



Voices of Vulnerability Choices for Change

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Introduction

Vulnerability is the degree to which a system is adversely affected by external and internal phenomenon. Human vulnerability includes the vulnerability of social and economic systems, health status, physical infrastructure and environmental assets.¹ In terms of vulnerability to climate change, the eco-system based communities are the most vulnerable. They are the marginalised majority which depends on local environments and resources. In India, 60 % of the population can be said to be marginalised. Adivasis , Dalits , fisher-folks, small-scale farm families, livestock herders and wide range of occupational groups living in rural areas, including forest and hilly terrains, flood plains, drought prone plateau lands and cyclone prone coastal tracts, largely depend upon local natural resources and eco system services. Further a rapidly increasing population is now being pushed into urban slums whose habitat is extremely vulnerable to climate change. This compilation takes us to these various eco-regions, and listens to the voices of those vulnerable and the examines the choices for adaptation to and mitigation of Climate Change that they point to, as distinct from the machinations at the global level each trying to protect their turf, or more correctly their relative competitive edge over the other.

A good vulnerability index should discriminate well – depending on vulnerability. There are a large number of variables that determine vulnerability. This along with differentiation across groups will result in non-standard interpretation. Thus rather than look for uniformity of variables, it is useful to arrive at socio-politico-technical decisions. And there are universal principles for solutions ---the solutions themselves should would vary according to agro-climatic, ecological, geophysical features.²

Understanding Vulnerability

The Inter Governmental Panel on Climate Change (IPCC) defines vulnerability as “the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. It is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity. The term ‘vulnerability’ may therefore refer to the vulnerable system itself, e.g., low-lying islands or coastal cities; the impact to this

¹ Mitchell, J. K. (eds.) (1999). *Crucibles of Hazard: Megacities and Disasters in Transition*. Tokyo: UN University Press. As quoted in Mumbai after 26/7 Deluge: Some Issues and Concerns in Regional Planning . R. B. Bhagat¹, Mohua Guha and Aparajita Chattopadhyay - www.cicred.org

² Prof. T Jayaraman, Lecture on Vulnerability & Risk at the National Conference of People Science Movements at Goregaon, Mumbai, 2011.

system, e.g., flooding of coastal cities and agricultural lands or forced migration; or the mechanism causing these impacts, e.g., disintegration of the West Antarctic ice sheet³.

Thus Vulnerability to Climate Change has to be looked at three levels:

- **Direct Impacts** are the system's exposure to crises, stresses and shocks. There is the direct impact due to rise in sea level and increase in sea temperatures that may inundate low lying areas or result in depletion of fish stock. Sea level rise will have multiple impacts. It will inundate coastal settlements, aggravate flood situations, erode beaches, further impacting settlements, and will leave vast swathes of land and water sources saline. The net result will be the displacement of people from these densely populated areas. There are also the impacts of extreme weather events like flash floods, heat waves, droughts and other impacts of rise in temperature of vectors,
- **Sensitivity of the System:** At the next level is the sensitivity of the system already impacted by environmental degradation - changes brought about by dumping of industrial waste or reduction of mangroves, deforestation, depletion of ground water, poor quality of amenities like sewerage etc.
- **Adaptive capacity & Long Term Recovery:** The ability of the system to attenuate stresses or cope with the consequences is critical. We need a clearer understanding of coping strategies or mechanisms, of who and what are at risk, from what. Which are the specific stresses and perturbations which have higher risk and major impacts. This includes the consequences and attendant risks of slow (or poor) system recovery. This perspective suggests that the most vulnerable individuals, groups, classes and regions and the most sensitive to perturbations or stresses, have the weakest capacity to respond and ability to recover.

When stresses or perturbations emanating from the environment coalesce with those arising from society, significant consequences can result. For example, economic depression reduces society's capability to develop or maintain pre-emptive coping measures to reduce the impacts of drought, such that the co-occurrence of drought and economic depression synergistically enlarges the vulnerability of the system⁴.

Risks due to climate change is (=) Vulnerability to climate change minus (-) resilience of a society towards these impacts minus (-) adaptive capacity of the society. Resilience is the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure,

³ IPCC – http://www.ipcc.ch/publications_and_data/ar4/wg2/en/ch19s19-1-2.html

⁴ The vulnerability of global cities to climate hazards, Alex De Sherbinin, Andrew Schiller And Alex Pulsipher, Environment and Urbanization, Vol. 21, No. 1, April, 2009-Sage, New Delhi

identity, and feedbacks (www.resalliance.org). Likewise, adaptive capacity is the ability of a system to adjust to climate change, to moderate potential damage, to take advantage of opportunities, and to cope with the consequences (IPCC 2007). Adaptive capacity in the context of human and environmental system could be defined as the ability to respond and recover to a specific changing context. The Inter-governmental Panel on Climate Change (2007) states that adaptive capacity is the degree to which individuals or groups can adapt to risk at any given time.

Climate and its Variability in India

The most important feature in the meteorology of the Indian subcontinent and, hence, its economy, is the Indian summer monsoon. The climate and weather are dominated by large seasonal precipitation in summer. Almost all regions of the country receive their entire annual rainfall during the summer monsoon (South-West monsoon), while some parts of the south-eastern states also receive rainfall during early winter from the north-east monsoon. Rainfall increases by almost three orders of magnitude from west to east across the country.

Over and above this seasonal mode, the precipitation relates to inter-annual and intra-seasonal components, which gives rise to extremes of short-period precipitation (rainstorms) or prolonged dry spells resulting in large-scale droughts and floods. The mean annual number of rainy days (with rainfall of 2.5 mm and above) over India varies from less than 20 days over the northwestern parts (west Rajasthan and Kutch region of Gujarat) to more than 180 days in the north-east (Meghalaya).

Indeed, rainfall during a typical monsoon season is by no means uniformly distributed in time on a regional/local scale, but is marked by a few active spells separated by weak monsoon or break periods of little or no rain. Thus, the daily distribution of rainfall at the local level has important consequences in terms of the occurrence of extremes.

All India and regional mean seasonal and annual surface air temperature for the period 1901-2000 indicate a significant warming of 0.4°C per hundred years. On a seasonal scale, the warming was more in post-monsoon and winter seasons. On a daily basis, the day time maximum temperatures have been increasing, while the minimum night time temperatures remained practically constant during the past century.

Climate projections

The next century is projected to show marked increase in both rainfall and temperature under a IS92a⁵ scenarios. The different models/experiments generally

⁵ IS92a scenario: The projection of climate change is based on computer calculations on the net impact of emissions in various scenarios that may unfold. The IS92a scenario is a

indicate the increase of temperature to be of the order of 2-5°C across the country. The warming is more pronounced during winter and post monsoon months, compared to the rest of the year.

The model showed an overall decrease in the number of rainy days over a major part of the country in an IS92a scenario. This decrease is more in western and central parts of the country (by more than 15 days) while along the foothills of Himalayas (Uttaranchal) and in north-east India, the number of rainy days is found to increase by 5-10 days.

The projections of climate variables for the 2050s, under the IS92a scenario of GHG emissions include:

- An all-round increase in temperatures and a general increase in monsoon precipitation in the monsoon season
- A large spatial variation in the relative increase in monsoon precipitation
- An overall decrease in the number of rainy days over a major part of the country
- An overall increase in the rainy day intensity by 1-4 mm/day
- An increase in the temperature (maximum and minimum) of the order of 2-4°C over the southern region which may exceed 4°C over the northern region

Climate change - water resources and forest eco-system

India's geographical area of 328.726 Mha is covered by a large number of small and big rivers. Over 70 per cent of India's population of one billion is rural and agriculturally oriented, for whom these rivers are the source of their livelihood and prosperity. Climate plays a very decisive factor in water resource availability of a country.

There are 12 major rivers in India (with individual catchment areas of more than 10 Mha), with a cumulative catchment area of 252.8 Mha. The annual precipitation, including snowfall, which is the main source of the water in the country, is estimated to be of the order of 4'000 km³. The water resources potential of the country (occurring as natural run-off in the rivers) is about 1,869 km³, as per the latest basin-wise estimates made by the Central Water Commission. No doubt the forest eco systems in the huge catchments area play crucial role in sustaining the water flow in the rivers.

In India we have about 200 million forest dwellers that directly depend on different natural resources and nature services provided by the forest eco systems. Further, forests play a critical role in sustaining the water flows in the rivers on which 70% of

'business-as-usual' type scenario which had been in wide use by the climate modelling and vulnerability, impacts and adaptation communities. There are also SRES scenarios: A1, A2, B1 & B2. The A1 and A2 families have a more economic focus than B1 and B2, which are more environmental, whilst the focus of A1 and B1 is more global compared to the more regional A2 and B2

the population involved in agriculture that is close to a billion people depend. They are also the depository of bio-diverse animal and plant gene pool and the driver of water and climates cycles, centred around which are an array of cultural practices, belief systems, health care practices, and knowledge.

Forests are now one of the most vulnerable eco-systems, more so because of the already changing climate. Various studies and reports already indicate migration of species, slowing of the regeneration process, which may severely affect biodiversity. Forests are also likely to bear the impact of change in other livelihood sectors such as agriculture, livestock and, fishing as forest fringe communities may need would be forced to draw on it as a 'quick-fix' alternative source of livelihood.

In context of Climate Change – mitigation, adaptation, technology and financial transfers - from the ethical perspective are the development needs of the majority of the population, which have not been met through decades of planning, and are in great jeopardy, given the state of international negotiations and the pressure put by the rich, developed nations.

The vulnerability studies in different ecosystems are part of exploration to collate insights from different ecosystems from people's perspective.

The insights from the assessment open many windows to the opportunities and challenges to deal with the complex development, adaptation-mitigation web in the climate changing times.

The coastal view

Among the predicted results of global warming are a rise in land and sea temperatures, changes in weather patterns, climate-related extreme events, sea level rise and consequently coastal land erosion and flooding, more intense tropical cyclones and storm surges. These will affect farming, fishery, forestry, etc and livelihood based on these sectors in the tropical countries.

Poor and marginalized communities who depend on natural resources and local ecosystems such as land and water (rainfall, river, sea, etc) for livelihood will be particularly vulnerable. Any adverse effects on these resources will affect their livelihood, more so in the long run when climate change impacts are expected to intensify.

The Development Threshold

Large proportions of these populations still depend on biomass, kerosene and diesel for their energy needs. In many pockets they have lost their forest, land and water. The growth and the development of the population that still lives in rural areas will mean an exponential growth in demand for energy, even at basic sustenance levels.

The issue then is how to integrate the development needs of the poor with a reduction of levels of emissions in the atmosphere? This implies that unless we adopt a model of development that takes into consideration the carrying capacity of the earth we will not be able to address the climate issue.

The low carbon emissions of the various local communities, - coastal, mountainous, forest, arid and semi-arid, and urban communities – may at one level seem to be by default, and less a choice; and not seen as a really desirable lifestyle. However, the practices in production and local consumption of food, clothing, shelter and energy gain greater relevance in the context of GHG emissions. It is these communities in fact which have been conservers of the environment - by choice or default!

It is the voices of these communities which are missing in national and international policy. It is these voices that are being sought to be captured in this exercise.