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CLIMATE CHANGE, NATURAL DISASTERS, MITIGATION AND PREPAREDNESS IN INDIAN CONTINENT: A STUDY

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ABSTRACT

Climate change and natural disaster risk are closely linked and climate change threatens to heighten these impacts in many areas, both by changing the frequency and/or intensity of extreme events and by bringing changes in mean conditions that may alter the underlying vulnerability of populations to hazards. Thus, a holistic management of disaster risk requires mitigation and preparedness action to reduce impacts of extreme events before, during and after they occur, hence, a key challenge and opportunity therefore lies in building a bridge between current disaster risk management efforts of mitigation and preparedness aimed at reducing vulnerabilities to extreme events and efforts to promote climate change adaptation. The paper examines the climate change, disaster mitigation and preparedness nexus in context of India.

KEYWORDS: *Climate change, Disaster, Risk management, Mitigation, Preparedness, Indian continent.*

INTRODUCTION

Climate change and natural disaster risk are closely linked. Climate change and disasters are fast emerging as the most defining challenges of the 21st century as global risks with impacts far beyond just the environment and implications on national security and development. Recent projections and analytical studies indicate that the increasing global temperatures, arctic and glacial melt down, sea level rise and other climate change induced environmental degradation will give rise to extreme weather events and overstretch many societies' adaptive capacities within the coming decades thus increasing societal vulnerabilities. Concomitantly a global review of the statistics of disasters by the Centre for Research on the Epidemiology of Diseases (CRED) indicates that natural disasters are increasing in terms of frequency,

complexity, scope and destructive capacity. Hitherto, disasters were linked to climate change through short term natural variability manifesting in extreme weather events such as cyclones, storms, floods, droughts, heat waves, windstorms and other natural hazards with potential for catastrophic loss of human lives, damages to infrastructure and environment. So, more extreme weather events in future are likely to increase the number and scale of disasters, while at the same time, the existing mitigation methods and preparedness tools of disaster risk reduction provide powerful capacities for adaptation to climate change. Climate change threatens to heighten these impacts in many areas, both by changing the frequency and/or intensity of extreme events and by bringing changes in mean conditions that may alter the underlying vulnerability of populations to hazards. Thus, climate change is one of the most important global environmental challenges faced by humanity. This unprecedented increase is expected to have severe impact on the global hydrological system (receding glaciers, erratic monsoon), ecosystems, sea level, crop production and related processes. The impact would be particularly severe in tropical areas mainly consisting of developing countries, including India.

Nearly 700 million rural people in India directly depend on climate-sensitive sectors (agriculture, forests and fisheries) and natural resources (water, biodiversity, mangroves, coastal zones and grasslands) for their subsistence and livelihood. It is estimated that approximately 142 million people may inhabit coastal India in 2050 and India's total number of flood zone refugee alone could be anywhere between 20 and 60 million. Under changing climate, food security of the country might come under threat. In addition, the adaptive capacity of dry-land farmers, forest and coastal immunities is low. Climate change is likely to impact all the natural ecosystems as well as health (e.g. malaria) and socio-economic systems. To manage these climate change-induced disasters, the country needs to have improved scientific understanding, capacity building, networking and broad consultation processes across every section of the society.

Further, human activities that contribute to deforestation, land degradation and climate change not only result in huge losses to the environment, but also increase the vulnerability of the environment to disasters and alter the resilience of the natural environment by reducing its ability to recover effectively from damage. Hence, climate change and natural disasters should be dealt with mutually and not in isolation. Disaster mitigation and preparedness are necessary for a sustainable growth of any society. It has also been observed that the numbers of people killed due to disaster are more in the places where human development is low. With rapid development of coastal areas, industrialization and urbanization, more populations are becoming vulnerable to climate-associated calamities and many have no choice but to move to safer places. For India, tackling the challenge of climate change and increasing in disaster risks posits particular significance. Valuable time and resources would be consumed in handling the increasing risks, which would impinge on its development, unless appropriate mitigation measures and mechanisms are not put in place now, and policies redefined to address the challenge.

WHAT IS CLIMATE CHANGE?

Climate change means the alteration of the world's climate that we humans are causing, through fossil fuel burning, clearing forests and other practices that increase the concentration of Greenhouse gases (GHG) in the atmosphere. Generally, scientists often use the term for any change in the climate, whether arising naturally or from human causes.



United Nations Framework Convention on Climate Change (UNFCCC) defines that climate change is the change that can be attributed “directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods”.

According to Intergovernmental Panel on Climate Change (IPCC) climate change as “a change in the state of the climate that can be identified ... by changes in the mean and / or the variability of its properties, and that persists for an extended period, typically decades or longer”.

CAUSES OF CLIMATE CHANGE

Increases in average global air/surface warming air temperature (1.1 - 6.4 °C), the oceans became more acidic, heat waves and precipitation events increases (hot extremes), the tropical cyclones (typhoons and hurricanes) will become more intense, ongoing increases of tropical sea surface temperature, widespread melting of snow and ice, and rising average global sea levels (global average sea level rose at an average rate of 1.8 mm/yr).

The current concentration of greenhouse gases in the atmosphere is now the highest it has been for the past 500,000 years, having grown by 70 percent between 1970 and 2004 alone, and having reached this level exceptionally quickly. Present human activities also, in particular fossil fuel use and changing land-uses, are the dominant factor in this growth and are responsible for most of the warming observed over the past 50 years.

WHAT IS DISASTER?

The United Nations (1992) defines disaster as “a serious disruption of the functioning of the community or society, causing widespread human, material, or environmental losses which exceed the ability of the affected community or society to cope using its own resources”. A disaster is a function of the risk process. It results from the combination of hazards, conditions of vulnerability and insufficient capacity or measures to reduce the potential negative consequences of risk.

CLIMATE CHANGE AND NATURAL DISASTERS

Generally, natural hazards by themselves do not cause disasters – it is the combination of an exposed, vulnerable and ill prepared population or community with a hazard event that results in a disaster. Climate change will therefore affect disaster risks in two ways, firstly through the likely increase in weather and climate hazards, and secondly through increases in the vulnerability of communities to natural hazards, particularly through ecosystem degradation, reductions in water and food availability, and changes to livelihoods. Climate change will add yet another stress to those of environmental degradation and rapid unplanned urban growth, further reducing communities’ abilities to cope with even the existing levels of weather hazards.

Climate change is likely to change the nature of many types of hazards, not only hydro meteorological events such as floods, windstorms, and droughts, but also events such as landslides, heat waves and disease outbreaks, influencing not only the intensity, but also the duration and magnitude of these events. Further, climate fluctuations and extreme weather events have been the most frequently occurring hazards and in combination with social



vulnerability have been responsible for the vast majority of disaster losses worldwide. The frequency of heavy precipitation events has increased over most land areas, which is consistent with global warming and the observed increases of atmospheric water vapor. More intense and longer droughts have been observed over wider areas since the 1970s, particularly in the tropics and subtropics. Higher temperatures and decreased precipitation have increased the prevalence of drier conditions as well as contributing to changes in the distribution of droughts. Changes in sea surface temperatures, wind patterns, and decreased snow pack and snow cover also have been linked to changing drought occurrence. Widespread changes in extreme temperatures have been observed in many regions of the world over the last 50 years; most notably the higher frequency of high temperature days and nights and heat.

Disaster risk and climate change are two threats to human well-being that adversely reinforce each other. Disaster risk is an intrinsic characteristic of human society, arising from the combination of natural and human factors and subject to exacerbation or reduction by human agency. While the adverse impacts of climate change on society may increase disaster risk, disasters themselves erode environmental and social resilience, and thus increase vulnerability to climate change. Although the relationship between climate change and extreme events remains uncertain, it is difficult to distinguish variability and changes in climate-related hazards from the impacts of long-term climate change. Improved knowledge on the linkages between extreme weather events and climate change is needed and can facilitate strategies to reduce vulnerability. Yet it is increasingly acknowledged that both preparatory actions and responses to climate variability and long-term climate change may often be similar. Consequently, there are growing calls for a common framework for approaching the reduction of vulnerability to disasters, climate variability and long-term climate change. Disasters have an enormous impact on human development. Globally, events such as earthquakes, floods, and droughts contribute to tens of thousands of deaths, hundreds of thousands of injuries, and billions of dollars in economic losses each year. In developing countries, disasters represent a major source of risk for the poor and can potentially destroy development gains and accumulated wealth. This has been recognized by the UN Member States in the Millennium Declaration, which sees the mounting losses caused by disasters as a major threat towards meeting the Millennium Development Goals (MDGs). But, at present, "Climate change will make it impossible for the world to achieve the Millennium Development Goals, because, Poverty is bound to increase and Food security is bound to get worse."

In Indian sub-continent is one of the most disaster prone areas of the world. In India, every year 60 percent of land mass prone to earthquakes and 40 million hectares (8%) of landmass prone to floods, 8000 Km long coastline with two cyclone seasons, 68 percent of the total area vulnerable to drought, 2.3 million houses damaged, 8041 k.m coast line exposed to tropical cyclones, 1 million houses damaged annually, US\$ 15059 Million public infrastructure exposed to natural hazards risk. The geo-climatic conditions coupled with a rapidly growing Population and rising urbanization scenario have manifested in increasing impact and devastation from disasters. India is among the world's most disaster prone areas. India support 1/6th of the world's population on just 2 per cent of it landmass. Nearly 59 per cent of India's land area is prone to earthquakes of moderate to very high intensity, over 40 million hectares (12 % of land), is prone to floods, close to 5700 kms of its 7516 km coast line (about 8%), is cyclone prone and exposed to tsunamis and storm surges, 2 per cent of land is landslide prone, and 68 per cent



of India's arable land is affected by droughts. In India, (among 28 States and 7 Union Territories) around 27 are disaster prone areas (GoI, 2004a). Most disasters in India are water related. The global disaster trends are alarming, singularly so in India. At aggregate country level, India ranks third with 21 significant disasters recorded (China recorded 38, followed by US which recorded 31). A scrutiny of the past records of 100 years too indicates that India figures in the first 10 in the world in terms of fatalities and economic losses in a variety of disasters. These trends are likely to exacerbate in future with climate change. The projected increase in precipitation and rainfall, the glacial meltdown and rising sea levels will affect India particularly severely, creating conditions for more hazardous events and will lead to increase in incidence of floods, cyclones, and storm surges. Though it is not possible to predict the future frequency or timings of extreme events but there is evidence that the risk of drought, flooding, and cyclone damage is increasing and will continue to do so. Climate change is also likely to threaten India's food security, increase water stress, and increase occurrences of diseases especially malaria. Lack of availability and access to technological and financial resources coupled with a high dependence on climate sensitive sectors- agriculture, fisheries, forestry- have made India highly vulnerable to climate change. A large and growing population densely populated and a low-lying coastline, and an economy closely tied to its natural resource base, further intensifies this vulnerability.

NEED OF MITIGATION AND PREPAREDNESS IN DISASTER RISK:-

In serious disaster situations, the major challenge for authorities is the protection of life (human and animal), property, and the vital life-supporting infrastructure necessary for disaster mitigation. Any delay or laxity in disaster relief could escalate the magnitude of distress for the victims. Disaster loss is on the rise with grave consequences for the survival, dignity and livelihood of individuals, particularly the poor and hard-won development gains. Disaster risk is increasingly of global concern and its impact and actions in one region can have an impact on risks in another, and vice versa. This, compounded by increasing vulnerabilities related to changing demographics, technological and socio-economic conditions, unplanned urbanization, development within high-risk zones, under-development, environmental degradation, climate variability, climate change, geological hazards, competition for scarce resources, and the impact of epidemics such as HIV/AIDS, points to a future where disasters could increasingly threaten the world's economy, and its population and the sustainable development of developing countries. In the past two decades, on average, more than 200 million people have been affected every year, by disasters. Disaster risk arises when hazards interact with physical, social, economic and environmental vulnerabilities. Events of hydro-meteorological origin constitute the large majority of disasters. Despite the growing understanding and acceptance of the importance of disaster risk reduction and increased disaster response capacities, disasters and in particular the management and reduction of risk continue to pose a global challenge.

In holistic management of disaster risk, it requires mitigation and preparedness action to reduce impacts of extreme events before, during and after they occur, including technical preventive measures and aspects of socio-economic development designed to reduce human vulnerability to hazards. Both mitigation and preparedness have been key levers in disaster risk reduction and climate change strategies. An integrated risk management framework needs to build on these two vital strategies. However, preparedness in comparison to mitigation has been the neglected stepchild in both disaster risk reduction and global negotiations and debates over climate change, mainly due to the complexity of separating



preparedness from other socio economic, environment and development issues. But preparedness is largely spoken about only in discussions. But, a key challenge and opportunity therefore lies in building a bridge between current disaster risk management efforts of mitigation and preparedness aimed at reducing vulnerabilities to extreme events and efforts to promote climate change adaptation.

DISASTER MITIGATION

Mitigation is means “an anthropogenic intervention to reduce the anthropogenic forcing of the climate system; it includes strategies to reduce greenhouse gas sources and emissions and enhancing greenhouse gas sinks”. Mitigation (structural, reduction of green house gases etc) with clear visible manifestation of actions has been the easier chosen option. India has many mitigation projects for disasters, viz, earthquake, flood, drought mitigation, etc.

Disaster mitigation focuses on the hazard that causes the disaster and tries to eliminate or drastically reduce its direct effects. The best example of mitigation is the construction of dams or levies to prevent floods or coordination of release of water from various irrigation dams to avoid flooding in the downstream areas. Other examples include strengthening buildings to make them earthquake resistant, planting of crops that are less affected by disasters, controlling land-use patterns to restrict development in high-risk areas and diversification of economic activities to act as insurance to offset losses in different sectors. A mitigation strategy however, cannot be successful unless it has the backing and support of all concerned – the administrative machinery, the research institutions, the non-officials and the community. So, it also becomes imperative to have built-in institutional arrangements and/or legislative backing to oversee the mitigation strategy over a period of time. Mitigation actions include more efficient furnace systems, developing new low-energy technologies for industry and transport, reducing consumption of energy-intensive products, and switching to renewable forms of energy, such as solar and wind power. Natural carbon sinks, such as forests, vegetation and soils, can be managed to absorb carbon dioxide, and technologies are being developed to capture carbon dioxide at industrial sources and to inject it into permanent storage deep underground. The main elements of mitigation strategy which can further broadly divided into structural and non- structural mitigation. Mitigation measures need to be considered in land use and site planning activities. Necessary mitigation measures need to be built into the design and costing of development projects.

Structural mitigation: - It is typically much more complex than non-structural mitigation, and usually has a higher associated cost.

NON- STRUCTURAL MITIGATION

Many of the non-structural mitigation measures are being carried out by the Government of India, under the Disaster Risk Management Programme. The Ninth Five-year Plan (1997-2001) of India saw the beginning of a gradual shift away from purely structural measures toward other forms of non-structural mitigation. In the Ninth Plan it was observed that in addition to the progress made in implementing structural flood protection measures, flood forecasting and warning systems had played a great role in mitigating the loss of life and enabling the protection of movable property. However, notwithstanding the growing understanding, the response of governments to floods and droughts (as evidenced from the flood and drought response synthesis reports) reveal that investment strategies focus on



structures and other physical interventions designed to increase control over water availability and flow. These investments are intended primarily to increase the physical availability of water during dry periods. In the case of floods, most investments are directed toward the construction and maintenance of embankments and other flood control structures. Both floods and droughts, in the practical sense of investment, are seen as external events that can be controlled through the construction of physical structures. Concepts of flood and drought proofing exist and do include the recognition of wide measures related to the vulnerability of livelihoods. Translating such concepts into governmental programs that actually direct significant investment into something other than the construction of water control structures has not, however, occurred on a widespread basis. Lessons from past efforts toward flood control indicate that structural actions often increase long-term vulnerability. There has been a gradual shift from purely structural measures to nonstructural measures for flood mitigation. This is reflected in the Tenth Five-year Plan of the Government of India, although much of the shift still remains on paper.

PREPAREDNESS

Preparedness means, the capacities and knowledge developed by governments, professional response organizations, communities and individuals to anticipate and respond effectively to the impact of likely, imminent or current hazard events or conditions. In other words, Preparedness means development, rehabilitation, and restoration on one side and mitigation, rescue, relief on the other side.

Preparedness is a state of being ready to react promptly and effectively in the event of an emergency. Preparedness measures to be undertaken depends upon the analysis of hazard severity and vulnerability, which is also the basis for deciding mitigation strategy. Preparedness for any emergency, especially those, which strike without notice, requires a plan. It is essential to identify the resources available, and ways to utilize them. It must also be reasonably certain that the plan will work in an emergency situation. Disaster preparedness is just one element of a holistic approach to the reduction of risk associated with natural hazards. However, an adequate level of preparedness can be particularly essential to saving lives and livelihoods in the face of a natural hazard event.

Preparedness is a continuous cycle of planning, managing, organizing, training, equipping, exercising, creating, monitoring, evaluating and improving activities to ensure effective coordination and the enhancement of capabilities of concerned organizations to prevent, protect against, respond to, recover from, create resources and mitigate the effects of natural disasters, acts of terrorism, and other man-made disasters. In the preparedness phase, emergency managers develop plans of action carefully to manage and counter their risks and take action to build the necessary capabilities needed to implement such plans.

Preparedness action is carried out within the context of disaster risk management and should be based on a sound analysis of disaster risks and be well linked to early warning systems. It includes contingency planning, stockpiling of equipment and supplies, emergency services and stand-by arrangements, communications, information management and coordination arrangements, personnel training, community drills and exercises, and public education. It must be supported by formal institutional, legal and budgetary capacities.



Preparedness planning aims to establish a standing capacity to respond to a range of different situations that may affect a country or region by putting in place a broad set of preparedness measures. This includes for example early warning systems, ongoing risk and vulnerability assessment, capacity building, the creation and maintenance of stand-by capacities and the stockpiling of humanitarian supplies.

Sound preparedness planning should lead to an improved state of readiness that ultimately leads to safeguarding lives and livelihoods. The process of developing a national preparedness capability should bring together each of the elements described in this document reflecting legislative and institutional arrangements, Co-ordination structures, contingency and response plans as well as information and communication systems. While the process may require significant time and resources, it is essential that all partners have a genuine sense of ownership, as this is a requirement for sustainability.

PREPAREDNESS PLAN

The purpose of a plan is to provide a systematic way of responding to an emergency situation. The following aspects should be taken into consideration in the development of Emergency Preparedness Plan. The disaster preparedness plan includes the following activities:

1. Measures related to national policy and planning for making institutional arrangement, providing legal framework, adopting national policy and plan on disaster management.
2. Measures related to geological, hydrological and meteorological hazard assessment and environmental engineering studies.
3. Infrastructure specific and hazard specific preparedness measures.
4. Measures related to strengthening fire fighting capabilities in fire prone areas.
5. Measures related to awareness raising, training, rehearsal, simulation activities.
6. Measures related to establishment of disaster management information system and stock piling of emergency supply materials.
7. Risk assessment for development planning.
8. Policies on the role of NGOs, local community, private sector and also people's participation especially women and socially disadvantaged groups.
9. Incorporation of environment impact assessment for disaster reduction development planning.
10. Promotion of regional and sub-regional cooperation between countries expecting same types of hazards.
11. Establishment of documentation centre on disaster activities.



REPAREDNESS and MITIGATION MEASURES (AT NORMAL TIME)

1. To provide awareness generation, education, training, formation of village level Task Force.
2. To establish Disaster Management Committees and Teams, development of Disaster Management Plans, conduct of mock drills, vulnerability assessment and coordination with Government and non government agencies.
3. Do required activities at grass root level at each district or sub-district level.
4. They can provide technical and material support to community since they are already working closely with the community and have better appreciation of their vulnerabilities, needs and the capacity for revival so as to bring them back to the pre-disaster stage at the earliest.
5. A well-coordinated approach giving a lead role to local civil societies with necessary linkages with larger NGOs and District Administration will go a long way in institutionalizing the role of Civil Societies in disaster risk reduction.
6. Meeting of transporters is held every quarter and database of transport requirement and the minimum vehicles to be provided by each transporter is up dated.
7. Media Management and awareness Campaign Strategy meeting to be reviewed every six months for co-ordination and implemented before every disaster season and actual disaster periods.
8. Once in a quarter, check that the database for DM plan is updated.
9. Training of officials who will man the DMIC in the 24-hour cycle for the entire disaster season to be completed in time.
10. Coordination meeting of stockiest is held every quarter and emergency level of stocks to be maintained by each stockiest for food stuff, mineral water, medicines, blood, kerosene, diesel, petrol, daily use house hold goods like candles, match boxes etc are updated in the data base.A

PREPAREDNESS PROCESS PRIOR TO DISASTER (12 HOURS BEFORE)

1. All vulnerable personnel are asked to shift to safe shelter.
2. All the task forces are put into operation.
3. All the volunteers are put into operation as per their area of responsibility and their activities monitored through the concerned Government officials.
4. The stockiest warned to keep their stocks ready to move at short notice.
5. Media/public briefing systems activated.



6. The transports as per the plan are hired as per requirement.
7. The progress is constantly monitored.
8. Temporary shelters, kitchens, water points are organized and operationalise.
9. Sanitary checks and disease surveillance are put into operation.
10. Arrangements for animal camp and fodder organized.

PREPAREDNESS STEPS/ACTIONS AT DISASTER TIME

1. To rescue and evacuate trapped people
2. To provide first aid to the injured
3. To take care of children, women and disabled people
4. To transfer the seriously injured and people needing urgent medical attention to hospitals
5. To restore communication network and essential services.
6. To clear debris blocking roads and communication networks
7. To provide shelter and relief to homeless people
8. To arrange for food and drinking water to the affected people
9. To take immediate measure for disposal of dead bodies and animal carcass to prevent the outbreak of epidemics
10. To take urgent measures for maintaining law and order
11. To take people to safer places in case of change of course of river due to floods.

D. PREPAREDNESS PROCESS OF POST DISASTER

During the post disaster phase, can take a lead by providing technical and material support for safe construction, revival of educational institutions and restoration of means of livelihood and assist the government in monitoring the pace of implementation for various reconstruction and recovery programmes.

1. A detailed assessment is carried out for damage, casualties, resource shortfall by deploying additional officers with support from the other NGOs/Volunteers, PRI and community after reconnoiter and survey.
2. Assistance in terms of food material, medicines, and clothing, cooking utensils provided to the affected population controlled through DMIC and incident commander/OIC of the disaster site.



3. Assistance in distribution under the supervision of Government officers, volunteers and responsible representatives from the community.
4. Assistance in ensure of all drinking water sources are disinfected and activated by concerned departments.
5. Disease surveillance to check occurrence of epidemic if any and preventive measures.
6. Trauma counseling if required is carried out for affected population.

SUMMARY

Disaster and climate change are increasingly being considered as a development constraint; hence, mainstreaming them into the development policy is all the more pertinent in the current context. Researchers and policy makers across the world understood the importance of this. Since disasters are a human phenomenon, we can change our ways to reduce our risks. Shifting of focus from hazards to risk management could make our life safer. There is a need to have a paradigm shift in disaster management especially under changing climate. Initiatives such as adaptation to changes, disaster auditing, cross-sectoral risk analysis, regulatory authority (legal framework), knowledge management (community awareness), training and capacity building, training of media personnel, coastal zone management, private–public partnership (PPP), research and development, and last but not the least, establishing rewards or incentives for good management could be undertaken.

REFERENCE

1. Anand Patwardhan, et al., 2003. 'Impacts of Climate Change on Coastal Zones', in the book Climate Change and India; Vulnerability Assessment and Adaptation. Universities Press(India),.
2. Bhavnani Rakhi, 2006. Natural Disaster Conflicts.
3. Blaikie, Piers et al., 1994. At Risk: Natural Hazards, People's Vulnerability and Disasters, New York.
4. DCDC (The Development, Concepts and Doctrine Centre), 2007. The DCDC Global Strategic Trends Programme 2007-2036. Third Edition.
5. DEFRA/GoI, 2005a. 'Indian Climate Change Scenarios for Impacts Assessments, IITM, Pune, India.
6. DEFRA/GoI, 2005b. 'Climate Change Impacts on Sea Level in India. National Institute of Oceanography, Goa, India

