand the climate and economic challenges that it faces. Bangladesh and India should take into consideration during their discussions and reach ecology-friendly, win-win solutions. Common ecological issues, such as 1) Farakka Barrage on the Ganges 2) Indian barrages on the River Teesta 3) *Tipaimukh* Dam on the River Barak 4) Interventions into the River Brahmaputra 5) Indian river linking project 6) Cross border flush floods 7) Cross border pollution 8) Approaches to the rivers (New Age, 2011c). Bangladesh government should ensure proper water sharing with India. An integrated water management and development project on the Ganges, Brahmaputra and Meghna should be taken to resolve the water catastrophe of Bangladesh (New Age, 2011c). Former caretaker advisor, Akbar Ali believes that the government should press for the formation of a Teesta River Commission a la the Mekong River Commission (in Southeast Asia) for total basin management in light of the framework agreement. He believes that when there will be a climate of goodwill in both sides, only then people will build connectivity for them across the region (New Age, 2011f). Nation should be united in the campaign for protection of the nature, ecology, and environment.

Natural disasters caused by long-term climate change, the human-made environmental/ecological destructions that make them dangerously more vulnerable, and corruption that deprive them of whatever aid money comes in for their 'relief'. It seems that even climate change will make the rich richer and the poor poorer unless there is greater vigilance by the government, the civil society and the population at large (New Age, 2011b). The country's future depends on how effectively the government implements the climate change strategy and action plan, emphasizing proper research to face the challenge (Daily Star, 2011g). We need to adopt energy efficiency technologies to cut carbon emission with a view to addressing global warming (Daily Star, 2011o). Utilization of climate funds is crucial and needs to be handled efficiently. The management of climate change is not only an environmental but an economic, social and

humanitarian issue. Any corruption of the funds allotted for this cause should be dealt with even more culpably (Daily Star, 2011s). Therefore, governance of climate funds is very vital at the international level as well as at national levels. Prime Minister of Bangladesh mentioned that Bangladesh will be benefited from Germany's high quality environment-friendly engineering and technology, because transfer of such technology is very much essential for Bangladesh to face the challenges of climate change" (Daily Star, 2011x). In terms of water consumption, rice production requires at least 1900 liters per kg whereas vegetables and potato require 300 to 500 liters per kg. Time has come to create social awareness to change food habit from excessive consumption of rice to more of potato and vegetables for better health, too (Daily Star, 2011[a]). The government plans has decided to formulate a long-term vision for 50 to 100 years to address the country's climate change related issues of water safety, food production, salt intrusion, land shortage, and environmental and ecological problems. The vision under "The Bangladesh Delta Plan 2100" will also aim to address some other important aspects to reach an adequate level of safety and food security as well as sustainable economic growth for the whole of Bangladesh. The Delta Plan will facilitate conservation of natural resources in a comprehensive manner, especially the river floodplains and coastal ecosystems that will eventually ensure sustainable provisions of services to the life and livelihoods of vulnerable people. It will also harmonise regional development plans for agriculture, environmental affairs, urbanisation, and tourism (Daily Star, 2011y). We also need to bring together all people from different professions and expertise such as scientific academics, health professionals, ecologists, technologist, social and cultural activists, media professionals, business entrepreneurs and policymakers from Bangladesh as well as from donor countries. Operationalisation of Green Climate Fund (GCF), compensation for climate refugees, and preferential treatment of low developing countries (LDCs) should be the most important priorities for Bangladesh in the December 2011 Durban climate conference in South Africa. The only way to enhance the accountability of public administration is if Bangladesh Government should immediately translate its National Environmental Policy into action and immediate strengthening of urban planning to benefit the people of this country.

Comments from climate change activist

Secretary General, Ban ki Moon warned the world leaders that climate change was 'to mobilize the political will and vision needed to reach an ambitious agreed outcome based on science at the UN climate talks in Copenhagen... there is little time left. The opportunity and responsibility to avoid catastrophic climate change is in your hands (New Age, 2011a). Globally, we are talking

about the largest mass migration in human history," says Maj. Gen. (R) Muniruzzaman; "By 2050 millions of displaced people will overwhelm not just our limited land and resources but our government, our institutions, and our borders" (envoinfo, 2010); "Let me tell you about Bangladeshis," says Zakir Kibria; "We may be poor and appear disorganized, but we are not victims. And when things get tough, people here do what they've always done-they find a way to adapt and survive. We are masters of climate resilience" (Envoinfo, 2010); "I have been staggered by the projections about global warming and the potential effects on food security, water, and changing patterns of diseases due to heat waves and vector-borne infections" (Honigsbaum, 2011).

Comments from climate change victim

"We are all under pressure, but there is really no point to worry. This is our only option, to move from place to place to place. We farm this land for as long as we can, and then the river washes it away. No matter how much we worry, the ending is always the same" Khalilullah is a char dweller (Envoinfo, 2010); "A woman's life is hard, and climate change is making it harder," says Aregash Ayele, an Ethiopian woman ...; "Because of changing rainfall patterns, crop yields are suffering and the family does not have enough food for everybody. It has never been like this" (Global health, 2011); Munni Aktar of Noakhali said "Our lands and homes are flooded every full moon. Villagers have to shift their homes very often. I want justice" (Daily Star, 2011x); "All the people who strain at this country's seams will drown with it," Anam says, "or be blown away to distant shores-casualties and refugees by the millions." The headstone would read, Bangladesh, 1971-2071: born in blood, died in water (The Independent, 2008).

NOTES

There are a number of sources for current information on the crisis. See the 1st International Conference on Climate Change and Energy development of Bangladesh (ICCEB, 2011), held in Bon University on 21 - 23 July 2011, website available: <http://www.icceb.info/2011/home/conference-photos.html> and, Resolve common environmental concerns during the September Summit, website available: <http://www.newagebd.com/newspaper1/oped/31589.html>.

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