

Climate Change Adaptation Activities in India



Coordinated by :
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The study has been conducted to provide information on climate change adaptation activities in the seven United Nations Development Assistance Framework (UNDAF) states in India. It is expected to contribute to the Programme Implementation Plan (PIP) of the UNDP India office for implementation of the Country Programme Action Plan (CPAP) phase 2008-2012.

The study is based on a review of the current initiatives and programmes being implemented by various agencies and organizations, including the Government, in the seven UNDAF states (Bihar, Chattisgarh, Jharkhand, Madhya Pradesh, Orissa, Rajasthan and Uttar Pradesh). Information has been collected from desk reviews and consultations with key stakeholders. The study was compiled in a very short period and hence contact with all the key players and visits to states was not possible.

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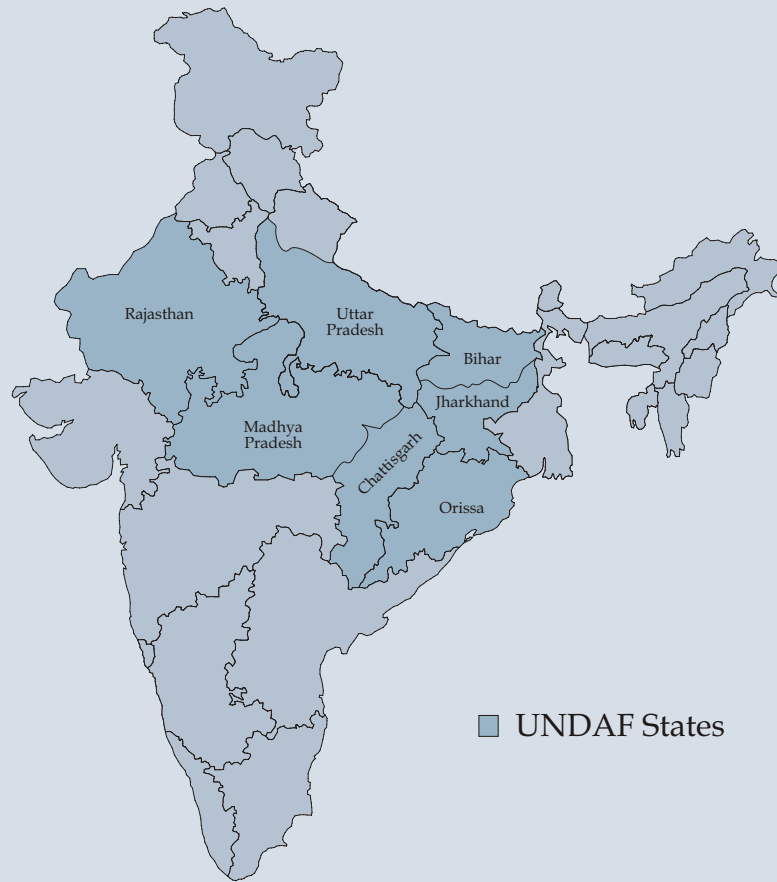
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Abbreviations

AAA	:	Agrarian Assistance Association
AAP	:	Adaptation Action Programmes
ADB	:	Asian Development Bank
ALCGAS	:	Asian Least Cost Greenhouse Abatement Study
ANM	:	Auxilliary Nuerses Midwife
API	:	Agricultural Parity Index
ATI	:	Administrative Training Institute
BDO	:	Block Development Officer
BIS	:	Bureau of Indian Standards
BPL	:	Below Poverty Line
BRGF	:	Backward Regions Grant Fund
BSDMA	:	Bihar State Disaster Management Authority
CAD	:	Command Area Development Programme
CDP	:	City Development Plan
CMRF	:	Chief Minister's Relief Fund
COD	:	Committee of Directions
CPAP	:	Country Programme Action Plan
CRF	:	Calamity Relief Fund
CWC	:	Central Water Commission
DDMA	:	District Disaster Management Authority
DDP	:	Desert Development Programme
DEFRA	:	Department for Environment, Food and Rural Affairs
DPAP	:	Drought Prone Areas Programme
DRM	:	Disaster Risk Management
EAS	:	Employment Assurance Scheme
EOC	:	Emergency Operations Centre
FFW	:	Food For Work
FPR	:	Flood Prone Rivers
FPS	:	Fair Price Shop
FWPR	:	Female Workforce Participation Rates
GCM	:	General Circulation Models (Global Climate Model)
GDI	:	Gender Development Index
GDP	:	Gross Domestic Product
GEAG	:	Gorakhpur Environmental Action Group
GEF	:	Global Environment Facility
GOI	:	Government of India
GOUP	:	Government of Uttar Pradesh
GP	:	Gram Panchayat
GSDP	:	Gross State Domestic Product
HDI	:	Human Development Index
HHS	:	House Holds
IAY	:	Indira Awas Yojana (Rural Housing)
ICDS	:	Integrated Child Development Scheme
ICT	:	Information and Communication Technology
IDRN	:	India Disaster Resource Network
IIT	:	Indian Institute of Technology
IMR	:	Infant Mortality Rate
IPCC	:	Intergovernmental Panel on Climate Change
IRCS	:	Indian Red Cross Society
IRDP	:	Integrated Rural Development Programme
IRN	:	International Rivers Network
ITK	:	Indigenous Traditional Knowledge
IWDP	:	Integrated Watershed Development Programme
JNNURN :	:	Jawaharlal Nehru National Urban Renewal Mission
JRY	:	Jawahar Rozgar Yojana

LDC	:	Least Developed County
MCS	:	Multi Purpose Cyclone Shelters
MDG	:	Millennium Development Goals
MHA	:	Ministry of Home Affairs
MoEF	:	Ministry of Environment and Forests
MoUD	:	Ministry of Urban Development
MP	:	Madhya Pradesh
NAPA	:	National Programme of Action
NASDORA	:	National Authority of Sustainable Development of Rainfed Areas
NATCOM	:	India's Initial National Communication (to the UNFCCC)
NCRMP	:	National Cyclone Risk Mitigation Programme
NDMA	:	National Disaster Management Authority
NE	:	North East
NEUPA	:	National University of Education Planning and Administration
NFCR	:	National Fund for Calamity Relief
NFHS	:	National Family Health Survey
NIFT	:	National Institute of Fashion Technology
NPCBAERM	:	National Programme for Capacity Building of Architects in Earthquake Risk Management
NPCBEERM	:	National Programme for Capacity Building of Engineers in Earthquake Risk Management
NREGA	:	National Rural Employment Guarantee Act
NREGS	:	National Rural Employment Guarantee Scheme
NREP	:	National Rural Employment Programme
NSS	:	National Sample Survey
NTFP	:	Non-timber Timber Forest Produce
NW	:	North West
NWDPPRA	:	National Watershed Development Programme for Rainfed Areas
NYK	:	Nehru Yuva Kendra
OBC	:	Other Backward Castes
ORC	:	Orissa Relief Code
OSDMA	:	Orissa State Disaster Mitigation Authority
PDS	:	Public Distribution System
PMGY	:	Pradhan Mantri Gramodaya Yojana (Rural Housing)
PMRF	:	Prime Minister's Relief Fund
POLENET	:	The Polar Earth Observing Network
PRI	:	Panchayati Raj Institution
RLEGP	:	Rural Landless Employment Guarantee Programme
RVP	:	River Valley Projects
SC	:	Scheduled Caste
SDMA	:	State Disaster Management Authority
SFDA	:	Small Farmer's Development Agency
SGSY	:	Swaran Jayanti Gram Swarozgar Yojana
SJGSY	:	Swarn Jayanti Gramin Swarozgar Yojana
SLR	:	Sea Level Rise
SPS	:	Samaj Pragati Sahyogarivartan Samudaya
SPWD	:	Society for Promotion of Wasteland Development
SRS	:	Sample Registration System
ST	:	Scheduled Tribe
TADP	:	Tribal Area Development Programme
TFR	:	Total Fertility Rate
UEVR	:	Urban Earthquake Vulnerability Reduction Programme
UNDAF	:	United Nations Development Assistance Framework
UNDP	:	United Nations Development Programme
UNICEF	:	United Nations Children's Fund
UP	:	Uttar Pradesh
UPDASP	:	Uttar Pradesh Diversified Agriculture Project
UPHDR	:	Uttar Pradesh Human Development Report
UPLDC	:	Uttar Pradesh Land Development Corporation

EXECUTIVE SUMMARY

This report, to support the implementation of United Nations Development Programme's (UNDP) India Country Programme Action Plan (CPAP), 2008-2012, is based on an assessment study on climate change adaptation activities in the country. The study, primarily based on a desk review of the literature and consultations with key persons, looked at the initiatives and programmes being implemented in the country by various agencies and organisations, including the Government, but focusing more on the seven United Nations Development Assistance Framework (UNDAF) states Uttar Pradesh (UP), Bihar, Jharkhand, Madhya Pradesh (MP), Chhattisgarh, Orissa and Rajasthan. The objective of the study was to identify the issues and constraints in the current initiatives as well as provide suggestions for areas/issues that need to be addressed and suggest a more effective implementation mechanism for activities/programmes.

Impacts of Climate Change

The projected impacts of climate change in India are an increase in average temperatures by 2-4 °C and marginal changes in rainfall during monsoon months, with large changes during the non-monsoonal months. The number of rainy days during the monsoons is projected to decrease by more than 15 days while the rainfall intensity is

expected to rise by as much as 1-4 mm/day. Cyclonic storms are likely to increase in frequency and intensity.

Overall, the inter- and intra-annual (seasonal) variability is expected to increase; in fact, this has already started happening in many parts of the country. Falling winter temperatures has led to, for instance, a reduction in the production of wheat and other winter crops. Climatic changes are manifested, amongst other things, through variability in water availability.

The impacts on Indian agriculture, still mostly rainfed, are potentially disastrous. Increasing pest attacks accentuate the crises being felt by millions of marginal and small farmers. Human health is affected by an increase in vector-borne diseases like malaria; the increase in malaria has been about 10 percent over the last few years. Other, water-borne, diseases too are on the rise. The coastal areas of the country are threatened by a rise in the sea level, leading to crises of drinking water caused by saline ingress and infrastructure and flow losses. In some areas, like coastal Tamil Nadu, marine stocks too, according to fisherfolk, are declining.

Climate change increases the vulnerability of the poor, and those dependent on natural resources for their livelihoods. It leads to less secure livelihoods due to depleted social, financial, physical and natural resources and human assets; increasing health risks due to diseases like malaria, dengue, cholera, dysentery, malnutrition and exposure, and constrained economic opportunities due to short and long term impacts of droughts and floods, and other extreme events. Taken together, all these factors render attaining the millennium development goals (MDGs) difficult.

Adaptation and Disaster Risk Mitigation

Adaptation is the response to actual or expected climate stimuli that moderates harm or exploits beneficial opportunities. In brief, adaptation is the ability of people and systems to adjust to climate change. In natural systems, adaptation is reactive by definition, but in human systems, it is both anticipatory and reactive; implemented by public and private actors.

Though adaptation and disaster risk reduction have gained acceptance in common parlance, clarity is needed in the use of these concepts. Disaster risk reduction need not be the same as adaptation. Central to the conceptualisation of adaptation or enhancement of adaptive capacities is the notion of vulnerability and resilience. In the literature, the term 'vulnerability' is used in many ways; but, essentially, the concept describes a condition of susceptibility shaped by exposure, sensitivity and resilience.

Resilience can be hard or soft. Hard resilience generally includes options that have physical characteristics ranging from flood control structures (dams/barrages) to information and communication technology (ICT).

Soft resilience options refer to skills, processes, institutions, social systems, policies and programmes.

The usual approach to disaster risk mitigation consists of hard options. What is missing is the emphasis on the soft options or a judicious mix of the hard with the soft, in participatory ways.

This is all the more important, as resilience and adaptive capacities ultimately depend on:

- Flexibility (within livelihood, economic, water management and institutional systems)

- Diversification (involving multiple independent flows to livelihood systems)
- The ability to learn from events (at both individual and institutional levels)
- Education (the knowledge base required to develop new systems when existing ones are disrupted)
- Mobility (an attribute of flexibility)
- Risk pooling and spreading
- Operational techniques for risk reduction before and following disruptions
- Convertible assets (or recovery) It has to be noted that the above are not stand alone factors, but in real life operate in myriad permutations and combinations.

The National Scenario

Nationally, some capacity, in about a quarter of Indian states, has been built for single rapid onset (such as earthquakes) and long onset (droughts) disasters and risks. By and large, the reliance is on hard resilience options. Managing a complex portfolio of hazard risks and vulnerabilities is beyond the capability of current institutional setup (public institutions and the nascent private re-insurance and insurance).

What is needed is a geographical estimation of probabilistic hazard risks and vulnerability, and the imputed composite multi-hazard economic risks. This should be accompanied by risk prioritisation by hazard; subsequently, elements at risk and their location can be undertaken and used for creating evidence based investment, as well as building regional, rural and urban development policies and building a bridge between public agencies, communities and the private sector.

The two aspects of climate change, the inter-annual variability, with extreme intensity and frequencies (both low and high), and gradual changes in temperature and precipitation, have implications for ecosystems in their having to shift to higher altitudes; for instance, crops that are grown in a particular area (or at a particular altitude) will no longer be suitable in those areas; these issues will have to be kept in mind in building the kinds of partnerships implied above.

Moreover, these kinds of changes will need 'incremental' treatment, calling for responsive institutions and knowledge generation, both on scientific and social dimensions. Static analyses, including the linkages with poverty alleviation, might not work in the contemporary situation of climate change, as historical trends in temperature and precipitation may not be valid for future projections. There are elements of uncertainty and there will be surprises (such as long duration droughts as well as droughts in conventionally flood-prone areas and vice versa). It will be necessary to analyse the inter-linkages between the natural, physical, social, financial and human capital in a given time and space context and then predict the possible changes in these individually as well as in conjunction with each other, with a view to reducing or mitigating the impacts at individual /household/ societal levels, and enhancing the capacity to recover from impacts. At the very least, this requires an integrated approach and not the kind of piecemeal and isolated planning that prevails today. This would be possible by detailing, through participatory ways, the mix of hard and soft options relevant to each region and sub-region, backed by proactive action research and the setting up of monitoring mechanisms that have in-built corrective mechanisms. These propositions become apparent in the detailed review considered for this study.

The State Level Situation

The seven UNDAF states are at the bottom of the Indian states in terms of human development index, gender development indicators, percentage below the poverty line and almost every other indicator of growth. These states are also chronically drought- and flood-prone, but increasingly over the years, floods have occurred in areas traditionally drought prone and vice-versa. The overall adaptation and disaster risk mitigation situation is rather grim, posing greater challenges for the achieving the MDGs in these states.

While all the states have in place some kind of machinery to deal with natural disasters like floods, major droughts or earthquakes, some of the states, like Jharkhand, do not have a disaster management policy. The stress is more on post-disaster activities rather than on preventive measures for mitigation. The approach is generally reactive and the emphasis, by and large, is on hard resilience interventions. Soft resilience efforts, mainly due to the UNDP's Disaster Risk Management (DRM) programme, have been in the form of creation of some awareness amongst the communities and governments. So far the notion of disasters, especially of the slower kinds, like temperature changes, or changes in the rainfall pattern, droughts in the flood plains or floods in the typically drought-prone areas, have not received the required attention even though they have already become a reality in many areas.

Health issues, already a major crisis due to weak supply and delivery systems, are in a greater predicament with new vectors coming up in many places due to climate change.

There are a variety of central programmes running in all the states, such as those for watershed development, command area development, drought prone areas'

Executive Summary

programme, crop diversification, expansion of irrigation and integrated water management, flood control and mitigation, National Rural Employment Guarantee Act (NREGA) and other programmes for poverty alleviation. For environmental regeneration there are numerous watershed development and soil conservation programmes. There are also programmes for agricultural development. Some of these programmes and interventions are decades old. Yet, despite the existence of these programmes, ground realities reveal that large sections of the population are deprived of their entitlements.

There is an urgent need to revisit the interventions and, if necessary, modify programme design and implementation so as to better meet the challenges posed by climate change.

The conceptual frameworks and documented evidence that underpin disaster risk reduction theories and practices have long emphasised that disasters disproportionately affect the poor and that poverty is a key factor in shaping and configuring disaster risk. Recurrent and major disasters would perpetuate poverty. In addition, the immediate and longer term impacts of disasters challenge the progress made towards achieving poverty reduction goals and sometimes (re)create conditions in which marginal communities are likely to be perpetually 'at risk'.

Evidence also shows that poverty would seem to be a key factor in increasing disaster risk. Poverty outcomes, determined by various socio-economic, political and environmental factors, are often manifested in the livelihood options people adopt, and in the kind of "built" environment they live in. Livelihoods actively shape a community's 'context of vulnerability', and in turn determine the mutual interactions between poverty and disaster risks.

Poverty plays a key role in the accumulation of extensive risk over time and space and acts in both directions dynamically. Thus, poverty is a factor in processes such as urbanisation and environmental degradation that in themselves generate extensive risk. Simultaneously, the outcomes of extensive risk, particularly the livelihood impacts, contribute to perpetuating or exacerbating poverty. Moreover, while mortality and economic loss is intensively concentrated in a few large-scale catastrophes, losses in livelihoods and assets would seem to be extensively distributed in space and time and manifested as frequently occurring small-scale disasters or even day to day disasters.

The situation is further confounded by the fact that there is very little systematic investigation into the relationship between poverty and extensive patterns of risk. Most programmes address only the specific target population, excluding large sections of the population whose needs are not addressed. Apart from the well-recognised BPL population, where chronic food shortages prevail, even households not normally deprived of food are rendered vulnerable in the regions prone to droughts.

Empirical evidence based on comprehensive and holistic conceptualisation is lacking, as the present study found. It is essential to analyse the relationship between natural hazards and poverty through quantitative and qualitative approaches. This would then strengthen the argument for hazard risk reduction as a key instrument to reduce poverty and for poverty reduction strategies in turn, to contribute to reducing people's susceptibility to hazard events. This would also facilitate a better understanding of adaptation strategies both locally, and at the level of the state and the nation.

Addressing this lacuna is an urgent imperative, for this will also then form the basis of comprehensive modelling for vulnerability assessment mapping. This study found that there is a serious lack of vulnerability assessment and mapping in most of the states, despite it being a necessary precursor for designing and implementing programmes for poverty reduction, disaster risk mitigation or climate change adaptation.

The above discussion points to substantial research gaps. In sum, the following research needs could be identified:

- Systematic investigation of poverty vulnerability (climate risk) linkages in each distinct agro-economic zone within each state, with environmental, socio-economic and political factors
- Estimating potential losses (both stock and flow)
- Understanding and establishing the links between climate change and inter-annual variability at smaller resolutions through scientific and technical research (such as by downscaling global climate models)
- Identification of the drivers of poverty in climate change in specific contexts through research on changing patterns and types of poverty dimensions due to climatic extremes, using quantitative and qualitative approaches
- Mapping and modeling of current and future vulnerability
- Identification of priority sectors (including which cities)
- Developing and supporting financial mechanisms for risk spreading and pooling - insurance instruments with public-private partnership (in the agricultural sector, for instance)
- Indigenous technologies of water

harvesting, crop management and the whole gamut of agrarian practices that can be supported to enhance the adaptation strategies; already, there are several NGOs in these states Society for Promotion of Wasteland Development (SPWD) and Tarun Bharat Sangh in Rajasthan, Samaj Pragati Sahyog (SPS) in Madhya Pradesh or the Gorakhpur Environmental Action Group (GEAG) in UP and Professional Assistance for Development Action (PRADAN) and Agrarian Assistance Association (AAA) in Jharkhand that are working along these lines

- Analyses of the roles and impacts of NGOs working in this sector seeking to bring about change through soft options or institutional mechanisms, essentially giving primacy to people's participation and process ownership, in bringing the required structural changes in the institutional mechanisms for State interventions
- The locale specific impacts of climate change on the industrial sector and vice-versa to enable better locating of industries
- Low cost technologies that promote employment but at the same time mitigate global warming and promote climate change adaptation

The above research would also enable the determination of the optimum mix of hard and soft options for building up resilience, and also help determine realistic time lines for the actualisation of the mix of options in an informed way.

Actions, Experimentation and Demonstration

Substantial structural and institutional changes and a paradigm shift towards climate change, development and poverty are needed. The study identified the following possible action,

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experimentation and demonstration paths:

- Identification of practical actions for vulnerability (and poverty) reduction (matrices) in specific contexts
- Development of climate change adaptation and vulnerability analysis frameworks at various levels -- national, state and local through a series of consultative processes
- Developing a national adaptation framework
- Developing inter-ministerial coordination that is the key to resolving the problem
- Finding ways to integrate the 73rd and 74th Constitutional amendments in the climate change adaptation frameworks
- Linking mitigation with adaptation (revenue model of carbon credit-forestry financing adaptation; Ministry of Finance and Planning Commission)
- Upgrading the National Disaster Management Authority (NDMA) under the Ministry of Home Affairs (MHA) to address climate change adaptation (by, for instance, working out ways to upgrade and implement the National Cyclone Risk Mitigation Programme, NCRMP, to address climate change issues)
- Promoting demonstration models for operationalising integrated climate change adaptation into regional and urban sectoral and investment planning
- Developing regional climate risk reduction (adaptation) models, taking into consideration both rural and urban areas and inter-linkages (eg ecosystem services drinking water, pollution), especially around mega cities
- Capacity building to address climate extremes how could the State Disaster Management Authority's (SDMA) be capacitated to address climate change impacts (State level Adaptation Action Plans)
- Integrating adaptation interventions with existing structures (e.g., the Jawaharlal Nehru National Urban Renewal Mission, JNNURM)
- Education, training and capacity building at schools and universities for public functionaries, managers and the media
- Preparing a National Risk and Vulnerability Atlas
- Developing new building and infrastructure codes (in cooperation with the Bureau of India Standards, BIS)

An important issue relates to the role of NGOs and other civil society organisations. A large number of NGOs such as the SPWD in Rajasthan, the SPS in Madhya Pradesh or the GEAG in UP and the AAA and PRADAN in Jharkhand, are doing good work in the seven states, in various fields related to disaster risk mitigation and empowerment of the people. They work in almost every field, from agriculture to health and education, women's empowerment, bio-diversity management to watershed development; specifically, they have worked on indigenous water harvesting systems, promotion of traditional seed varieties that require less water and are less disease prone or adjustments that are made by farmers to combat the impact of droughts and floods, such as by shifting to crops that have shorter/different cycles. Useful lessons can be learnt from these experiences. However, removing poverty and promotion of adaptive strategies obviously remain the ultimate responsibility of the state.

Impacts of Impacts of Climate Change

1 IMPACTS OF CLIMATE CHANGE

The overall objective of this assessment study is to provide information on climate change adaptation activities through a detailed review of the existing initiatives and programmes in India.

1. Context

To support the implementation of the United Nations Development Programme's (UNDP) India Country Programme Action Plan (CPAP) (2008-2012), select activities and studies have been envisaged as a "Programme Initiation Plan" (PIP) that would provide the India Country Office (CO) information critical to the development of future initiatives. The results of these studies will serve as a basis for the development of new UNDP initiatives and will ensure that the CPAP is properly implemented and the stated development results achieved.

The overall objective of this assessment study is to provide information on climate change adaptation activities through a detailed review of the existing initiatives and programmes in India. This will form the basis for the activities and programmes in the seven designated/identified United Nations Development Assistance Framework (UNDAF) states¹ for the UNDP India Country Office.

2. Scope and Strategy

Given this context, a review was undertaken of the current initiatives and programmes being implemented by various agencies and organisations, including the Government, but focusing more on the seven UNDAF states. Given

the limitations of time and resources, information from various sources was collected for desk review. This was followed by discussions and consultations with key stakeholders such as experts, NGOs, funding organisations and senior government officials. The present report has been drafted based on the above and seeks to highlight the issues and constraints in the current initiatives and provide suggestions for areas/ issues that need to be addressed in the formation of an effective implementation mechanism for activities/programmes.

3. Impacts of Climate Change

The importance of monsoons in the Indian context cannot be emphasised enough: a large part of Indian agriculture dependent on the monsoons, so that even share markets show fluctuations due to early/delayed arrival of the monsoons. Any change in the country's rainfall pattern impacts agriculture, and hence the country's economy and food security. Yet global warming poses serious threats to the weather system, which can potentially affect millions of small, marginal and poor farmers and all those who depend on agriculture for their livelihood.

In this context, adaptation strategies are of key significance. Adaptation to climate change, briefly put, involves the adjustment of practices, processes and structures to reduce the negative effects of change while simultaneously taking advantage of any opportunities associated with climate change.

Despite the problems with the forecasting models, it is now more or less accepted that due to the impact of global warming, the following climate changes will occur between 2040 and 2060 (CSE: FACT 17; Mall et al., 2006):

¹ The seven UNDAF states are Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Rajasthan, Orissa and Uttar Pradesh.

- The average surface temperature will rise by 2-4°C
 - There will be marginal changes in the rainfall expected in monsoon months
 - Large changes during non-monsoon months are expected
 - Number of rainy days is set to decrease by more than 15 days
 - Intensity of rains is projected to increase by 1-4 mm/day, and
 - Cyclonic storms are likely to increase in frequency and intensity
- It is predicted that the semi-arid regions of western India are expected to receive higher than normal rainfall as temperatures soar while central India will experience a decrease between 10 to 20 percent in winter rainfall by the 2050s (CSE: FACT 17). The predicted climate change impacts, according to various studies that have used different models and parameters, are given in table 1 (Mall et al., 2006).

Table 1 : Predicted climate change scenarios

Region	Temperature	Rainfall
All India	Increase in winter temperature by 1-4° degrees C with increased CO ₂ concentration	Precipitation increase of about 20 percent Increase in heavy rainfall days during summer monsoon and increased inter-annual variability
All India	Over the region south of 25° N (south of cities like Udaipur, Khajuraho and Varanasi) maximum temperature will increase by 2-4°C during 2050s. In the northern region, increase in maximum temperature may exceed 4°C. A general increase in minimum temperature upto 4°C all over the country	Decrease in the number of rainy days over a major part of the country. This decrease is more in the western and central parts (by more than 15 days) while near the foothills of the Himalayas (Uttaranchal) and in northeast India, the number of rainy days may increase by 5-10 days. Increase in rainy days intensity by 1-4 mm/day, except for small areas in northwest India where rainfall intensity may decrease by 1mm/day.
All India	Average temperature change is predicted to be in the range of 2.33 to 4.78°C with a doubling in CO ₂ concentration	Increased frequency of heavy rainfall events.
All India	Average annual mean surface temperature rise is projected to range between 3.5°C and 5.5°C degrees C by the end of the century More warming in winter	Increase of about 7-10 percent in annual mean precipitation; decline of 5.25 percent in winter precipitation. Increase in monsoon precipitation is 10-15 percent Monsoons over NW India - Increase of more than 30 percent by 2050. Western semi-arid region could receive higher than normal rainfall in a warmer atmosphere. Decrease in winter precipitation by 10-20 percent over Central India by 2050.

Source: Mall et al, 2006

Two of the most obvious impacts of climate change are on agriculture and health. Other impacts will be on bio-diversity, especially the coastal and mountain eco-systems.

There may be disputes about the forecasting models and accuracy of the predictions, but in many parts of the country, the impacts of climate change are already being felt. Two of the most obvious impacts are on agriculture and health. Other impacts will be on bio-diversity, especially in the coastal and mountain eco-systems that have the potential of affecting the large human populations dependent on them.

Agriculture

Agriculture will be affected adversely by an increase or decrease in the overall amounts of rainfall and also by the shifts in the timing of precipitation. For instance, over the last few years, the Chhattisgarh region has received less than its share of pre-monsoon showers in May and June. These showers are important to ensure adequate moisture in fields being prepared for rice crops. Agriculture will be adversely affected in the coastal regions of Gujarat and Maharashtra where agriculturally fertile lands are vulnerable to inundation and salinisation. Standing crops in these regions are more likely to be damaged due to cyclonic activity. In Rajasthan, a 2°C rise in temperature was estimated to reduce production of pearl millet by 10-15 percent (CSE: FACT 17).

An increase in CO₂ in the atmosphere could have a dubious benefit for Madhya Pradesh, where soybean is grown on 77 percent of all agricultural land; according to some studies, soybean yields could go up by almost 50 percent if the CO₂ concentration in the atmosphere doubles. However, if this increase in CO₂ is accompanied by an increase in temperature, as expected, then soybean yields could actually decrease. If the maximum and minimum temperatures go up by 1° C and 5° C, the gain in yield comes down to 35 percent. If the

maximum and minimum temperatures rise by 3° C and 3.5° C respectively, then soybean yields will decrease by 5 percent compared to 1998 (CSE: FACT 17).

Changes in the soil, pests and weeds brought about by climate change will also affect agriculture in India. For instance, the amount of moisture in the soil will be affected by changes in factors such as precipitation, run-off and evaporation.

Creation of irrigation potential has been a major key to India's agricultural development, production stability and food security. Apart from the monsoon rains, India has, for centuries, depended on the Himalayan rivers for its water resource development. Temperature increases associated with global warming will increase the rate of snow melting, and consequently, snow cover will decrease. In the short term, this may increase water flow in many rivers that may, in turn, lead to increased frequency of floods, especially in systems where water carrying capacity has decreased due to sedimentation. In the long run, however, a receding snow line would result in reduced water flow in the rivers. Under the climate change scenario, the onset of the summer monsoon over India is projected to become delayed and often uncertain. This will directly affect the rainfed crops as well as water storage, placing stress on water available for irrigation. Since the availability of water for cultivation would face tremendous competition for alternate uses, agriculture would be under greater strain.

Practically all soil processes important for agriculture are directly affected by climatic factors. Changes in precipitation patterns, amount and temperature can influence soil water content run-off and erosion, workability, temperature, salinisation, biodiversity and organic carbon and nitrogen content. Changes in soil water induced by global climate change may affect all soil processes and

ultimately, crop growth. An increase in temperature would also lead to increased evapotranspiration, resulting in the lowering of the ground water table in places. Increased temperature along with reduced rainfall may lead to upward water movement, causing accumulation of salt in upper soil layers.

Organic matter content, already reduced in most parts of the county, will continue to remain low, but climatic change through temperature and precipitation mediated processes may affect its quality. An increase of 1° C in the soil temperature may lead to higher mineralisation but nitrogen availability for crop growth may still decrease due to increased gaseous losses. Biological nitrogen fixation under elevated CO₂ may show an increase, provided other nutrients are not strongly limiting. The change in amount and frequency of rainfall and pattern of winds may alter the severity, frequency and extent of soil erosion. These changes may further compound the direct effects of temperature and CO₂ on crop growth and yield.

Most crops in India, even in irrigated environments, are very sensitive to climatic variability, which considerably affects the nation's food security, despite impressive development of the irrigation potential. In the field and regional situations, it is not easy to quantify the impact of climatic variation on food production due to the impact of the changing technologies used. India had a record harvest of 75.5 Mt wheat in 1999-2000, an increase of 5 Mt over 1998-2000, with almost the same technology level. The change was largely due to the cool weather during January to March 2000 that was favourable to grain formation and filling. Such variations in food production would be much larger in paddy, pulses and oilseeds, where a large portion of the cropped area is rainfed. The gluts and shortages of rice, onions

and potatoes in recent times could be due to the effects of climatic variability (in addition to short-sighted policy and mismanagement).

According to the India's Initial National Communication (Natcom) to the United Nations Framework Convention on Climate Change (UNFCCC), agriculture productivity will be impacted due to changes in temperature and rainfall, rise in CO₂ concentration in the atmosphere and occurrence of pests and disease. The wheat yield is projected to decline 4 to 24 percent in different regions, while rice yield will generally decrease with the rise in temperature. The doubling of CO₂ and warming (3 °C), accompanied with reduction in rainfall, will lead to reduction in yields of several dry-land crops, and losses in farm-level net revenue is predicted (Natcom, 2004).

Health

In the summer of 1994, western India experienced temperatures as high as 50 °C, providing favourable conditions for disease carrying vectors to breed. Not surprisingly, 1994 was also the year Surat was hit by an epidemic of pneumonic plague, resulting in 59 deaths. In the same year, as summer gave way to the monsoon and western India was flooded with rains for three months, Surat was hit by a malaria epidemic (CSE: FACT 17).

Weather conditions determine transmission of vector-borne diseases to a considerable extent. Heavy rainfall results in puddles, providing breeding grounds for mosquitoes. In areas of western Rajasthan and Gujarat, malaria epidemics have often followed excessive rainfall. In parts of eastern UP, the recurrent annual toll of Japanese encephalitis is a recent phenomenon. In very humid climates, drought may also turn rivers into puddles.

A critical concern is the loss of working

Most crops in India, even in irrigated environments, are very sensitive to climatic variability, which considerably affects the nation's food security, despite the impressive development of the irrigation potential.

A critical concern is the loss of working days and the drain on scarce resources of an impoverished population due diseases that are boosted by the impact of climate change.

days and the drain on the scarce resources of an impoverished population due to diseases that are boosted by the impact of climate change. However, all the health impacts of climate change are yet to be fully understood.

According to the Natcom, by the 2080s, malaria will penetrate elevations above 1,800 metres and some coastal areas. Ten percent more states may offer climatic opportunities for malaria vector breeding throughout the year with respect to the year 2000. The transmission windows in Jammu and Kashmir and Rajasthan are likely to increase by 3 to 5 months. In the southern states, however, the window is likely to shorten by 2 to 3 months (Natcom, 2004).

Industry

Needless to say, the industrial sector too would be affected by climate change.

Some industries will be directly affected. These include those in coastal areas like the hotel and hospitality industry, and sectors like salt manufacturing, fisheries, coastal refineries and so on. Coastal infrastructure, such as ports, railway networks (like the Konkan railway) and roads are particularly at risk. The change in energy consumption due to increased space cooling requirements in building and transportation sectors and due to changed irrigation requirements are also some of the projected direct impacts.

Nearly all industries would potentially be affected due to escalating energy costs. These include the various agro industries, those dependent on the forestry sector (building, paper, power generation), as also transportation and insurance. Another possible indirect impact will be due to the poor health of workers.

There is a lot of scope in the industrial sector to mitigate the impacts of climate change. The contemporary climate change scenario offers business

opportunities like clean air technology transfers and energy efficiency improvements. Moreover, funding mechanisms are also available for incorporating such technologies.

The construction sector, one of the major sources of pollution, has been growing steadily for the last two decades. Construction related activities account for quite a large portion of carbon dioxide emissions. The contribution of the building industry to global warming cannot be ignored anymore.

Energy consumption in modern buildings occurs in five phases. The first phase corresponds to the manufacturing of building materials and components, which is termed as embodied energy. The second and third phases correspond to the energy used to transport materials from production plants to the building site and the energy used in the actual construction of the building, which is referred to as grey energy and induced energy. Fourthly, energy is consumed at the operational phase, which corresponds to the running of the building when occupied. Finally, energy is consumed in the demolition process of buildings as well as in the recycling of their parts, when this is promoted.

Cost effective construction technologies can bring down the embodied energy level associated with the production of building materials by lowering the use of energy consuming materials. This embodied energy is a crucial factor for sustainable construction practices, effective reduction of which would contribute in mitigating global warming. Cost effective construction technologies would emerge as the most acceptable case of sustainable technologies in India, both in terms of cost and environment. Also the employment potential is very high (Sengupta, 2008).

Impact of Climate Change in Coastal Areas

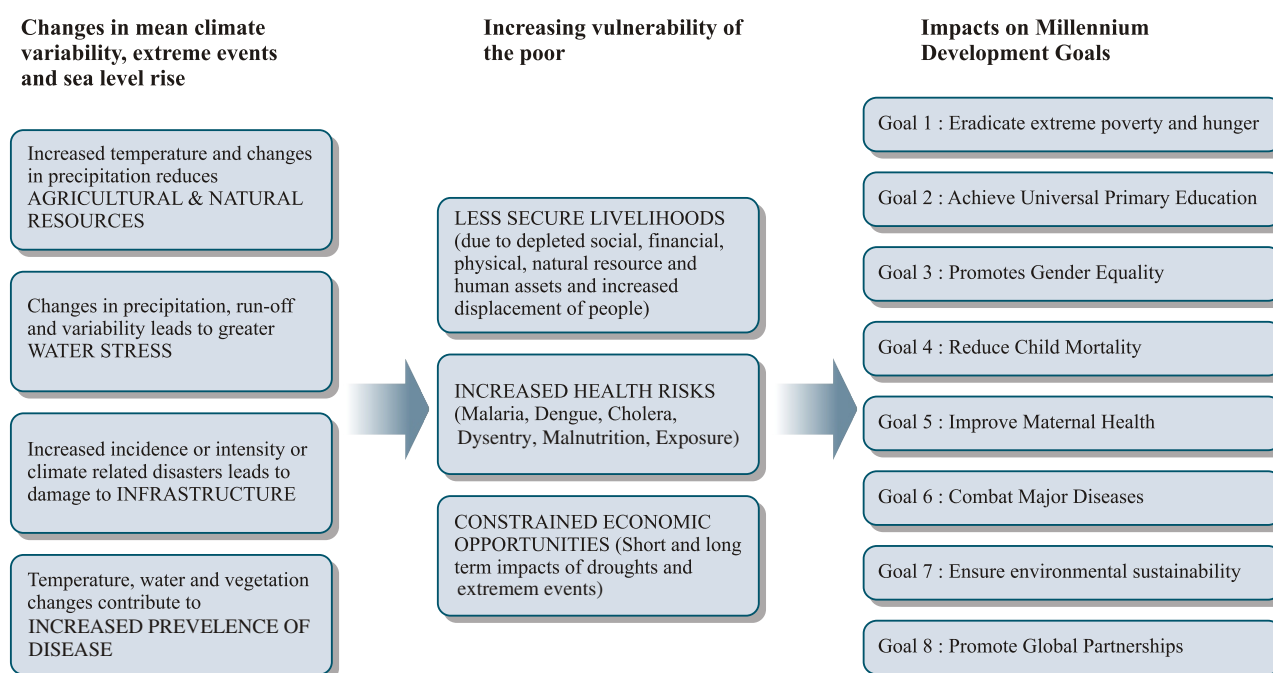
The coastal areas of the country, in the states of Orissa, Andhra Pradesh, Tamil Nadu, Kerala, Karnataka, Maharashtra, Goa and Gujarat, face grave risks due to climate change. There is the risk of cyclones and tsunamis, the intensity of which is predicted to rise. Rising sea-levels, which could flood land (including agricultural land) and cause damage to coastal infrastructure and other property, pose another threat. For instance, Goa stands to lose a large percentage of its land area, including many of its famous beaches and tourist infrastructure. A one metre rise in sea level, it is estimated, will affect 7 percent of Goa's population and cause damage to the tune of Rs 8,100 crore. Similarly, in Maharashtra, over 13 lakh people are at risk; in Mumbai alone, the cost of damage is estimated to be Rs 228,700 crore. Mumbai's northern suburbs, like Versova beach and other

populated areas along tidal mud flats and creeks, are also vulnerable to land loss and increased flooding due to sea level rise (CSE: FACT 17).

Beyond actual inundation, rising sea levels will also put millions of people at greater risk of flooding. This will displace a large number of people and result in rapid urbanisation, while straining resources and putting more pressure on civic amenities. Increased sea water percolation may further reduce freshwater supplies.

Indeed, the full impact of climate change is yet to be understood totally. The problem is compounded by the lack of comprehensive data or accurate models and the sheer complexity of the problem. The impacts work in compound, interactive ways. This renders adaptation all the more important, and without adequate investment in adaptation, it may not be possible to attain the MDG goals (see figure 1).

Figure 1: Impact of climate change on the MDGs



Source : WB, 2002 : 16

Although greenhouse gas emissions need to be reduced to mitigate climate change and avoid future human suffering, adaptation to climate change is also necessary.

Poor countries face a host of development challenges apart from climate variability and climate change, such as the threat of HIV/AIDS, environmental degradation, declining export prices, demographic changes and so on. Climate change is an additional challenge that though significant, has often been overlooked in addressing poverty reduction and sustainable development.

Climate change is very much a development problem, since the poor, with the least adaptive capacities and hence the greatest vulnerability, are expected to suffer the most adverse effects. Vulnerability to climate variability and climate change is only one set of challenges the poor face, especially in the poorer states. Other challenges include indebtedness, HIV/AIDS, food insecurity, environmental degradation, impacts of global trade, conflict, economic decline, increasing urban poor, increasing inequality and macro-economic shocks. Climate change provides an additional threat that adds to, interacts with and can reinforce these existing risks, placing additional strain on the livelihoods and coping strategies of the poor. Climate change is expected to have both direct and indirect effects on poverty.

There is a serious danger that climate change in the form of more extreme droughts, floods and storms, rise in sea level and more intense rainfalls will undermine development interventions and MDGs, and increase poverty (IPCC, 2007).

Although greenhouse gas emissions need to be reduced to mitigate climate change and avoid future human suffering, adaptation to climate change is also necessary. As explained earlier, adaptation to climate change is the adjustment of practices, processes and structures to reduce the negative effects and take advantage of any opportunities associated with climate change. Due to

past greenhouse emissions, some level of human induced climate change over the next decades is inevitable. But at the same time, societal changes such as privatisation of natural resources, declining health, conflicts and insecurity do affect populations and make them increasingly vulnerable even to present climatic variability such as seasonal droughts and extreme events. This is because these developments may have placed people's livelihoods at the brink of collapse or undermined their existing adaptation strategies.

4. Adaptation: Approaches and Issues

The World Bank conceptualises adaptation in natural or human systems as "a response to actual or expected climate stimuli or their effects, which moderates harm or exploits beneficial opportunities" and looks on adaptation as all those "responses to climatic conditions that may be used to reduce vulnerability. Adaptation is a broad concept and can be used in a variety of ways. Adaptation to the (expected) negative impacts of climate change generally takes place in two ways: anticipatory (before the impacts take place) and reactive (as a response to initial impacts). In natural systems, adaptation is reactive by definition. In human systems, adaptation can be both anticipatory and reactive and can be implemented by public and private actors. Private actors include individuals, households, communities, commercial companies and other actors such as NGOs. Public actors include government bodies at all levels" (WB, 2002).

Adaptive capacity is defined as the "ability of people and systems to adjust to climate change; e.g., by individual or collective coping strategies for the reduction and mitigation of risks or by changes in practices, processes or

structures of systems. Adaptive capacity cannot be easily measured since it is related to general levels of sustainable development such as political stability (civil conflict, functioning democracy), economic well being (GDP growth, incidence of poverty), human and social capital (literacy, life expectancy, level of local organisation, micro-finance institutions) and climate specific aspects (such as existing disaster prevention and mitigation systems)” (ibid.)

Adaptation and disaster risk reduction are now common currency in policy debates, the media and public dialogue. Yet a comprehensive understanding of what climate risk reduction or adaptation to the impacts of climate change actually entails is elusive (Moench and Dixit, 2007: 2).

As has been pointed out, challenges of responding to climate risk are shaped by complex interactions between dynamic natural, social, economic, cultural and political systems. These dynamics are due to their complexity, dependence on initial conditions and non-linearity, which are inherently chaotic and difficult to predict. Consequently, attempts to develop “integrated” approaches that respond to all the potential consequences and dynamic changes in human and natural systems will be ineffective and are inherently inappropriate (Holling and Meffe, 1996). Instead, approaches need to be founded on an understanding of systems broad perspectives that recognise the complex interplay between systems (Gunderson 1999; Holling, 2001; Gunderson and Holling, 2002).

There has been substantive conceptualisation and theorisation of adaptation and related notions (see Moench and Dixit, 2007; IISD et al., 2003). Irrespective of future greenhouse gas emissions, inevitability of changes to climate is accepted widely. In this context, there is a consensus that adaptation to climate change is, therefore,

no longer a secondary and long-term response option only to be used as a last resort. Climate change is a reality and, for those communities already vulnerable to the impacts of present day climate hazards, adaptation issues require urgent attention. Indeed, globally there is acceptance that successful adaptation must be accomplished through actions that target and reduce the vulnerabilities poor people now face, as they are likely to become more prevalent as the climate changes (cf. IISD et al., 2003; Moench and Dixit, 2007; WGCCD, 2007). Adaptation, though not proposed as panacea for the world's ills, does offer a new opening to revisit some long-standing problems of the environment and development in an innovative way.

Important in the understanding of adaptation are the notions of disaster risk reduction (DRR) and contextualising vulnerability within it. DRR, simply put, relates to the people and institutions involved in preparedness, mitigation and prevention activities associated with extreme events. These include hazard forecasting and immediate relief efforts for major disasters resulting from floods, cyclones and, in some cases, pollution events (IISD, et al 2003: 4)².

Vulnerability is a term that is used in many different ways, usually describing a condition of susceptibility shaped by exposure, sensitivity and resilience (Kasperson et al., 1996). For the poor, vulnerability is both a condition and a determinant of poverty and refers to the (in)ability of people to avoid, cope with or recover from the harmful impacts of factors that disrupt their lives and that are beyond their immediate control. This includes the impacts of shocks (sudden changes such as natural hazards, war or collapsing market prices) and trends (for example, gradual environmental degradation, oppressive political systems

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² For more detailed discussions of DRR, see Moench and Dixit, 2007.

In relation to climate change, vulnerability relates to direct effects such as more storms, lower rainfall or sea level rises that lead to displacement and to indirect effects such as lower productivity from changing ecosystems or disruption to economic systems.

or deteriorating terms of trade). The need for, and scale of, adaptation reflects the vulnerability of people and natural systems to disruption from changes that reflect the impacts of climate conditions (IISD et al., 2003: 6).

In relation to climate change, vulnerability relates to direct effects such as more storms, lower rainfall or sea level rises that lead to displacement and to indirect effects such as lower productivity from changing ecosystems or disruption to economic systems. With the poor being more directly dependent on ecosystem services and products for their livelihoods, the vulnerability of natural systems has profound implications. Any consideration of the need for adaptation to help poor communities to adjust to the effects of climate change must take into account all of these different forms of vulnerability. Of course, exactly how the effects of climate change will impact upon different people in different places is largely unknown one of the many uncertainties that surround the climate change debate. This is because of the uncertainties inherent in specifying these impacts and because the vulnerability of people will be affected by many events and conditions beyond climate change (IISD et al., 2003).

Central to the understanding of vulnerability is the concept of resilience. The resilience of the poor represents their ability to withstand the impact of the trends and shocks mentioned above, absorbing them while maintaining function (Folke et al., 2002). Resilience varies greatly from household to household, even in one locality. It is determined by two characteristics of peoples' livelihoods: the assets they possess and the services provided by external infrastructure and institutions. Both assets and services are extremely broad in their scope. Assets include the amount and quality of knowledge and labour available to the household, the

physical and financial capital they possess, their social relations and their access to natural resources. External services include those provided by flood control, coastal protection and other infrastructure, transport and communications, access to credit and financial systems, access to markets and emergency relief systems. For many poor people in developing countries, access to these external services is extremely limited, so that their resilience is in large part a reflection of the local asset base. Strategies to strengthen the resilience of communities, particularly poor communities, should be based on the most effective combination of measures to secure and enhance the community's asset base and measures to provide improved external services. The best balance in any one place needs to be determined through effective assessments of local needs and capabilities.

Concepts of resilience take two broad forms:

- **Hard resilience:** these are the direct strength of structures or institutions when placed under pressure
- **Soft resilience:** this connotes the ability of systems to absorb and recover from the impact of disruptive events without fundamental changes in function or structure

In the disaster context, resilience is often treated as the simple inverse of fragility. Engineers, for instance, often refer to increasing the resilience of a structure through specific strengthening measures to reduce their probability of collapse with respect, for example, to earthquake intensities, wind loading or other physical stresses. As resilience increases, the degree of damage for a given intensity hazard decreases. Such approaches fall largely under the category of strengthening hard resilience (Moench and Dixit, 2007).

However, resilience can be viewed more comprehensively, encompassing the entire ecosystem. Ecosystem resilience is the capacity of an ecosystem to tolerate disturbance without collapsing into a qualitatively different state that is controlled by a different set of processes. A resilient ecosystem can withstand shocks and rebuild itself when necessary. Resilience in social systems has the added capacity of humans who are able to anticipate and plan for the future. As part of the natural world humans depend on ecological systems for survival and also continuously impact the ecosystems in which they live, from the local to the global scale. Resilience is a property of these linked social ecological systems. Resilience, as applied to ecosystems or to integrated systems of people and the natural environment, has three defining characteristics (Giot, 2002; IISD, 2003: 7; Moench and Dixit, 2007):

- The amount of change the system can undergo and still retain the same controls on function and structure
- The degree to which the system is capable of self organisation
- The ability to build and increase the capacity for learning and adaptation

Rather than simply strengthening structures or institutions in relation to specific stresses, soft resilience attributes depend on the flexibility and adaptive capacity of the system as a whole. Research in South Asia (Moench and Dixit, 2004) indicates that resilience and adaptive capacities in communities depends on:

- Flexibility (within livelihood, economic, water management and institutional systems)
- Diversification (multiple independent flows to livelihood systems)
- The ability to learn from events (at

both individual and institutional levels)

- Education (the knowledge base required to develop new systems when existing ones are disrupted)
- Mobility (an attribute of flexibility)
- Risk pooling and spreading (institutional arrangements or other mechanisms for spreading and pooling the impacts of disruptions on the system as a whole)
- Operational techniques for risk reduction before and following disruptions (that is, techniques for directing the reorganisation process so that growth and conservation phases do not increase rigidity and ultimate vulnerability)
- Convertible assets (the ability to convert assets accumulated during periods of growth into other forms when disruptions occur)

All of the above contribute to system resilience that is, the ability to adjust to shocks and variability without fundamental changes in the overall system, structurally as well as functionally.

Understanding these notions is important as the poor in India already face multiple risks, including that of global economic forces, deprivation of their entitlements and development dues to which are added the risks associated with climate change. Climate change and associated ecological changes also pose threats to the viability of many economic and social structures, even where people are not displaced or in serious physical risk; this is particularly true in situations where changes will lead to decline in the availability or quality of natural resources, such as water or land, on which the livelihoods of many poor people are based. This is the ultimate goal of adaptation processes: to provide security to people who face greater

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India has undertaken four officially supported national technical assessments of Climate Change risks, impacts, adaptation and mitigation options since 1992.

threats because of changes to the climate conditions in which they live.

5. The National Scenario

Central to the notion of adaptation to climate change is the provisioning of security to people who face greater threats because of changes to the climate conditions in which they live. India made a late start in engaging with questions of climate change. Public engagement with this question picked up only recently, in spite of early environmentalist and academic positions on these questions (Agarwal et al., 1993). This is largely because of the country's post-Rio (1992) pre-occupation with pressing poverty, economic/social development and political challenges, at a time when climate change began to gain significance in the global policy agenda (IPCC, 1995).

India has undertaken four officially supported national technical assessments of climate change risks, impacts, adaptation and mitigation options since 1992. The first was supported by the Asian Development Bank (ADB); the second, the Asian Least Cost Greenhouse Abatement Study (ALCGAS) was supported by the Global Environment Facility (GEF); the third was a Climate Impact Assessment study funded by the Department of Environment, Food, and Rural Affairs (DEFRA), Government of the United Kingdom; and the fourth was the recently concluded National Communication Project supported by the Global Environment Facility (GEF) (Sathaye et al., 2006). These assessments shared three common features: one, they were largely externally funded and driven; two, they were coordinated by the Ministry of Environment and Forests (MoEF), Government of India (GoI); three, they were primarily focused on the "science" of climate change, closely allied to the Intergovernmental Panel on

Climate Change (IPCC) agenda and trends of analysis, and, therefore, were weak in engaging with the complex nature and intensity of vulnerability in India, which is probably the most critical factor in risk mitigation (Revi, 2005). A range of long-range resource, energy and sustainable development studies have also been undertaken, but have had limited impact on the GoI agenda (Planning Commission, 2002; TERI, 1998).

Addressing a complex of six major risk groups: temperature and precipitation variability; drought; flooding and extreme rainfall; cyclone and storm surge; sea-level rise; and linked environmental health risk, is a serious public policy and adaptation management challenge for India.

An important new method that can help address these concerns is composite risk assessment and adaptation planning. This enables a geographically explicit estimation of probabilistic hazard risk, vulnerability and the imputed composite multi-hazard economic risks. Risk prioritisation by hazard, elements at risk and location can thereafter be undertaken, assisting in creating evidence-based investment and regional, rural and urban development policies, and building a bridge between public agencies, communities and the private sector (GSDMA/TARU, 2005).

While some capacity has been built nationally and in about a quarter of Indian states to address single rapid-onset (e.g., earthquake) and long-onset (e.g., drought) risk, nevertheless, managing a complex portfolio of hazard risks and vulnerabilities is both beyond the current mix of public institutions and the nascent private re-insurance and insurance industry.

India has no robust national estimates of composite economic risk due to natural hazards, unlike Bangladesh (Benson and

Clay, 2002). A national Vulnerability Atlas (BMTPC, 1997) is being updated to assess district-level building vulnerability to cyclone, storm surge, earthquake and a broad-brush estimate of flood risk exposure. Unfortunately, this does not use probabilistic methods of risk assessment and the fragility functions used are based on a very limited analysis of loss. Further, no economic loss estimates have been derived. China, on the other hand, is moving towards probabilistic risk assessment methods in cooperation with global re-insurance industry (Shi, 2002).

The only robust state-level estimates of composite risk indicates an annual Gross State Domestic Product (GSDP) compression of about 2 percent for Gujarat, of which drought makes up 57 percent, cyclone and storm surge 12 percent and inland flooding 5 percent, over a 100-year time horizon (GSDMA/TARU, 2005). This assessment breaks new ground by disaggregating risk to economic output and capital stock separately for urban and rural areas. This is one of the most detailed sub-regional risk assessments in the world that percolating down to *talukas* (i.e., sub-district level) for eight crops, animal husbandry, fisheries, industry, services and critical infrastructure (roads and bridges, power, ports and airports). Yet, even though completed in 2005, it does not take into account increased hazard risk due to climate change, because of the low awareness of climate risk exposure in India.

A similar national and state-level estimate of gross domestic product (GDP) or gross state domestic product (GSDP) compression would need to be generated as a priority based on disaggregated district-level analyses to enable actionable intervention sets. A fundamental challenge will be the locus of such an effort. Conventional discipline

and hazard-based approaches (e.g., earthquake, drought or cyclonic storms) are currently situated across a high fractured institutional environment ranging from the Ministries of Science and Technology, Environment, Agriculture and Home Affairs. This is a sure means of ensuring that little strategic perspective and no coordinated action takes place, especially because states, urban local bodies (ULBs) and communities are where the adaptation and mitigation action will take place. Given the significant national development and security implications of climate change, this could be best situated in the Cabinet Secretariat of the GoI. This apex arrangement can help coordinate a large network of institutions that will need to be mobilised across India, to address climate change adaptation and mitigation.

The urgency of the problem lies in the fact that vast sections of the Indian population continue to be deprived of basic amenities and even necessities. India is improving on many critical demographic indicators. The average life expectancy at birth has gone up from 32 years in 1951 to over 60 years today. The Total Fertility Rate (TFR) has declined during 1982-1992 resulting in the reduction of almost one child per woman. The TFR is projected to decline further from 3.13 during 1996-2001, to 2.52 during 2011-2016. The Infant Mortality Rate (IMR), a sensitive indicator of health status as well as of human development, has also declined considerably for both males and females. The average literacy rate has gone up from less than 20 percent in 1951, to more than 65 percent in 2001 (Natcom, 2004). The poverty level has gone down to 26 percent of the total population in 2000 from 51.3 percent during the 1970s.

Yet, despite these achievements, India continues to face the persistent challenge of population and poverty. Around 74

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percent of the population lives in rural areas, in about 5.5 lakh villages, many with poor communications and transport facilities. Reproductive health and basic health infrastructure require considerable strengthening, despite commendable achievements in the last 50 years. Nearly a 100 million people live in urban slums, with limited access to clean potable water, sanitation facilities and health care services. In addition to this, there is the issue of a large-scale migration of people from rural to urban areas.

Almost every sector of the economy, be it agriculture or health, faces a silent (or sometimes not so silent) crisis today due to a complex mix of reasons. Climate change risks will accentuate these crises, and the issue remains whether adopting a business as usual approach, as is often evident in national development programmes, will enhance the adaptation capacities of the poor or enable disaster risk reduction.

On the face of it, the Indian government is aware of these issues and is acting to change things. One example is that in 2006-07, India used 2.17 percent of its GDP, compared to 0.6 percent in 2000-01, on projects that would help communities

adapt to climate change and reduce their vulnerability to climate change, as disclosed by the joint secretary in the MoEF on September 15, 2007 (TOI, New Delhi, 16/9/2007). The Ministry reached this figure by back calculating and claiming that there are several government programmes that address the key factors increasing vulnerability to climate change; these are, 22 programmes in crop management, 19 in drought proofing, 19 in health, 6 in risk finance, 6 in disease control, 12 in forestry and 30-odd in poverty alleviation (ibid.).

A publication available on the ministry's website gives the following graph to further illustrate the above, and adds that along with agriculture, water resources, health and sanitation, forests, coastal zone infrastructure and extreme weather events are specific areas of concern.

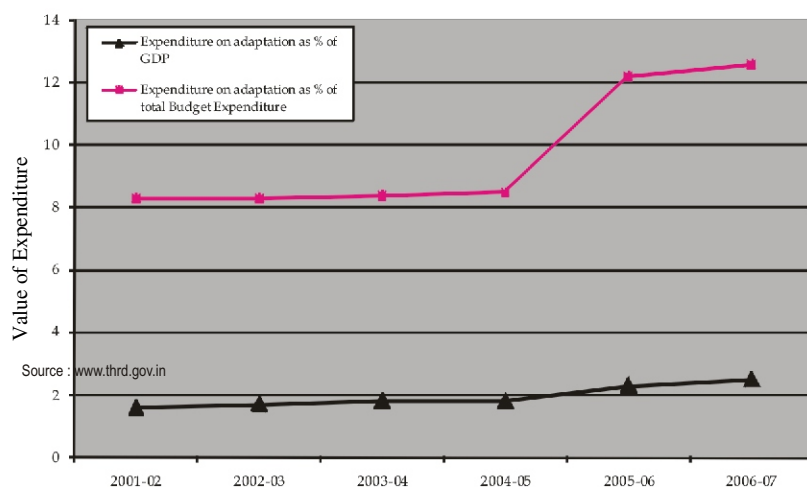
All this data notwithstanding, there is enough evidence to show that lack of accountability and transparency is a serious issue, and that without these it is not possible to attain the goals of intervention processes, no matter how well meaning they may be. The above figures were contested almost as soon as they were released (TOI, 16/9/2007). In the course of the present study an

attempt was made to validate the calculations but to no avail. The issue here is not so much the authenticity of the data and the inclusion or exclusion of programmes that have been considered, but that of the lack of transparency.

The Urban Scenario

India will experience one of the most dramatic settlement transitions in history over the next 40-odd years as its urban population grows from about 300 to over 700 million (Hughes and Hillenbrand, 2006). Unlike most

Figure 2 : Expenditure on adaptation programs in India



Source: www.thrd.gov.in

Source: MoEF, GOI

other regions of the world, South Asia has been marked by a low level of recent urbanisation, although it was one of the most urbanised pre-colonial regions of the 18th century (Banga, 2005; Revi, 2002). About 30 percent of India's population lived in urban areas in 2006 (Census, 2006), but given a 1.1 billion-plus population, its urban population exceeds that of Japan and the European Union (EU) and most other regions of the world, except the United States and China (UN, 2006).

In India, climate change risk should be seen in the perspective of an ongoing three-part transition: a demographic transition that will see India's population stabilising at about 1.6 billion in the 2060s; a simultaneous urban transition, which will see an addition of almost 500 million people in an estimated 7,000 to 12,000 urban settlements over this period; and simultaneously brown (e.g., water, sanitation and environmental health); grey (e.g., air and water pollution) and green (e.g., climate change) environmental transitions (McGraham et al., 2007). This complex interplay of effects requires multiple strategies that are sub-regionally nuanced to respond to the climate crisis, drawing on considerable local experience of coping with uncertainty and far-from-equilibrium systems.

A central challenge of Indian urbanisation over the early 21st century is that by 2050, there will be an almost equal number of people living in about 0.6 million villages as in 12-15,000 towns and cities. By 2025, an estimated 70 Indian cities are expected to have a population size of over one million. In addition, three mega urban regions Mumbai-Pune (50 million), the National Capital Region of Delhi (over 30 million) and Kolkata (20 million) will be among the largest urban concentrations in the world (Census, 2006; Dyson and Visaria, 2004; Revi, 2006).

India could, by mid-century, have both the largest national urban and rural populations of the time. This will have an important bearing on global climate vulnerability and the potential for mitigation and adaptation. Hence, the future direction of Indian urbanisation is not only an important domestic concern, but will be a major international opportunity to demonstrate the viability of a more sustainable development paradigm.

Urban India overtook rural India in its GDP share in the late 1990s, in spite of having less than 30 percent of the national population. This income skew has been accentuated by a recent rapid economic growth in the city-based services and manufacturing sectors. Urban per capita incomes are now over thrice that in rural areas (CSO, 2006; RBI, 2006). India's agriculture sector currently contributes only 18 percent of its GDP, but nevertheless provides livelihoods to close to 60 percent of the population, as well as the biomass and ecosystem services that enable the 'metabolism' of most Indian cities to function. The transformation of this metabolism towards more efficient and productive use of renewable energy (via biofuels and wind) and sustainable water management will be crucial not only to the sustainability of cities, but also the creation of 21st century livelihoods, in a culture that is still in touch with its peasant roots.

Climate change could, in unexpected ways, catalyse the ongoing agrarian crisis in rural India (Sainath, 2002) into a migratory rout, driven by an increase in frequency and intensity; expansion of endemic drought to more areas in the semi-arid peninsula; drought and flooding in the super-dense Indo-Gangetic and Brahmaputra plains; and coastal flooding and drought in the coastal plains (Gosain et al., 2006; Mall et al., 2006; Ramesh et al., 2005). These

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scenarios have only been broadly articulated, but not systematically investigated with fine-grained GIS-linked models (GSDMA/TARU, 2005; Kumar et al., 2006). Hence, most projections on this count can only be seen as speculative at this point of time. Nevertheless, India's medium and long-term social and political stability will require a more nuanced and geographically explicit understanding of these risks as demographic dynamics alter the political representation of southern and western India in key democratic institutions, like the Parliament (De Vries et al., 2007).

It is possible that drought and resource conflict induced by climate change may force the pace of rural-urban migration over the next few decades. Alternatively, severe stresses induced in urban areas due to a mix of water scarcity, environmental services breakdown, flooding and consequent water borne disease and malaria-like epidemics, combined with a rapid rise in health expenditures, could maintain the low current level of rural-urban migration. A greater mobility of the more marginalized and vulnerable sections of society could, in time, alter the migration dynamics across demographically dominant northern and eastern India. This indicates the potential for climate change (along with other driving factors) to induce bifurcation behaviour in migration and hence urbanisation trends questions that need more investigation.

Maintaining two-way flows of food, biomass, water, energy, livelihoods, products and services across the rural-urban (rurban) continuum will be crucial to India's 'development transition' and medium-term sustainability. Hence, climate change adaptation in both cities and their embedding countryside is an undiscovered near-term policy concern -- intimately connected with livelihoods and drought, biomass and energy security (Revi, 2006).

The other important post-2004 development is the reappearance of urban development, urban renewal and governance as a significant public policy agenda after a hiatus of over a decade. The Jawaharlal Nehru National Urban Renewal Mission (JNNURM) was initiated in 2005 to target 60 of the largest and most important cities with a \$10 billion challenge fund that addresses improvements in infrastructure development, urban poverty and urban governance. While this has taken off to a slow start, it is hoped that more rational urban infrastructure development with a strong pro-poor focus would help address some of the structural vulnerabilities of a number of million-plus cities and state capitals.

A large chasm exists between the official urban 'city building' development agenda and vulnerability reduction for those most at risk in these urban areas. A root cause is the ambiguity of the Indian state and its elites, in accepting the centrality of the poor and their informal settlements in the process of urban development and economic growth. This ongoing institutional and cultural failure has been documented for decades, but is now reaching a scale, along with recurrent demolitions and relocations, that has led to the compounding of vulnerability of a large section of urban residents. The most vulnerable populations and elements most at risk in a typical Indian city are:

- Slum, squatter and migrant populations residing in traditional and informal settlements, which are often located in the most vulnerable locations
- Industrial and informal service sector workers, whose occupations place them at significant risk to natural hazards, which is then accentuated by additional stressors such as climate change
- Buildings, especially traditional and

informal housing, that are especially vulnerable to wind, water and geological hazards

- Industrial units and their in-house infrastructure, plant, machinery and raw materials
- Lifeline public and private infrastructure, which includes roads, bridges, railways and ports
- Airports and other transportation systems; water, sewage and gas pipelines; drainage, flood and coastal defence systems; power and telecommunication infrastructure and critical social infrastructure such as hospitals, schools, fire and police stations, and first responder's infrastructure
- Ecosystems and the natural environment, especially wetlands, riverine, estuarine and coastal ecosystems, and surface and groundwater systems

Hence, the imperative of delivering entitlements of adequate services (water, sanitation, solid waste management, drainage, power) and equitable access to land and housing to the bulk of city residents is still a matter of contention. There is, however, currently no independent JNNURM sub-component that addresses either urban vulnerability or risk mitigation, and no climate change-related response in sight.

Risk adaptation and mitigation measures need to address particular populations and elements at risk within a rural landscape to be effective in responding to a heterogeneous field of constraints and opportunities. Hence, decentralised adaptive management strategies that engage with a political, policy and implementation continuum from the neighbourhood, city, and region to national level have proved to be more effective than centralised top-down interventions (Moffat et al., 2003, cited in

Revi, 2005). A coherent framework, within which public policy, private sector and civil society urban development and planning actions are taken, can reduce vulnerability and risk in a steady iterative manner, over a period of decades (Revi, 2005). This, in turn, requires a new set of incentives and structures that link short-run priorities with long-run strategic actions a major shift in the current urban management paradigm.

In the rest of this section programmes that relate specifically to adaptation or disaster risk reduction, insofar as they have the potential or are actually reducing the risks of the poor in rural areas to climate change, are discussed. However, it has to be noted that most of these programmes were not designed with the issue of climate change in mind.

5.1 Government Programmes for Climate Change Adaptation³

The Government of India, as well as several state governments, has launched various programmes to conserve and develop water resources for agricultural and domestic sectors. These programmes, which aim at conservation and sustainable use of water resources, also reduce vulnerability to water stress as well as addressing eradication of poverty. Some of the important programmes are described below.

The centrally-sponsored scheme for soil conservation for the enhancement of productivity of degraded areas in the catchments of River Valley Projects (RVP) and Flood Prone Rivers (FPR) is being implemented on a watershed basis in 45 selected catchments throughout the

³ International Agencies such as the UNDP or the DFID have several programmes, including UNDP's DRM programme. However, most of these are implemented through Government Agencies. They are not discussed here as it is presumed that relevant information/evaluations are available with the agencies concerned. Similarly, there are many NGOs across the country implementing many programmes whose objectives are the same as the government ones. Some of them have yielded very good results, which will be discussed in the section on the states.

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“ Overall national objectives of reducing the adverse impact of droughts, improving/stabilising the production of important rainfed crops like pulses and oilseeds, and controlling siltation of reservoirs, have not been achieved to a satisfactory level.”

country. Other schemes include the Drought Prone Areas Programme (DPAP), Desert Development Programme (DDP), National Watershed Development Programme for Rainfed Areas (NWDPRAs), Soil, Water and Tree Conservation (Operation Soil Watch), operational research projects on Integrated Watershed Management, and the Jawahar Rojgar Yojana (JRY). All these programmes had definite objectives: improvement of productivity of catchment areas, optimum use of soil, land and water and their conservation, and employment generation.

Watershed Development Programme

This programme has been in operation for nearly 40 years. It has emphasised the importance of soil and water conservation, and people's participation through Watershed Associations in planning and management.

As the Natcom notes, “Overall national objectives of reducing the adverse impact of droughts, improving/stabilising the production of important rainfed crops like pulses and oilseeds, and controlling siltation of reservoirs, have not been achieved to a satisfactory level.”

However, the impact of some of the watershed projects in reducing siltation, expansion of cropped area, increase in cropping intensity and grain/biomass yields has been very pronounced and visible on the ground. The watershed development programme has emphasised soil and water conservation

efforts/methods, but not on productivity-linked best agronomic practices (Natcom, 2004).

Command Area Development Programme (CAD)

This programme has had a positive impact on irrigation water utilisation, irrigation intensity, agricultural productivity and soil and water environment. It has been felt that the main emphasis of CAD has so far been on hard resilience or physical works, such as construction of field channels and on-farm development work.

Crop Diversification

Crop diversification methods such as crop rotation, mixed cropping and double cropping, reduce the vulnerability of crop yields. Crop diversification has also been found to result in reduced erosion, improved soil fertility, improved crop yield, reduced risk of crop failure and enhanced water savings.



Source : GEAG Resource Centre

Expansion of Irrigation and Irrigation Water Management

Irrigation reduces the vulnerability of crop yields to the vagaries of rainfall. India has implemented a large programme to expand irrigation from diverse sources. However, about 60 percent of the net sown area is still under rainfed cropping.

Flood Control and Flood Management

Flooding is a major problem in the Himalayan rivers. About 40 Mha, which is close to one-eighth of the geographical area of the country, is vulnerable to floods. Flood protection works in the form of flood embankments and reservoirs have not proved very useful. It has been felt that it may not be possible to provide complete protection against floods. What is needed is a greater emphasis on the efficient management of flood plains, flood proofing, including disaster preparedness and response planning, flood forecasting and warning, and many other non-structural measures.

There are several bodies that have been set up expressly to deal with the problem of floods. The National Flood Commission (*Rashtriya Barh Ayog*) was set up in 1976 by the Government of India to review and evaluate the flood protection measures undertaken since 1954, and to evolve a comprehensive approach to the problem of floods. In 1996, the Government of India set up a Task Force to review the impact of recommendations of the *Rashtriya Barh Ayog* and analyse the strategies evolved so far for mitigating flood problems, and to suggest both short-term and long-term measures.

Though there is no dearth of critiques of the various development programmes, they rarely lead to any constructive outcome or positive change. Thus, despite the barrage of criticisms, the flood

control and management measures have remained confined mostly to the construction of dams and embankments. Hence, the International Rivers Network (IRN) argued, in a 2007 report, that flood control based on dams and embankments failed to stop the rapid rise, severity and number of floods (IRN, 2007). Dams and levees can never be fail proof and when they do fail they can cause catastrophic damage. In addition, by creating a false sense of security, they encourage questionable development on vulnerable floodplains. Thus, in 2006, monsoon waters were released from the Ukai Dam in Gujarat to stop the dam breaching. At least 120 people were killed and many millions of rupees of damage were caused. At least 39 people were killed walking across the Sind River in Madhya Pradesh during a religious ceremony, washed away by sudden releases from the Manikheda Dam. These stories were repeated in many river basins across India in 2006, including the Mahi, Sabarmati, Chambal, Narmada, Krishna, Godavari and Mahanadi basins. Sudden high releases of water from dams were the prime reason for most of the flood damage in these basins.

Similar releases of water from dams or the backwaters of reservoirs like the Massanjore Dam on the Mayurakshi River affect thousands of people annually, most of them tribals. In 1999, when the "super-cyclone" hit Orissa on September 30, the barrage upstream of Bhadrak town was opened, flooding large parts of the town, including the low-lying stream beds that had been occupied over the years by the poor. Though not directly cyclone affected, many lives were lost as a result.

In agriculture, despite the emphasis on the marginalised and the poor, and the stress on people's participation, farmer suicides seem to be on the increase. According to the eco-feminist Vandana

The International Rivers Network (IRN) argued, in a 2007 report, that flood control based on dams and embankments failed to stop the rapid rise, severity and number of floods (IRN, 2007).

Shiva, the Indian government policies have already marginalised Indian small farmers and made them more vulnerable to climate change. "Policies driven by corporate globalisation are pushing farmers off the land, and peasants out of agriculture," said Shiva in April 2007, "This is not a natural evolutionary

process; it is a violent and imposed process and the 150,000 farmer suicides are one aspect of this violence" (WGCCD, 2007:46)

Similarly, the DPAP and DDP too have come under intense criticism from several government appointed committees (see box).

BOX A critique of the GoI led drought proofing efforts

Systematic long term drought proofing efforts were launched by the GoI during 1973-74 (DPAP) and 1977-78 (DDP) to create assets designed to reduce the impact of drought. A Planning Commission sponsored study on Droughts in Gujarat (Roy and Hirway, 2007) shows that the results of these programmes so far have not been satisfactory.

Both programmes seek to:

- Minimise adverse effects on crop productivity, livestock, water and human resources;
- Promote economic development of the poorer sections through creation and equitable distribution of productive resources;
- Increase employment opportunities through sustainable livelihoods; and
- Reduce ecological degradation and desertification in perpetual drought regions.

But subsequent evaluations of these programmes, by as many as six committees, reveal that projects under the DPAP and DDP have not resulted in raising productivity and conservation of soil moisture to reduce the adverse impact of drought, and in checking desertification. Till 1994, the DPAP and DDP were being implemented on a sectoral basis where major activities like soil-moisture conservation, water resource development, afforestation and pasture development were taken up in a fragmented manner by different line departments. Isolated implementation of wide ranging sectoral activities over widely disjointed areas of very small sizes failed to bring about any noticeable impact, and programme objectives remained farfetched. In 1993 the Hanumantha Rao Committee suggested major policy changes. These included

- (a) Development of lands, water and vegetative resources on a watershed basis in the area development programmes, including IWDP.
- (b) The treatment for the watersheds should include all categories of land including private, village commons, revenue and degraded forest lands.
- (c) A micro-watershed with about 500 ha may be taken up for management and development.
- (d) Watershed development programmes should be implemented with the total participation of the beneficiaries.
- (e) Awareness raising including dissemination of relevant information relating to the programme should be given priority.
- (f) State and District Level Committees should be constituted to monitor the programmes.

- (g) States should also contribute a suitable matching share in watershed development schemes.
- (h) Training at various levels for the preparation of Watershed Development Plan should be arranged.
- (i) For identification of blocks to be covered under the DPAP and DDP, the criteria of moisture index, three eco-systems - arid, semi-arid and dry sub-humid and area under irrigation may be taken into consideration.
- (j) It is necessary to organise independent evaluation studies on a regular basis through reputed independent and autonomous organisations

Based on the above recommendations, uniform guidelines for all the three programmes, i.e., DPAP, DDP and IWSD, were formulated. Both sectoral and area development were given importance under these programmes. The Government attached utmost importance for development of waste and degraded lands by increasing their productivity following the principle of equity, transparency and community empowerment by adopting low-cost locally available technology and material. These guidelines were in operation for a period of over six years.

However, the performance under these schemes has so far not been satisfactory. This has been largely due to: a) lack of convergence of other rural and agriculture development programmes at the ground level, b) the projects were implemented in isolation and in a disjointed manner, c) management of projects failed due to lack of inter departmental coordination, d) projects under these programmes became, over the years, too large to handle, and e) large scale malpractice has been observed at ground level. Nonetheless, the projects under the supervision of NGOs and local CBOs have shown some good results in achieving the goals of integrated watershed development programmes, thereby reducing the impact of drought.

In fact, this was reflected in the S Parthasarthy Technical Committee of 2005, appointed to look into the nation's watershed programmes. The salient findings of the Committee were as follows:

- Dry-land regions of India have suffered due to a lack of attention
- Financial resources have been abysmal
- Implementation has been totally top down
- Rigid bureaucratic system of project execution
- Participation of grassroots agencies and local NGOs is needed
- Massive investment proposal for dry land development to the tune of Rs 10,000 crore annually for 15 years is required

The committee recommended the creation of a National Authority of Sustainable Development of Rainfed Areas (NASDORA). The NASDORA should be a quasi-independent authority with the mandate to manage the watershed programme, must be endowed with autonomy and flexibility to respond innovatively to local needs, and must have clear accountability for performance. This recommendation is yet to be implemented.

Yet all these interventions and programmes can still be adapted to adequately meet the challenges of climate change. The Public Distribution System (PDS), spread across every part of the country, could be useful but is very much in need of restructuring⁴. Programmes under the National Rural Employment Guarantee Act (NREGA) can be used to deal with the impacts of climate change in agriculture in rural populations by ensuring a safety net for those facing droughts and/or floods, or too little or too much rainfall. Climate proofing could be undertaken through judicious public works based on the principles of community based planning, which are embedded in the provisions of the act itself⁵. A major change that is needed is the way families are identified as being below or above the poverty line. Local

specify that employment (of 100 days a year) is available only to one person per family and not all those who demand work. Moreover, the selection of persons for employment is dependent on the local power elite, who have the backing of various political parties. In many areas, the norms prevent building of community assets and are restricted only to making *kutchra* roads (Mitra, 2007)⁶.

Government sources recognise that water resources need to be managed efficiently so that wastage is minimised (Natcom, 2004). Management issues should include linkages with the farmers, command area development, water conservation techniques, participatory irrigation management and institutional reforms. All reforms must be backed by research and diagnostic analysis for optimal results. The efficiency of existing systems



politics plays a major role in this process almost all over the country. The NREGA has recently been expanded to all the districts of the country, but still the norms

needs to be enhanced so that the savings in water are utilised to increase irrigation intensity. Irrigation consumes nearly 83 percent of water being used at present; it

is estimated that even in the year 2050 the requirement will continue to be about 79 percent of the total water consumption. Yet, even a nominal saving of 10 percent in irrigation water can result in an increase in the availability of water for domestic and industrial use by about 40 percent in the long term. Such an increase may also be used



Source : www.ruraldev.gujarat.gov.in

to offset the impacts of climate change in areas where reduction in water availability is projected (ibid).

The fact remains that despite the numerous technological, managerial and institutional options available, the country's national programmes for agriculture, water or biodiversity do not adequately address developmental issues, in spite of the impending challenge of climate change. The same set of issues that mark most development programmes, such as lack of transparency and accountability or the participation of the people in the planning and implementation processes also mark the measures that are being sought for adaptation to climate change. One example given above is that of the spending on climate change adaptation programmes and its ratio to the GDP.

Several other issues are involved too. Just as the inter-linkages between various interventions, even in the same local area, are ignored, leading to several line agencies working at cross purposes or duplicating efforts, issues like education

(both non-formal and formal) are often neglected. Health issues remain a major concern, with a weak and underdeveloped public health infrastructure, even in states like West Bengal. Sectoral issues apart, the major problem lies in the very approach itself. It is generally assumed that building up hard resilience will automatically lead to developing soft resilience. Sometimes, even the measures to build soft resilience are treated as though hard resilience structures are being built, with solutions arrived at mechanically, not taking into account the flexibilities required when dealing with human beings and social problematics. Some of these issues will be discussed in greater detail in the discussion on the states.

4 The PDS essentially seeks to give a certain amount of foodgrains, the amount varying from state to state, at very subsidized rates to those who are too poor to buy them in the open market. The entitlements are linked to whether one is below the poverty line (BPL) or above the poverty line (APL). What is needed is a change in the method of classifying families as BPL or APL.

5 <http://www.nrega.nic.in>

6 These are rough paths that are not paved, bricked or macadamized.



The State Level The State Level Scenario

2 THE STATE LEVEL SCENARIO

1. Background: Inter-regional Disparities in Human Development

The states of Rajasthan, UP, MP, Chhattisgarh, Bihar and Orissa form the UNDAF states. They are not only some of the most disaster prone states in the

Table 2: HDI Rankings of the UNDAF States (undivided)⁷

State	1981 (rank)	1991 (rank)	2001 (rank)
Bihar	0.237 (15)	0.308 (15)	0.367 (15)
Chhattisgarh	NA	NA	NA
Jharkhand	NA	NA	NA
Madhya Pradesh	0.245 (14)	0.328 (13)	0.394 (12)
Orissa	0.267 (11)	0.345 (12)	0.404 (11)
Rajasthan	0.256 (12))	0.347 (11)	0.424 (9)
Uttar Pradesh	0.255 (13)	0.381	0.472
All India	0.302	0.381	0.472

Source : Planning Commission, GoI, National Human Development Report, 2001

They are not only some of the most disaster prone states in the country, but also the poorest and the worst performers in terms of economic and social development too, and represent the high level of interregional disparities in the country.

country, but also the poorest and the worst performers in terms of economic and social development too, and represent the high level of interregional disparities in the country. The data from India's Human Development Report, 2001, shows that the human development ranks of these states remained almost the same across two decades (see Table 2). Though there was some improvement in the absolute figures between 1981 and 2001, the HDI (human development index) was much below 0.5

In fact, taking the undivided five states and West Bengal, which too is disaster prone, and where a large proportion live

below the poverty line and are subject to the vagaries of climate change, these were the bottom five worst performing states till the middle of the 1990s. These states form a single large geographical block that demands far more serious and concerted public and intellectual attention than it has received so far. One should note that within this line-up of *Bimaru*⁸ states (Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh), other states such as Orissa must also be considered. In fact, a more detailed examination reveals that Orissa is closer to Bihar in its non-performance than to Madhya Pradesh and Rajasthan, which seem to show some signs of positive change (Kannan, 2004).

Kannan (ibid.) selected indicators to represent four basic social security concerns, that is, food, health, education and housing. They were examined at four different levels. The first two composite indicators together capture all the four concerns; the next seven are general but unitary indicators to examine them individually; the next seven are intended to explicitly bring in the gender dimension; and the last

five to examine the performance in terms of the well-being of two sections of the population those belonging to the Scheduled Castes and Tribes (SC and ST) who continue to be at the bottom of the social and economic ladder in Indian society. All the data refer to the 1990s or the early 2000s.

Table 3 shows the extremes in performance levels, which are rather disturbing. The Human Development Index (HDI) of Kerala in the early 1990s is closer to that of Vietnam and Indonesia

⁷ Subsequently, Bihar was bifurcated into two states and Jharkhand was formed; similarly, Chhattisgarh was formed out of Madhya Pradesh and Uttaranchal was carved out of UP

⁸ This acronym, which means "sick" or "ill" in Hindi, is used to lampoon these states and their chronically low development.

(110) and at least 20 countries above that of India as a whole. The HDI of Bihar is closer to the bottom six of the total of 140 countries in 1990. In fact, there were only six countries, all in Africa, that had HDI values that were closer to or less than that of Bihar. The internal disparity is sharply portrayed by the fact that Bihar's

attainment is only half that of Kerala. Examining the Human Poverty Index (HPI), which is a measure of deprivation, the disparity is sharper, with Kerala indicating one-fifth of its population as deprived, whereas in Bihar the proportion is more than two-and-a-half times that of Kerala.

Table 3: Disparity in Performance between the States

Disparity in Performance Between the Best and the Worst Performing States

No.	Indicator	Best Performer	Worst Performer
1.	HDI, 1991 (value)	Kerala (0.59)	Bihar (0.31)
2.	HPI, 1991 (percent of households)	Kerala (20)	Bihar (52)
<i>Indicators for all population</i>			
3.	Income poverty, 1999-00 (percent of population)	Jammu and Kashmir (4)	Orissa (47)
4.	Total literacy, 2001 (percent of population)	Kerala (91)	Bihar (48)
5.	Ever enrolment rate, 6-14 years, 1994 (percent)	Kerala (99)	Bihar (59)
6.	Infant Mortality Rate (per 1000 births)	Kerala (16)	Uttar Pradesh (87)
7.	Kutcha housing, 1994 (percent households)	Haryana (14)	Orissa (77)
8.	Households with a toilet, 1994 (percent)	North East Region (68)	Orissa (3)
9.	Households, with electricity, 1994 (percent)	Himachal Pradesh (88)	Bihar (9)
<i>Gender sensitive indicators</i>			
10.	Gender Disparity Index (value)	Kerala (0.83)	Bihar (0.47)
11.	Female life expectancy, 1993-97 (years)	Kerala (75.9)	Madhya Pradesh (55.2)
12.	Female literacy, 2001 (percent of population)	Kerala (88)	Bihar (34)
13.	Sex ratio, 6 yrs + females per 1000 males)	Kerala (1071)	Sikkim (858)
14.	Infant mortality, girls, 1998 (per 1000 births)	Kerala (13)	Madhya Pradesh (97)
15.	Any anaemia among women 1994 (percent)	Kerala (23)	Assam (70)
16.	Dropout among girls, primary, 1994 (percent)	Kerala (-5)	Rajasthan (63)
<i>Indicators for Scheduled Castes and Tribes</i>			
17.	Kutcha housing, 1994 (percent)	Haryana (24)	Orissa (87)
18.	Households with a toilet, 1994 (percent)	North East region (67)	Orissa (0.7)
19.	Households with electricity, 1994 (percent)	Himachal Pradesh (84)	Bihar (4)
20.	Overall literacy, 1994 (percent of population)	Kerala (78)	Bihar (28)
21.	Ever enrolment rate, 6-14 years, 1994	Kerala (97)	Bihar (45)

Source : Kannan, 2004

A far starker picture emerges on analysing the unitary indicators that depict the basic socio-economic condition of the people. Income poverty in the worst performing state of Orissa is 12 times that of the best performing Jammu and Kashmir (J & K). In fact, the five best performing states fall in a range of 4 percent (in J & K) to 12 percent (in Kerala), whereas the figure ranges from 36 percent (Sikkim) to 47 percent (Orissa), with Bihar, MP and Assam coming in between. These two sets of states represent the two ends of the poverty spectrum.

Housing represents an important dimension of human dignity and the internal spatial disparity could hardly be worse. Orissa has 77 percent of households with kutcha housing, that is, more than five times that of the best performing Haryana. But a more basic and pointed indicator of human dignity is the availability of a toilet. Only 3 percent of households in Orissa had a toilet compared to 68 percent in the North Eastern states. Electricity, a modern basic amenity, is a ready indicator of the quality of living: in Himachal Pradesh, 88 percent households have electricity, but in Bihar, it is only one-tenth of the former, at 9 percent.

Gender sensitivity is generally perceived to be a weak point of Indian society. But that would perhaps appear a sweeping statement to make when one looks at the spatial disparities. Women's life expectancy in Kerala is 76 years, not only comparable to those in developed countries but also well above that of men by 4 to 5 years. Punjab is a distant second with 69 years. But the worst performing, Madhya Pradesh, has just 55 years, that is, 20 years lower than that of Kerala. In fact, the worst performing states of MP, UP, Orissa, Assam and Bihar show a range of only 55 to 58 years compared to the best performing ones between 65 to 76 years.

A basic and robust indicator of social development is the ability of a society to reduce the probability of death of infants before they attain the age of one year. The disparity between the best performing Kerala (16) and worst performing Uttar Pradesh (87) is more than five times; the latter represents one of the highest rates in the contemporary world. Here again, a far more disturbing picture emerges when we look at girl children. The worst performing state, Madhya Pradesh, records an infant-girl death rate of 97, seven times more than that of Kerala. Similarly, the disparity in female literacy is also much higher than in overall literacy. The wide disparity in dropout rates of girl children in primary schools and in the incidence of anaemia is also alarming.

By all indications, the socio-economic status of those listed as SC and ST is at the bottom of Indian society. But here again there are significant spatial variations. Based on the availability of data, Kannan (ibid.) selected two sets of indicators that emphasise the dimension of human dignity: the quality of housing and access to basic education. The disparities here are so stark that one cannot now make a sweeping statement about the condition of SC and ST population across the entire length and breadth of this country.

Hardly one percent of SC and ST households in Orissa have a toilet while the figure is a truly remarkable 67 percent in the North Eastern region. 87 percent of households in Orissa live in a kutcha house while only 24 percent do so in Haryana; the disparity is more than three-and-a-half times. In the case of electrification of houses of SC and ST population, Himachal Pradesh again shines with 84 percent while it is the turn of Kerala to shine in the case of literacy, with 78 percent, compared to a mere 28 percent in Bihar. As in the case of literacy, so is the case of school

enrolment, with Kerala recording a remarkable 97 percent compared to 45 percent in Bihar.

Taking all these 21 indicators, Kannan identified states that figure at the top five and bottom five to indicate "best" and "worst" performances in a comparative setting. The ranking here indicates the overall ranking (see Table 4). The number of indicators in which the identified states score is given in brackets.

Table 4: Best and worst performing states

Best Performing and Worst Performing States in 21 Indicators			
Rank	Best	Rank	Worst
1	Kerala (19)	1	Bihar (19)
2	Himachal Pradesh (13)	2	Orissa (14)
3	Punjab (13)	3	Uttar Pradesh (12)
4	Tamil Nadu (12)	3	Rajasthan (12)
5	Maharashtra (9)	4	Madhya Pradesh (11)
6	Haryana (8)	5	West Bengal (7)

Source : Kannan 2004

Several significant issues emerge from this analysis. First, the best performers constitute only about a quarter of the Indian population whereas the worst performers account for more than half of the total. Therefore, unless the latter improve rapidly in terms of basic socioeconomic development, the Indian averages will continue to be on the downside. When one examines the share of SC and ST population among the best and the worst, the picture is even more disturbing, with the worst performers accounting for 58 percent and the best one just for 20 percent of the country total.⁹ Against the above background, we examine in detail the situation of climate change adaptation in the major UNDAF states, that is, Rajasthan, Uttar Pradesh, Bihar, Madhya Pradesh and Orissa. The discussions on the states are descriptive, more to give an idea about the

dimensions of poverty and deprivation and the various developmental programmes and issues. Most of the information is from 1) Human Development Reports (MP, Rajasthan, Orissa), and 2) the relevant state government websites. Other sources used have been cited appropriately. For UP, extensive use was made of material made available by GEAG. An attempt is made to look at the disaster proneness as well as preparedness. Given that this exercise

was primarily a desk review combined with interviews with key persons, data and information on Jharkhand and Chhattisgarh was not

readily available. However, it can be surmised that the situation is not very markedly different from the states of which they were a part until a few years ago. Also, due to the diverse sources of information, the data is not strictly comparable across the states nor is the format uniform.

⁹ States with a higher share of the SC and ST population do not necessarily perform badly; Himachal Pradesh, one of the best performing states, has around 30 percent SC and ST population, which is close to that of Rajasthan and West Bengal, the two worst performing ones, though less than that of Bihar and Uttar Pradesh. In fact, the share of SC and ST population in Punjab (28 percent), another best performing state, is much more than that of Uttar Pradesh (21 percent). Clearly the issue is not one of population share. In fact, some states in the North East region such as Mizoram, Manipur and Nagaland with a very high share of ST population have a high achievement record in Human Development Index, literacy and the status of women. It is quite possible that the achievements are related to their historical access to resources along with a high degree of autonomy in affairs of state that shape public policies.

2. The States

(i) Uttar Pradesh



It is the third poorest state in India with a per capita annual income of US\$200. Some 80 percent of the people in UP live in rural areas, and 66 percent depend on agriculture for their livelihood.

Uttar Pradesh (UP) is home to 166.2 million people living in high density - 689 persons per sq km. The population is spread over 70 districts, with 300 *tehsils*¹⁰ and 813 blocks across 4 geographic regions - western, eastern, central and Bundelkhand. It is the third poorest state in India with a per capita annual income of US\$200. Some 80 percent of the people in UP live in rural areas, and 66 percent depend on agriculture for their livelihood; agriculture accounted for 38 percent of the GSDP in 2001-02. Six percent of the population is involved in household industries and 28 percent in other services¹¹.

The social composition of its people is as diverse as its regions. As per the 2001 census, Hindus constitute 80.6 percent, Muslims 18.5 percent, SCs 21.5 percent and STs 0.7 percent of the population, while other religious minorities constitute 0.9 percent.

Large disparities exist amongst the social groups despite the affirmative action from the government to bridge the gaps of exclusion through affirmative action policies for SCs/STs, besides other policy interventions for addressing alleviation of

poverty and deprivation of marginalised social groups.

According to the UP Human Development Report (UPHDR)¹², 2007, UP ranked 15th in terms of per capita income out of the 18 major Indian states considered for the study. Its poverty ranking amongst the states was 11: 32.8 percent of the population was below the poverty line in 2004-5. Every 6th malnourished child in the country lives in UP. The IMR is 73 per 1,000, much higher than the national average of 58 per 1,000. (2000-2005).¹³ Almost 40 percent of its population remains uneducated, seriously affecting their ability to make any demands on the state for a better quality of life, access to development initiatives or healthcare or even a livelihood.

Education and Literacy

There is a great deal of variation in educational development, reflected in divergent literacy rates across the state, with literacy rates of 55.22 percent, 58.44 percent, 59.04 percent and 60.32 percent in eastern, western, central and Bundelkhand regions, as against the state average of 57.36 percent. Some districts exhibit very low male and female literacy rates in comparison to the state average of 70.2 percent for men and 42.9 percent for women.

About 7.85 lakh children from marginalised and deprived social groups still continue to be outside the mainstream of elementary education.

More than 52 percent children are involved in domestic labour while 12 percent (mainly girls) are involved in sibling care, 3.75 percent children do not

10 A *tehsil* is the administrative sub-division of a district.

11 Ashok Kumar Tripathi and Purnima Varma, 2007

12 Government of Uttar Pradesh, 2006-7

13 UP Human Development Report, 2006

14 Mid term review, Sarva Shiksha Abhiyan (SSA) UP, 2007, for National University of Education Planning and Administration (NEUPA)

have access to schools and 20 percent are out of school due to various other reasons. Among the never enrolled children, Other Backward Classes (OBC)¹⁵ is the largest group with 2.38 lakh¹⁶ (44 percent children, of which girls constitute the majority). The OBCs comprise the largest group in the state population too. Even among enrolled children, the dropouts are higher among the OBCs, at 36 percent. The never enrolled children in the different social groups vary as per household survey: OBCs - 44 percent, SCs - 24.3 percent, minority - 23 percent and general - 6.55 percent.

Health

Although UP has a fairly large public sector health infrastructure which had an outlay of 4.6 percent till the 10th Plan, it received a boost to 7.3 percent outlay for the 11th Plan. However, only 9 percent people actually make use of this facility for treatment of ordinary ailments. The Primary Health Centres (PHCs) at the village level in most cases function minimally. Doctors absent themselves regularly as most of them live in urban areas, far from the centres. The ANMs (auxiliary nurse and midwife) are not available on a daily basis as they have their own issues regarding commuting to work areas.

Patients with serious diseases or child birth complications have no choice but to resort to District Civil Hospitals. Here again, lack of ready transportation and financial poverty impair recovery. In UP, only half of all pregnant women receive antenatal care services and only 18 percent women have institutional deliveries. More than 80 percent women in the rural areas are dependent on local traditional birth attendants (*dais*) for deliveries.

The Total Fertility Rate (TFR) for rural women in UP remains at 3.8, much higher

than the national average of 2.8. It could be assumed that women in rural areas have more children as immunisation is low, diseases cannot be contained and hygiene is of low priority, and thus more children die at infancy, resulting in more pregnancies to replace the loss.

The proportion of public resources the state commits to health services is one of the lowest in the country. UP had a low increase in per capita expenditure on health after 1998 even though the decadal population increase has been 16.6, up from 15.2 from 1991-2001. Per capita expenditure for Family Welfare in 2001-02 rose to only Rs 18.5 from Rs 15.3 in 1995-96. (Srinivasan et al., 2007).

Japanese encephalitis has emerged as a serious problem in rural areas of eastern UP. The scourge of the disease is most severe in Gorakhpur District. The disease is now gradually spreading to other parts of the state. This was recently evident by the death of more than four dozen children infected with the disease in Sarahanpur District of western UP. According to State Government sources, Japanese encephalitis has claimed more than 2,700 lives since 2002 in UP. Medical surveys in the state reveal that of the total diseased persons, children represent 80 percent. Thus, compared to adults, children are more susceptible to the disease. Children surviving the disease often develop complex problems relating to the brain. Water-logging and pig farming are the two most important predisposing factors favouring the development and spread of the disease.

15 The Central Government of India classifies some of its citizens based on their social and economic condition as Scheduled Caste, Scheduled Tribe and Other Backward Class (OBC). The OBC list presented by the National Backward Classes Commission is dynamic (castes and communities can be added or removed) and will change from time to time depending on social, educational and economic factors. For example, the OBCs are entitled to 27 percent reservations in public sector employment and higher education. In the constitution, OBCs are described as "socially and educationally backward classes", and government is enjoined to ensure their social and educational development.

16 SSA, 2005-06

Women in UP¹⁷

In 2000, UP's Department of Women and Child Development, with the help of the Mahila Samakhya, and in consultation with multiple stakeholders government, NGOs, planners, academicians, activists and many other committed people drafted a Policy for Women. The Draft Women's Policy has been vetted, revised and is finally ready, but has yet to be publicly announced by GoUP, a reflection of the priorities and commitments of the state administration.

Women in UP face a considerable gender gap in human capital, due to low levels of education, which is reflected in the literacy levels eastern UP is a case in point. Their contribution, though immense in reproductive and unpaid work, is undervalued. Due to gender biases women's work is often and largely invisible and this is accompanied by lack of educational opportunities for women as well as lack of access to health care. Consequently, population density is high in certain regions due to large family size, as reflected in a high TFR.

Gender wage gaps are prevalent in the rural sector with women's low bargaining power due to lack of other work opportunities. The differential wage rate continues to be prevalent in the unorganised sector. Though women's participation in

the labour market formal and informal has increased, they are burdened with domestic responsibilities, suffer from job segregation and do not have the privilege of exercising choices for work/jobs due to economic constraints. Work and job insecurity is high due to low level jobs because of lack of education. Women experience poor working conditions and other work place-related discriminations and harassments. Labour market discrimination against women, especially in managerial positions, is evident across sectors and levels. Women's presence in

the work arena is impacted equally by economic development and caste dimensions. The work wages for different types of work for agricultural operations varies for males and females. This is evident in the following table:

Table 5 : Differential wages in agricultural work

Activity	Amount in Rs.	
Sowing	F 45.29	M 51.12
Harvesting	F 47.43	M 52.03
Threshing	F 47.83	M 51.95
Others	F 45.47	M 60.48

Source : GoUP, 11th Plan Document, 2007-08

When mechanisation replaces manual labour, it is the women who get displaced, leaving them hardly any opportunity to find alternate jobs. Men often migrate to other areas in search of work, a possibility that is closed to women due to social and cultural factors, as well as the necessities of reproductive work. Paradoxically, more than 50 percent of the total work force comprises women but only 13 percent are seen as workers. They do not qualify as wage workers since much of the work (87 percent) is not economically valued as it entails reproductive work. However, in the urban areas, the proportion of women workers in secondary and tertiary sectors is roughly the same as men. Work in the household industry and informal sector entails long working hours, hardly any social interaction and low monetary compensation. So, it is not surprising that women with low bargaining power are seen here in large numbers (Table 6) The organised sector employed only 9 percent women as against 91 percent males (1998-99). Women were most visible in the casual labour sector.

17 Based on Latha Nair and Nishi Mehrotra, 2007: Gender, Caste and Growth: UP Sub-national Study, Draft Report submitted to DFID

Table 6 : Percentage of gender distribution in the labour market

Work	Male	Female
Cultivators	41.0	20.0
Labourers	20.0	41.22
Household Industry	4.35	8.24
Other work	33.51	12.0

Source : GoUP, 11th Plan Document, 2007-08

Micro-finance initiatives for economic empowerment of poor women, for making accessible funds for emergencies, consumption, productive enterprises and personal savings, are yet to become a visible force in UP. This strategy for poverty alleviation and market action has largely been taken up by NGOs.

Government initiatives to set up self help groups (SHGs) through Swarn Jayanti Gramin Swarojgar Yojana (SJGSY) have not taken off because of lack of concerted efforts to work with women around their economic needs, their inherent skills and capacities, and connect them with existing resources and markets. UP has been way behind in this movement.

Rural women continue to be denied rights to land so they are unable to access finances and agricultural inputs (technical and non technical) to raise productivity of small holdings (typical of poor SC/OBC families), particularly where men migrate or when they are engaged in share cropping.

Consequently, productivity is affected, providing low yields through low inputs and inefficient practices, which ultimately makes small scale marginal farming unviable and cost intensive. As a result, women farmers, who form the bulk of the small and marginal sector in agriculture, continue to face challenges of breaking even and earning substantive profits from farming. Even agriculture extension and low cost/no cost technology and inputs are not available to them through the government extension network.

What is also becoming increasingly visible is the gap in rural-urban incomes. Agricultural wages have not increased at the pace of other wages or salaries. If the majority of people continue to be located in the agricultural/rural sector, inequalities are likely to rise further between rural urban income and expenditures. Here too, women are more adversely affected than men because of low wages, poor work opportunities and low bargaining power. They also face vulnerability due to climatic vagaries such as floods/drought that impact work availability in rural areas.

Poor SC/ST and OBC women face violence and sexual harassment at work in all sectors. Female work force participation rates (FWPR) for them are higher than for other castes; also, the gap between males and females is much lower than in other castes, in both urban and rural areas. UP also has a lower WPR for SCs/STs than the national average. In the organised sector, only 9 percent participate as workers compared to the national average of 16 percent, with the highest rates being in Kanpur, Lucknow and Ghaziabad. The highest proportion of regular salaried workers and the lowest proportion of casual work is seen among the upper castes. The SC/ST and OBC have a low percentage of regular and salaried jobs 7.9 percent SCs and STs constitute the bulk of casual labourers. Muslim women's labour participation is also the same, at 20.7 percent, though salaried work is low, but higher than Scs.

The Agrarian Crisis: Land Holdings, Land Distribution and Agricultural Production

Of the state's total geographical area of 24.2 million hectares (mha), 16.8 mha (69.42 percent) is under cultivation. Agriculture contributes about 40 percent to the SGDP as against 25 percent at the

Rural women continue to be denied rights to land so they are unable to access finances and agricultural inputs (technical and non technical) to raise productivity of small holdings (poor SC/OBC), particularly where men migrate or when they are engaged in share cropping.

national level. According to the 2001 census, 62.12 percent of the state's total workers are engaged in agriculture. UP contributes, on an average, 21 percent to the national production of foodgrains. With the average foodgrain production of about 42.7 million tonnes and per capita production of 234 kg per year, third highest among major states, UP is considered to be a foodgrain surplus state.

UP's agriculture is characterised by very small sized land holdings; around 90 percent of the farmers in the state are small and marginal farmers. Some 73.8 percent of the total operational holdings in the state are marginal (below 1.0 ha) and another 15.5 percent holdings are small (between 1 and 2 ha). Due to the preponderance of the small holdings, UP agriculture is still largely subsistence oriented.

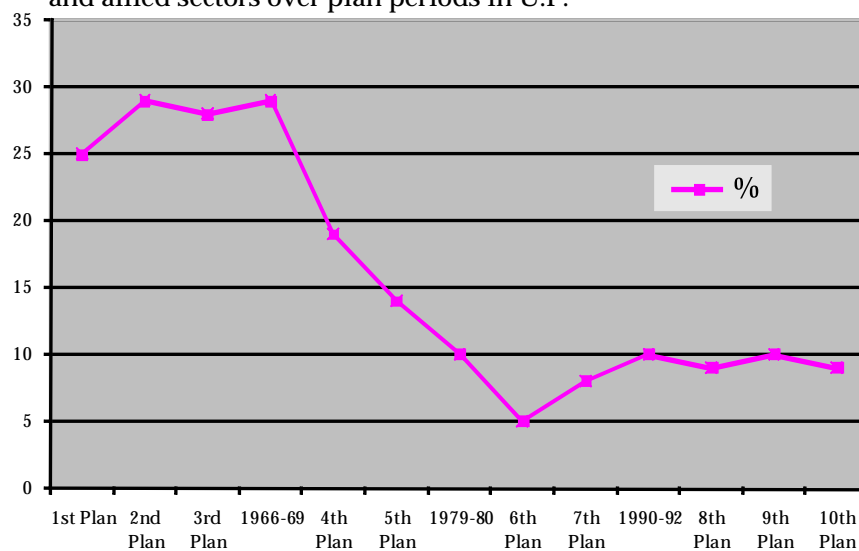
Landholdings in UP are becoming more fragmented over the time. Thus, between 1985-86 and 1995-96, while the total size of the holdings increased from 18.98 million to 21.53 million ha, the proportion of the area under medium and large holdings declined from 8.3 percent to 7.4

percent and from 3.22 percent to 2.5 percent respectively, and the share of the area under marginal holdings increased from 72.6 percent to 75.4 percent; the estimated average holdings of marginal farmers and small farmers are 0.35 ha and 1.38 ha respectively. The average size of land holdings in UP, cutting across all categories of farmers, 0.85 ha.

Public Investment in Agriculture

Public or government investment is crucial for the development of agriculture. The actual public investment in the agricultural sector in UP is only 1.3 percent of the total SGDP. Expenditure in agriculture and allied sectors has declined over the Plan periods from a high of about 29 percent during the Second Five Year Plan and the Annual Plans of 1966-69 to a low of 5.47 percent during the Sixth Five Year Plan. Though there has been a slight tendency toward recovery in the successive Plans, the percentage of expenditure still remains very low compared to the initial Five Year Plans (see figure 3).

Figure 3 : Percentage (of the SGDP) expenditure on agriculture and allied sectors over plan periods in U.P.



Source : GoUP Annual Plan (2006-07)

Declining Returns on Investment in Agriculture

Despite the rise in the cost of all inputs like seeds, power, fertilizers, pesticides and water, farmers are selling their outputs today at prices that are in reality half of those 20 years ago. Returns on investment are reducing further. Simultaneously, due to a whole range of factors, including reduced soil productivity, the dependency of farmers across the country on external inputs is rising. All of these seem to make agriculture an unviable and unsustainable proposition, especially for small and marginal farmers; for instance, the agricultural parity index (API)¹⁸ of prices received and paid by the farmers has declined from 91.3 in 1984-85 to 87.7 in 2003-04 (see Table 7).

say, would be worse for marginal and small farmers, given the problems they face in marketing their produce.

Rural Indebtedness

According to the National Sample Survey (NSS) data, out of the 22.12 million rural households in UP, 17.16 million (77.46 percent) were farmer households, of which 6.92 million (40.3 percent) were reported to be indebted. As the following table shows, nearly 89 percent of the indebted farmers belong to the small and marginal categories.

Table 7: Agricultural parity index (API) of prices received and paid in UP

Agricultural Year	Index of Prices Received by Farmers (a)	Index of Prices Paid by Farmers (b)	Agricultural Price Parity Index (a/b) percent (c)
1984-85	260.4	307.1	91.3
2003-04	1112.3	1268.7	87.7

Source : GoUP, 11th Plan Document, 2007-08

The above calculations have been made for the farming sector as a whole, that is, for all categories of farmers. The API, needless to

Table 8: Percentage distribution of farmer and indebted households (per size class of land held)

Size of holdings (ha)	Percent of Farmer households	Percent of Indebted Farmer households	Prevalence Rate of Indebtedness (percent)
<1.00 (marginal)	74.40	71.1	38.54
1.01-2.00 (small)	16.50	17.4	42.54
2.01-4.00	6.80	7.8	46.28
4.01-10.0	2.04	3.4	67.15
10+	0.26	0.3	46.86
All	100.00	100.00	40.33

Source : GoUP, 11th Plan Document, 2007-08

¹⁸ Agricultural Price Parity Index refers to the parity between the prices received and paid by the farmers/cultivators. It is measured by the ratio of the indices of the two sets of prices, that is index of the prices received /index of prices paid, expressed in percentage terms. The parity index can be calculated on a monthly basis or for an agricultural year (or crop year) as a whole.

Impact of Climate Change

Increasingly, the impact of climate change and global warming is being felt in the state, as in other parts of the country. On the whole, there has been a greater frequency of droughts and floods, one of the hallmarks of climate change. By the first half of the four-month monsoon season in 2007, according to the World Meteorological Organisation, the region experienced double the number of monsoon depressions, causing heavy rainfall and flooding across South Asia. Nearly a third of India's meteorological districts had received higher than average rainfall by the first week of August 2007, according to GoI's Home Ministry figures. More than 2 mha of croplands had been affected, 130,000 homes destroyed and 1,428 people killed.



Source : GEAG Resource Centre

Thus, in eastern UP, chronically flood prone, the very nature of the flooding has changed, with a greater intensity of flash floods. Embankments along the various rivers, unable to withstand the heavy flooding, often break, washing away croplands and mud homes. There has been change in flooding patterns too. The floods here are frequently flash and

accidental (that is, sudden and unexpected); smaller rivers are also causing extensive damage, and periods of water retention (and hence water logging) have increased. Crop damage is on an increasing trend. Cropping patterns are changing and pulses (once a major crop in the area and a major source of protein) are not grown due to longer periods of water logging, which disrupts the whole crop cycle and production, even in the *rabi* season, is severely affected. Many become victims of water-borne diseases like diarrhoea, cholera, dengue and Japanese encephalitis as the flood waters stagnate, the natural lines of drainage being disrupted due to embankments, roads and other encroachments. As ActionAid's Hunger Monitoring Project found in 2007, the last

four to five years have seen an accentuation of adverse weather conditions with farmers being affected by prolonged drought, floods and hailstorms and decrease in annual rainfall.

In the Bundelkhand area, with its high levels of poverty, many small and marginal farmers are indebted, both to moneylenders and government banks. As the weather gets hotter, the chances of paying back loans become difficult, leading to stress and, in some extreme cases, suicides.

The growing water scarcity poses further problems of survival to people and animals alike. In recent years, the level of the water table has gone down significantly

and there are reports from the region of cattle dying due to water shortage.

While climate change is affecting everybody, regardless of caste, ethnicity, sex, race or level of income, women in the poorer households suffer the most. Their unequal position in society means that women have less access to money, land,

food, protection from violence, education and healthcare. They are more dependent on natural resources for subsistence. Hence, they are more exposed to climate shocks and have fewer resources to protect their own lives, assets and livelihoods while looking after their families.

Local Policy and Institutional Context of Disaster Management

The natural disasters that are significant for the state are floods, drought, fires and earthquakes. Loss of life and property from these disasters, especially the former three, amount to hundreds of crores of rupees, annually. The recurring floods and droughts are manifestations of increased vulnerability and the inadequacy of the sporadic mitigation measures attempted.

Floods are the most commonly occurring disaster in UP, affecting approximately 2.7 mha of the area and causing losses up to Rs 432 crore. Out of the 240 mha of the total area of UP, approximately 7.3 mha is flood prone. As per the Irrigation Department's estimate, only 5.87 mha of this area can be protected and the protection provided so far is merely for 1.6mha. The areas worst affected by floods are eastern UP as well as those situated in the Terai¹⁹ region bordering Nepal. The Bundelkhand area is chronically drought affected.

The traditional framework for disaster management in UP has been oriented towards natural hazards and civil disturbances, with revenue, police and fire services as primary emergency responders. The focus has been more on immediate relief and recovery, with the State Relief Commissioner, District Magistrates and Superintendent of Police as crisis managers.

With the increase in frequency of disasters, the emerging context is one of

rising levels of vulnerability and escalating costs of disasters, significantly narrowing the differences between natural and human made disasters. There has been a paradigm shift in the approach to disaster management, from reactive relief and rehabilitation to proactive mitigation of disasters and pre-disaster preparedness.

UP has been progressive on disaster management measures, having enacted the Disaster Management Act, 2005 (the third state to do so after Gujarat and MP). The act provides legal backing to all preparatory and post disaster measures and responses, and allocates major responsibilities to all the stakeholders.

The UP Disaster Management Authority (UPDMA) has been set up. It is headed by the Chief Minister as its Chairperson, with a 14-member Governing Body. The District Disaster Management Committee (DDMC) is headed by the respective District Magistrates.

Disaster Specific Working Groups were also formed for each specific disaster, to dovetail ongoing schemes with specific disaster mitigation efforts and address disaster management concerns in annual and five year plans. The working group is headed by an officer at the level of Principal Secretary. The Remote Sensing Application Centre-UP (RSAC-UP) advises each working group.

Natural resources related GIS Mapping of 40 districts has been completed in UP. The Academy of Administration and Management is the nodal institute for all training programmes related to disaster

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¹⁹ The *Terai* ("moist land") is a belt of marshy grasslands, savannas, and forests at the base of the Himalaya range in India, Nepal and Bhutan, from the Yamuna River in the west to the Brahmaputra River in the east. Above the *Terai* belt lies the *Bhabhar*, a forested belt of rock, gravel, and soil eroded from the Himalayas, where the water table lies from 5 to 37 meters deep. The *Terai* zone lies below the *Bhabhar*, and is composed of alternate layers of clay and sand, with a high water table that creates many springs and wetlands. The *Terai* zone is inundated yearly by the monsoon-swollen rivers of the Himalaya. Below the *Terai* lies the great alluvial plain of the Yamuna, Ganges and Brahmaputra, and their tributaries (<http://en.wikipedia.org/wiki/Terai>).

management, and disaster management modules have been adopted in all in-service training programmes in the state. The subject has been also been introduced in school curricula.

The GoI-UNDP Disaster Risk Management Programme is currently running in 13 pilot districts and 6 cities. Disaster Management Development Plans have been initiated at district, block and village levels.

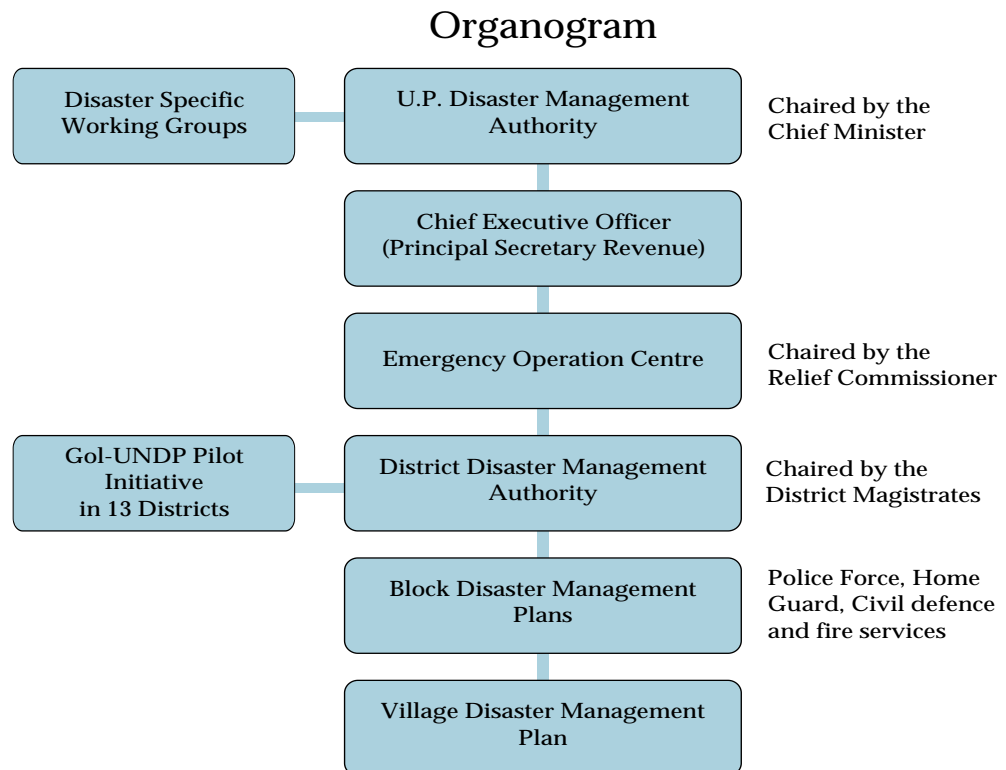
The UNDP supported Disaster Risk Programme, operative in 17 states, is also being implemented in UP, covering the following 12 districts:

Baharaich	Gonda
Balrampur	Gorakhpur
Bijnor	Rampur
Budaun	Saharanpur
Deoria	Sant Kabir Nagar
Ghazipur	Sitapur

The India Disaster Resource Network (IDRN), under the auspices of MHA-GOI, has a district-wise inventory of resources for mobilization during emergencies and the district magistrates have been directed to update this database on a priority basis.

State and District Level Emergency Operation Centres (EOC) have been set up at the office of the Relief Commissioner and 13 pilot districts (under the UNDP-GOI programme). The district centres are equipped with National Informatics Centre (Nicnet) facilities. SPACENET and POLNET are also being established as per GOI guidelines.

Figure 2 : Disaster Management in UP



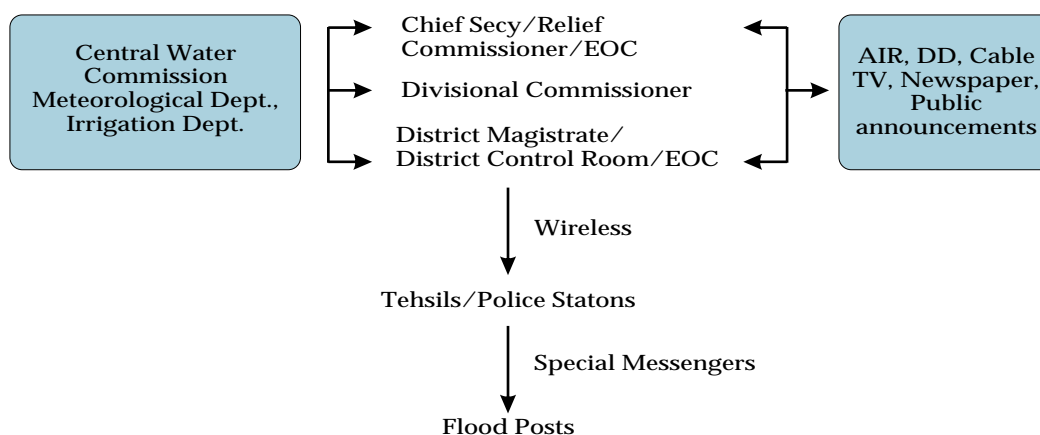
Flood Forecasting Mechanism

Information about water levels of major rivers is provided by the Central Water Commission (CWC) and Meteorological Department to the Relief Commissioner and District Control Rooms, EOC, every day at 9 am and 3 pm, from 15 June onwards. The warning/information from the District Control Rooms is to be communicated to *tehsils*/police stations through wireless, and is to be subsequently passed on to flood posts through special messengers.

with recommendations, to the state government. If the state government accepts it, the notification is done through an official gazette as well as publishing the declaration in local newspapers. Thereafter, the Commissioner/District Magistrate/DDMA convenes an emergency meeting of all the concerned departments/institutions and relief, rescue and rehabilitation are undertaken as per the District Disaster Management Plan and the plans of various line departments.

Essentially, then locale specific and household specific approaches are needed to solve the problems: a “one package fits all” approach does not work.

Figure 3 : Forecasting System



Declaring an Area Disaster Affected

With the enactment of disaster management procedures (gazetted August 11, 2005), there are principles and procedures laid down for various stakeholders. The formation of a State DMC chaired by the Chief Minister reveals the importance and priority of the disaster management agenda in the state. The Act contains a provision to declare an area as disaster affected, when several relief and rescue measures are implemented in the area.

The Divisional Commissioner (in case the disaster covers more than one district) or District Magistrate (where the disaster is limited to the district) sends the report,

As such, land, water and human resources are the most important endowments in UP. The state has been divided into nine agro-climatic regions, areas with their own agro-climatic specifications and related socio-economic linkages. Small and marginal holders in agriculture comprise the mainstay of the economy in each of these zones. However, the exact agricultural patterns and livelihood mechanisms vary widely. Essentially, then locale specific and household specific approaches are needed to solve the problems: a “one package fits all” approach does not work. The state faces many problems, including that of structural adjustment and now climate change, all of which impact the sustainability, not only of agriculture and

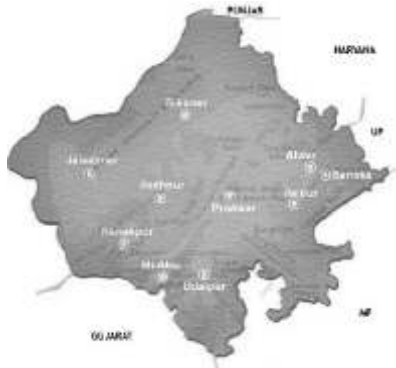
other livelihood mechanisms, but of the very human actors themselves. This is accompanied by oppression at the local level and the distancing of the masses from governance, despite the *panchayati raj* institutions (PRIs). Forced/distress migration, usually as casual labour to the urban areas of the state and the nation's metros, is the order of the day. The state led solutions, as reflected in major projects like UPDASP and UPLDC, though purportedly eco-friendly and sustainable, end up not being able to achieve their objectives as they are mainly centred around technology transfer and

enhancing agri-outputs and do not seek to address the social aspects and long term interests of small, marginal, landless and women farmers, as the approach is not context specific. While components like biodynamic agriculture, organic farming, indigenous traditional knowledge and so on have been incorporated due to growing pressures, a definite and comprehensive plan is still not in place. Gender equity and other equity issues are largely ignored due to the traditional mindsets of agricultural scientists in northern India.



Source : GEAG Resource Centre

(ii) Rajasthan



Economic Development

Rajasthan has traditionally been classified as a state ranking low on human development. For the three decades of development up to the early 1980s, the state showed a slow progress on almost all economic and social indicators. A mere three percent growth in its GSDP resulted in almost no growth in per capita income. Poverty levels were high and maintained above 40-45 percent of the population for most part of these three decades. Literacy levels were about 30 percent in 1981 about 46 percent among males and 15 percent among females. Health and demographic indicators too were equally indifferent.

In the 1980s, Rajasthan began to display improvement in its economic and social performance. Economic growth rates rose, poverty proportions noticeably reduced, literacy rates visibly improved and there was an all round improvement in infrastructure. Rajasthan's real GSDP has grown at about 5.5 to 6 percent per annum over the period of 1980-2006. Additionally, there has been a regional dimension to this development pattern: some northern and a few eastern districts and most urban areas have exhibited dynamism but the southern districts and those in the far west, particularly, have

lagged behind. Sharp differences in social attainment exist between, on the one hand, the far western districts (low literacy rates and extremely adverse sex ratios in Jaisalmer, Barmer) and some eastern ones (low female literacy and high infant mortality in Bharatpur, Dholpur), and the rest of the districts, on the other.

However, Rajasthan has experienced rapid reduction in poverty in the last three decades, with a fall in the population below the poverty line from an estimated 50 plus percent in the early 1970s to less than 20 percent in 1999-2000.

The distribution of workers suggests that the majority are still engaged in agriculture for their livelihood. People have devised alternative adaptation strategies to sustain their livelihoods since agriculture yields little in the face of repeated droughts. These include mixed cropping, animal husbandry, multiple occupations within a household and short term out-migration.

Social attainment in Rajasthan presents a picture of some success, some grey areas and a lot of challenges.

Literacy and Education

The literacy rate among males in Rajasthan in 2001 was 75.70 percent and among females 43.85 percent, up from 54.99 percent and 20.84 percent respectively, in 1991. These numbers make Rajasthan among the best performers on this count during the decade. Consequently, the gap between literacy rates in the state compared to the national aggregate has reduced from being 15 percentage points in 1991 to a mere three percentage points in 2001. A few focused programmes, earmarked funding and some concerted effort by the government and NGOs made these achievements possible.

All data on education infrastructure available in the state suggests that more

However, Rajasthan has experienced rapid reduction in poverty in the last three decades, with a fall in the population below the poverty line from an estimated 50 plus percent in the early 1970s to less than 20 percent in 1999-2000.

than demand constraints, there are supply constraints that impede access to formal education.

Health and Nutrition

Demographic indicators Life expectancy at birth increased during 1981-91, from 54 to 59 years, but stagnated at around 60 years in 2001. The IMR in the state has also not improved much, as it has in most other states. In rural areas a decline has been seen since 1997. Near stagnancy in life expectancy is to a great extent influenced by the (high) IMR. During 1991-2001, IMR in rural areas fell but not too quickly. In urban areas too, there has not been a remarkable improvement. The latest data (pertaining to 2004) shows a sharp reduction in the state IMR from 77 in 2003 to 67 (combined rural plus urban; male: 66, female: 69).

Malnutrition

The incidence of child malnutrition in Rajasthan at 51.2 percent in 1998-99 was higher than the all-India average of 47.8. Rajasthan is the only state where the incidence of child malnutrition increased between 1992-93 and 1998-99 (as seen from the two National Family Health Surveys, NFHS).

55 percent children in the state were seen to be malnourished, as of December 2005, according to ICDS (Integrated Child Development Services) data. Out of these, 60 percent fell in grade 1 of the malnutrition scale (mild malnutrition), which is not considered as a serious condition; thus, less than 30 percent children were moderately or severely malnourished. Malnutrition is more prominent in the Banswara, Bhilwara, Chittorgarh, Jaisalmer, Rajsamand and Udaipur districts, each of which has a large tribal population.

Status of Women

In almost all spheres of life, be it in the labour market or education, women have a lower status compared to men. Within Rajasthan, there are regional dimensions of these problems as well, arising from caste/ethnic, religious as well as historical differences: the western regions harbour one kind of orthodoxy and socio-economic conditions, eastern regions present another, and the south, yet another. Thus no simple generalisations are possible.

Sex ratios

The eventual mark of a long-standing inequitable status of women in society is the declining sex ratio. Adverse sex ratios occur when there is prolonged neglect and (even) infanticide/foeticide of one sex. Rajasthan, like other states in north-western India, belongs to that category of states where adverse sex ratio is an issue. The sex ratio was 910 in 1991 (females per thousand males), and 921 in 2001.

Social practices and customs

A number of prevalent practices, customs and values - such as female foeticide, infanticide, son preference, child/early marriage and dowry - have implications for the status of women. They adversely impact the lives of poor people in general and women (and girl children) in particular. Many of these practices result in strengthening relationships of iniquity.

Physical and Geographical Features

Rajasthan is the largest state of India with a land area of 342 thousand sq. km and a population of 56.47 million, of which 76.6 percent is rural and 23.4 percent urban (Census 2001). Administratively, the state is divided into 32 districts and 241 *tehsils*.

It has only 1 percent water resources, 10.4 percent of total area and 5 percent of the total population of the entire country. Sixty percent of the area of the state, covering 40 percent of total districts, falls within the great Indian Thar Desert.

Recurrent droughts, poor resource base for economic development, highest per capita cost of development due to arid and semi-arid areas with very low density of population, low levels of literacy, particularly among women, a very high rate of population growth and scarcity of water make the task of socio-economic development a formidable one.

The climate of Rajasthan varies from arid to sub-humid. In the 11 districts to the west of the Aravali range, covering roughly more than 50 percent area, the climate is characterised by low rainfall with erratic distribution, extremes of diurnal and annual temperatures, low humidity and high wind velocity. The climate is semi-arid to sub-humid east of the Aravali range, comprising 12 districts, characterised by more or less the same extremes in temperatures, by relatively lower wind velocity and high humidity with better rainfall. The remaining area falls in the south within the Aravali range with high rainfall and hilly topography with forest cover, classified as tribal area.

Drought Situation

Low rainfall coupled with erratic monsoons in the state make Rajasthan the state most vulnerable to drought. Based on historical data, the frequency of occurrence of droughts in the state is reported in Table 9.

In such arid and semi-arid regions, people adopt long-

and short-term strategies against climatic uncertainty leading to drought; these strategies are shaped by resource endowments and production environment of the area. The rural population in these areas is dependent on rainfed agriculture. Coping with low rainfall with a high coefficient of variation across time and space is the major challenge. Low fertility of soils along with paucity and uncertainty of moisture is a source of constant threat of drought and scarcity. Groundwater acts as a major life saving resource both for crops and living beings. However, hard-rock based geo-formation puts limits to the availability of groundwater. These characteristics have not only shaped the farming systems in the regions, but have greatly influenced public policies and programmes in these areas. Despite all these adversities, people living in these areas have tried to adapt both good and bad rainfall situations, using the lessons and experiences of many past generations.

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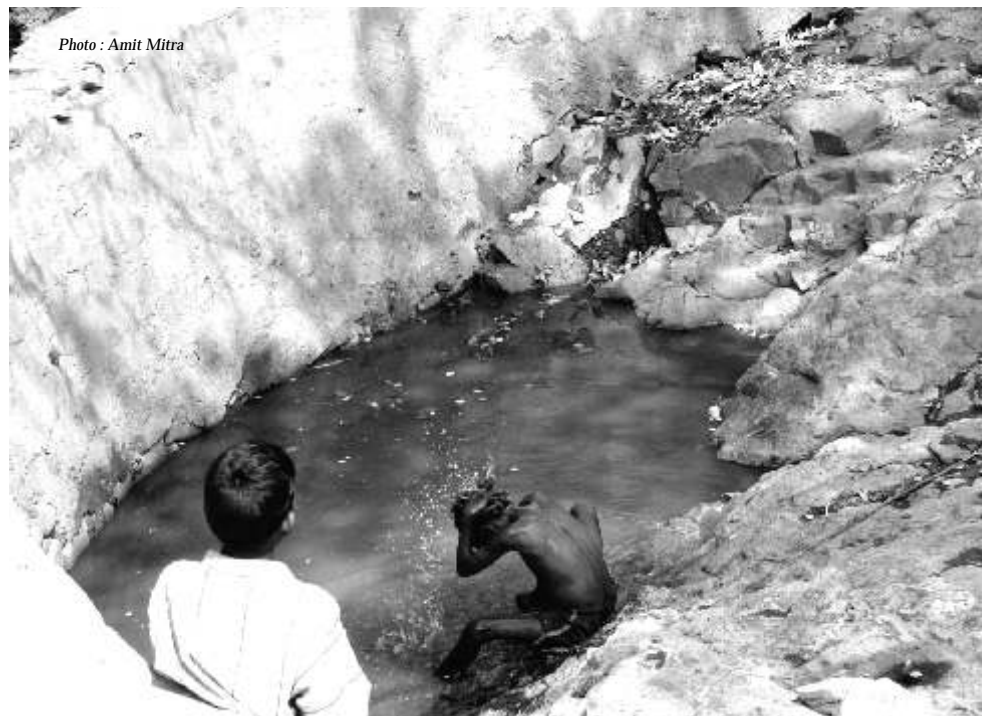


Table 9 : District-wise frequency of occurrence and intensity of drought, 1901-2002

District	Intensity of Drought				Percent of Total Years
	Very Severe	Severe	Moderate	Light	
Zone-I	12	12	11	11	45.0
Barmer	4	15	17	11	46.0
Jaisalmer	6	12	13	17	48.0
Bikaner	8	12	16	10	46.0
Sri Ganganagar	9	9	12	18	47.5
Churu	8	11	8	17	43.1
Nagaur	2	17	15	15	48.5
Jodhpur	5	16	16	18	53.9
Pali	7	12	19	14	52.0
Jalore	7	13	13	20	48.1
Zone-II	12	8	11	16	46.0
Sikar	5	20	11	14	49.5
Jhunjhunu	9	15	12	12	47.0
Alwar	7	16	10	15	47.0
Jaipur	10	11	16	9	45.5
Ajmer	6	16	21	13	45.5
Tonk	9	11	10	15	45.9
Sawai Madhopur	8	8	14	21	50.0
Bharatpur	9	13	11	12	44.5
Zone-III	10	12	9	12	42.1
Bhilwara	3	9	10	14	40.0
Chittorgarh	10	12	9	13	44.0
Udaipur	10	14	14	6	43.5
Sirohi	5	17	10	21	53.0
Banswara	11	14	13	9	44.7
Dungarpur	9	16	10	5	49.5
Bundi	7	16	13	11	44.7
Kota	8	16	11	11	45.5
Jhalawar	8	13	14	8	43.8
Overall Rajasthan	10	10	15	13	47.0

Source : Rathore, 2005

However, policy makers and administrators often respond only to drought situations. Protection of drought prone areas through periodic relief or protective irrigation has been the key focus of public interventions in these areas in the past. Moreover, the various components of drought management strategies as well as development strategies were not sensitive to specificities of the resource base in these areas.

State Policy and Institutional Response to Drought

Since Independence, a large number of rural development programmes, such as infrastructure development (roads, communication and electrification), market network, new crop technology based on seed-fertiliser-irrigation inputs and watershed development, were initiated with different objectives of poverty reduction, and drought mitigation and relief. These have significantly helped drought prone areas and populations reduce their vulnerability to severe scarcities caused by periodic droughts. However, most of the initiatives could not bring about the desired results because they failed to recognise the high environmental diversity and resource specificities within the drought prone areas and relate them to the age old, traditional adaptations and coping strategies of the people. Similarly, generalized institutional programmes like land reforms, community development projects and panchayat systems were extended to these areas, without assessing their potential impacts on sub-marginal lands, common property resources, and climatic uncertainty. Public relief strategies to help the drought-affected people were designed and pushed to such a level that they have more or less

displaced the people's own adjustment mechanism and generated strong dependence on public relief. Irrigation facilities were developed in a few pockets, but used on crops requiring high water,



Source : www.flickr.com

and in areas well endowed with water. In the process, dry crops also suffered a backlash. Market integration took place, but it had serious adverse effects on strategic self-provisioning systems and the fragile resource base. Even the special DPAP initiative developed on the basis of watersheds and their specificities, in practice had not only discarded the concept, but followed a development process suitable for other, better endowed areas. All this indicates the need for understanding, and explicit consideration of, specificities of drought prone areas in both development strategies and drought management.

Rural Development Programmes

The major rural development programmes are:

1. National Watershed Development Programme for Rainfed Areas

- (NWDPR) and Integrated Watershed Development Programme (IWDP)
- 2. Drought Prone Area Development Programme (DPAP)
- 3. Desert Development Programme (DDP)
- 4. Employment Generation Programmes (EGP) are SSGRY, Employment Assurance Scheme (EAS) and Jawahar Gram Samridhi Yojana (JGSY)

Rural Poverty Alleviation Programme:

There are three types of programmes under this category, and these are as follows:

- A. Individual Beneficiary Programmes: These started with the Small Farmers Development Agency (SFDA) and Integrated Rural Development Programme (IRDP) and now include
 - i) Swaran Jayanti Gram Swarozgar Yojana (SJGSY)
 - ii) Indira Awas Yojna (IAY), a rural housing scheme for people below the poverty line
 - iii) Pradhan Mantri Gramodaya Yojana (PMGY) Part of this scheme is dedicated to providing rural housing²⁰
- B. Rural Infrastructure Development:
 - i) Rural electrification
 - ii) Rural roads
 - iii) MP Local Fund Development Programme
 - iv) MLA Local Fund Development Programme
 - v) Accelerated Rural Water Supply Programme (ARWSP)
- C. Area Development Programmes:
 - i) DDP

- ii) DPAP
- iii) Tribal Area Development Programme (TADP)
- iv) Special Area Development Programme for areas such as the Mewat, Dang and border areas in Rajasthan

D. Drinking Water Supply

- i) Tanker supply of water by road and rail
- ii) Installation of new hand pumps, deepening of wells, and new tube well based supply sources

Undoubtedly the state has made steady progress in poverty reduction. The major impact of these efforts has been that, unlike during periods of serious droughts in the past, large scale migration of human and cattle population does not now take place, the capacity of the system to respond to the needs of the population has increased, and certain amount of resilience has also been developed to face the challenge. Nevertheless, during periods of severe droughts the vulnerable population below the poverty line, landless agricultural labourers and small and marginal farmers still require government support for provision of employment, fodder and drinking water. This is because agriculture remains a gamble during the monsoons and the sustainability of livelihoods of people dependent on agriculture still remains an issue. Moreover, burgeoning human and cattle population is putting increased pressure on natural resources thus negating the impact of developmental efforts.

20 The PMGY has two components: Programmes for rural connectivity with 50 per cent allocation, and other programmes of primary health, primary education, rural shelter, rural drinking water and nutrition with the remaining 50 per cent allocation (<http://planningcommission.nic.in/plans/annualplan/ap2021pdf/ap2021ch5-2.pdf>)

21 The special status of these areas derive from their historically low level of development, inhabited as they are by SC/ST and OBC populations as well as religious minorities. The terrain and climate also tend to be hostile, with high levels of desertification and low rainfall.

Public Distribution System

The Public Distribution System (PDS) in India, with a network of 4.74 lakh Fair Price Shops (FPS), is now one of the largest in the world. From the drought mitigation and management point of view, PDS network has been playing a significant role in the distribution of 17,451 thousand tonnes of foodgrain through its 4.74 lakh network of Fair Price Shops (FPS) all over India. This network is also available for relief work at the time of natural calamities in any part of the country. As drought is a recurrent phenomenon, the system turns out to be effective in the distribution of essential commodities to the affected population. The PDS has proved to be the cornerstone of food security in Rajasthan.

Food Assistance Programmes Initiated by the Rajasthan Government

Both the Central and State Governments have initiated many meaningful measures to increase access to food. The most popular ones are:

- PDS
- Provision for making available 25 kg of wheat at the rate of Rs 4.60 per kg to BPL families
- Antyodaya Food Scheme (launched on December 25, 2000): The programme is meant for the "poorest of the poor"; as a first step under the scheme, the poorest among the poor families are identified and 25 kg of foodgrain (wheat) is made available to them at the rate of Rs 2 per kg and rice at Rs 3 per kg

- Mid Day Meal Programme (started in 1995-96): This involves the allocation of 3 kg of foodgrain per child per month for schooling children between classes I and V
- Food for work: This scheme is meant to mitigate the onslaught of the drought on the people
- Nobody should die of hunger (2002): Provision of two bags of wheat kept with the village *Sarpanch* (elected head of the gram panchayat,²² the local self-governance institution) for free distribution to a person or household in the village starving due to lack of food

Institutional Arrangements

In a drought year, a Committee of Directions (COD) under the chairmanship of the Chief Minister is formed and a strategy to combat the drought situation is formulated that includes the following:

1. Crop contingency planning
2. Additional employment generation through relief works
3. Cattle conservation measures
4. Provision of drinking water
5. Other measures

The relief measures undertaken under each strategy are as follows:

1. Employment generation
 - Drought proofing
 - Dovetailing works with other schemes
2. The crop contingency plan for advising alternative crop strategies to the farmers is put in place immediately
3. Cattle conservation
 - Transportation of fodder
 - Cattle feed
 - Cattle camps
 - Bull subsidy

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²² Gram panchayats are local government bodies at the village level in India. As of 2002 there were about 265,000 gram panchayats in India. The gram panchayat is the foundation of the Panchayat System. A gram panchayat can be set up in villages with minimum population of 500; sometimes two or more villages are clubbed together to form group-gram panchayat when the population of the individual villages is less than 500. (http://en.wikipedia.org/wiki/Gram_panchayat)

The root of the problem lies in the depletion of groundwater, which meets more than 90 percent of rural drinking water needs. A serious review of the water policy of the state is thus required.

- Veterinary health
- 4. Provision of drinking water
 - Augmentation of existing resources
 - Hand pump repair campaign
 - Revival/renovation of traditional water resources
 - Hiring of private wells
 - Water made available in all the tanks reserved for drinking water
 - Installation of new tube wells and hand pumps
 - Transportation of water through tanker or rail in the deficit areas
- 5. Other measures
 - Ex-gratia relief payments
 - Supply of mid-day meal to schoolchildren to take care of health and nutrition
 - Provision of medical support to labourers on relief work sites
 - Medicare scheme for BPL families
 - Suspension of both land revenue collection and recovery of short-term cooperative loans

Gaps in Policy

The main shortcoming of these programmes is that they address only the specific target population, excluding large sections of the population whose needs are not addressed. Apart from the well-recognised BPL population, where chronic food shortages prevail, even households not normally deprived of food are rendered vulnerable in the regions prone to droughts. In terms of social category based on caste and class distinctions, the general understanding is that STs/SCs and OBCs, agricultural labourers, marginal and small farmers are the most vulnerable. Within households also there is a differential in food distribution or access to food; women and

girl children are more deprived of food compared to male members. Hunger, insufficient food or seasonal food distress strongly affects lives and social behaviour of families hovering on the edge of the poverty line. Not only actual food distress, but even the threat of future food shortages can become a powerful instrument in shaping the behavioural patterns of those affected by it. Children are the first affected by this distress as they are forced to join the labour force. Future policy and programmes should take cognisance of these issues.

The other major shortcoming of the state response is its relatively low sensitivity to the livestock population. The state is neither supportive to people's traditional strategy of animal migration nor to building stocks of fodder similar to foodgrains. To build fodder banks in the state, special steps need to be taken during good agriculture years within the state and neighbouring states to gather fodder at lower rates and stock it in areas where it is most demanded.

Traditionally, people also used to store fodder for longer durations; the state should facilitate this process and revive such practices where they have died out.

The present policy of supplying water during droughts needs a drastic change as it is neither economically feasible nor sustainable. The root of the problem lies in the depletion of groundwater, which meets more than 90 percent of rural drinking water needs. A serious review of the water policy of the state is thus required.

(iii) Bihar



The challenge of development in Bihar is enormous, due to persistent poverty, complex social stratification, unsatisfactory infrastructure, weak governance, and, more recently, climate change.

Bihar's 2001 population of 83 million, 8.1 percent of India's total, makes it the third most populous state. Unbifurcated Bihar (that is, before the state of Jharkhand was created) accounted for nearly 15 percent of the nation's BPL population. Bihar recorded poor economic growth through the nineties and grew at 4 percent during the Tenth Plan period, against the national annual growth rate of 7 percent for the same period. The average annual per capita income of approximately Rs 6,500 is a quarter of the national average. Bihar is predominantly rural with 89 percent of the population living in rural areas and a rural poverty ratio of 44.3 percent, the second highest after Orissa.

Bihar lies in the Himalayan catchment in the foothills of Nepal. Heavy rainfall in the upper catchment areas affects the entire northern region of the state for at least 4-5 months of the year during the rainy season from July to October. Though Bihar is prone to multi-hazards like floods, earthquakes, high wind velocity and cold waves, as well as village fires in summer, floods have become a

significant problem, recurring every year. An estimated 73 percent of the total land area of the state is affected with floods annually. 61 percent of the catchment areas lie in Nepal and Tibet while the major rivers like the Kosi, Gandak, Bagmati, Mahananda and the Adhwara group of rivers originate in Nepal. Due to the steep gradients of the Himalayan ranges, the flooding leads to heavy silt-loads for the plains of Bihar, causing siltation of the river beds and overtopping of water in various directions. The rivers change course often during the monsoons, causing great damage to human habitation and crop lands. Although 3,430 km of embankments have been constructed to protect about 2.95 mha of the state, they do not provide the desired support for flood control as rainfall in the catchment areas in Nepal results in overtopping, and often breaching, of the embankments.

The situation in rural Bihar is characterised by poor service delivery, complex political and social fabric, limited inclusion in institutions, limited economic opportunities and poor development infrastructure. These factors, along with the lowest per capita development expenditure in Bihar, have prevented improvement in its 32nd rank amongst all India states, in the HDI (0.367) and the Gender Equity Index. Bihar's performance, in almost every sector, lags seriously behind national trends and is a significant contributing factor to the growing income gap across states.

While the state has witnessed a decrease in the poverty ratio from 64.4 percent in 1983 to 44.3 percent in 2006, the absolute number of poor is still a staggering 36 million (of a total population of 83 million). Poverty is heavily concentrated amongst the landless or near landless agricultural households, with these two vulnerable groups constituting 70 percent of all households in Bihar. It is estimated

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that nearly 2.3 million poor are exposed to huge amounts of high cost debt for food, health and education, accounting for 25-30 percent of consumption expenses, further impoverishing them. There are also intra-state inequities with North Bihar being more poverty stricken than South Bihar. SC Hindus and Muslim households, constituting 25 and 15.4 percent respectively, of landless households, are among the poorest in the state. Disparities are also evident along gender and caste lines, with SCs accounting for one-fourth of Bihar's landless poor. These issues have constrained social and economic mobilization in Bihar, especially the development of institutions of and for the poor. Absence of a sensitive support and facilitation structure has led to low levels of social capital among the poor and consequently hindered formation of good quality organisations of the poor. This has been accompanied by much slower progress than the rest of the country in meeting the MDGs: Bihar is projected to fall well behind on most of the MDG targets for 2015, undermining national performance. Although progress has been made in some areas, such as infant mortality and household access to improved water supply, it is from a low base and a substantial performance gap in relation to the rest of India persists. In other areas, performance has been far worse: net primary enrolment actually fell over the 1990s and access to improved sanitation has barely changed. Bihar's poverty profile is complex but instrumental in understanding both how people fall into poverty and the differential impacts on them due to public policy interventions, including those for disaster management and adaptation to climate change. Poverty is predominantly rural. The high rural poverty is associated with limited access to land and livestock, poor education and health care, as well as limited access to

well-paid occupations and social status. The rural poor tend to depend on agricultural wages or casual non-farm work for survival, a large proportion being landless or near landless, owning lower quality livestock, and likely to be poorly educated (80 percent of the bottom quintile household heads do not have education). Social or caste characteristics are also strongly associated with a lack of opportunities: STs are thrice as likely to be poor as compared to upper castes, and significantly so in relation to Muslims and OBCs.

Bihar's growth performance, which was slightly below the national trend in the 1980s, became far lower subsequently. The state experienced zero growth in the 1980s and since 1994-95, when data for divided Bihar became available, annual growth averaged 3.8 percent or about 1 percent per annum per capita. Consequently, income growth and consumption levels have lagged behind, widening the gap between Bihar and the rest of the country. Underlying this result has been Bihar's exceptionally weak performance in agriculture and services. Industry has performed better relatively but this is from a very small industrial base.

Agriculture is the backbone of Bihar's economy, employing 80 percent of the workforce and generating nearly 40 percent of the SGDP. Improving the performance of agriculture and related non-farm activity is therefore important for maintaining livelihoods and reducing poverty levels. However, agriculture has performed particularly poorly, declining in the early 1990s by 2 percent per annum and growing less than 1 percent per annum since 1994-95 (hence falling in per capita terms). Despite this, Bihar accounts for some 10 percent of India's agricultural production. It's the country's second largest producer of vegetables, the third largest producer of fruits, and the largest producer of litchis (75 percent of the total

production in India) and fox nut (*Euryale ferox*), known locally as “*makhana*”. But during 1991 to 2001, there was a sharp decline in cultivator households from 47 to 33.6 percent and an increase in agricultural labour from 39.4 to 48.6 percent. Also, the land tenure system is skewed with 96 percent of the farmers working on 68 percent of the land at subsistence or below subsistence levels.

Agricultural output has also been highly volatile due to shocks from both droughts and periodic monsoon flooding. Crop productivity trends have been below the Indian average for most cereals and far below their potential yield, given the state's land, water and human resources. The yield gap is caused by numerous factors:



Source : GEAG Resource Centre

low investment rates, improper water management with annual flooding of the Gangetic plain districts, and weak transport and marketing infrastructure, to name a few. Severe and ongoing fragmentation of land holdings also impedes productivity, and subsistence farming predominates. Poor agriculture growth has clearly been a major factor hindering poverty reduction, and has serious implications for the consumption security of the poor.

These trends are exacerbated by the declining levels of investment: private investment is much lower than in other states and Bihar's share of private projects in the 1990s was the lowest among the major states in the country. Public investment levels have also fallen, partly due to the state's fiscal constraints in an overall national scenario of structural adjustment programmes and a weak

governance system that leads to fiscal indiscipline. Bihar gets large tax transfers from the centre; in fact one of the highest per capita transfers in India, but the state still faces serious fiscal constraints, more severe than those in other states. Fiscal deficits are high, pushing up the debt level to among the highest in the country. Bihar's own state revenues barely cover interest payments on the debt. The bifurcation of the state with the creation

of the state of Jharkhand worsened the fiscal outlook as the latter received most of the revenue yielding industrial, mineral and forest resources while Bihar retained the liabilities. Consequently, the mix of public spending worsened: the share of capital spending fell from about half of the total spending in the 1980s to one fifth after the formation of Jharkhand. Though the share of social services in total spending has been maintained, the share of economic services has been cut by more than half, negatively affecting growth. Bihar's fiscal crisis has a widespread and clearly visible impact: poor roads, dilapidated schools, health clinics with no doctors or medicines and very low levels of rural electrification. As such, programme resources allocated to Bihar from the centre are often not fully utilised or efficiently utilised, though Bihar is very much dependent on these

Bihar is prone to multi-hazards.

transfers to finance public investment and development programmes as compared to most other states. Given Bihar's development needs, the efficient use of such funds is vital. Bihar has India's lowest utilisation rate for centrally funded programmes: in the period 1997-2000, an estimated 20 percent of central plan assistance was forfeited.

Some relevant facts and figures relating to Bihar are given below.

Box 2 : Bihar in a comparative perspective

- Literacy Rate Year 2001: Bihar (48 percent), National average (67 percent); Bihar has the lowest rate among 16 major (in terms of population and area) states.
- Literacy Rate by gender Bihar: Males 62 percent (National average 76 percent), Females 35 percent (National average 54 percent).
- Proportion of children (6-14) attending school Year 1998-99: Bihar: Males 71 percent (National average 83 percent), Females 54 percent (National average 74 percent). Again the numbers for Bihar are the lowest among 16 major states in both categories.
- Average household expenditure per capita in 1999-2000 Bihar: Rs 414 (National average is Rs 589). Bihar lowest among 16 major states. .
- Per capita development expenditure in 2000-03 Bihar: Rs 3,000 (National average close to Rs 7,000). Bihar lowest among 16 major states.
- Growth rate of real per capita state GDP 1980s: Bihar - 2.6 percent, national average - 3.3 percent; 1990s: Bihar - 0.0 percent, national average - 4 percent.
- Total fertility rate 1996-98: Bihar - 4.4, second highest after UP, national average - 3.3.

As mentioned above, Bihar is prone to multi-hazards. Every year, the northern and eastern part of the state is moderately to severely affected with floods due to heavy rain fall in the catchment areas in Nepal. While almost 25-27 districts are affected by floods almost every year, the central and southern part of the state is affected by drought. Many of the rivers that originate from the catchment areas of Nepal affect the normal lives and livelihoods of the rural population. The flood of 2004 had affected almost 27 districts of the state. Besides floods, the state of Bihar is in a high seismic intensity zone as its epicentre lies in Nepal. Out of the total 38 districts of the state, almost 8 districts fall under zone-V and 22 districts fall under seismic zone-IV, which signifies the vulnerability of the state to earthquakes.²³ Bihar has witnessed major earthquakes in 1934, 1962 and again in 1988. According to earthquake experts, the state of Bihar might be hit with a major earthquake at any time, which will cause heavy loss of lives and livelihoods, especially in the urban areas.

Bihar is also prone to recurrent village fires along with heat waves and cold waves. The last cold wave of 2003 was particularly severe, which resulted in the loss of many lives, especially in the northern part of the state.

Of late, there has been a shift in the disaster management practices with the formation of a new Department of Disaster Management. The objective is to shift from traditional relief to preparedness and effective response mechanisms.

The state has passed its State Disaster Management Act in 2004, which is being revised now according to the National Disaster Management Act.²⁴

The state has prepared its rules and regulations for setting up of the State Disaster Management Authority, which

has been referred to the law department for legal vetting. Once it is approved, the Bihar State Disaster Management Authority (BSDMA) would be formed.

The State Disaster Management Policy has been prepared and is in the process of approval.

The state level Search and Rescue team has been identified for immediate response in case of any emergency in any part of the state.

The state has amended its Building Bye-laws to bring it in line with Bureau of Indian Standards (BIS) codes and standards.

The State Disaster Management Plan is in the process of preparation and will be completed at the earliest.

The Administrative Training Institute (ATI) has been identified as the nodal training institute in the state for training of government and other officials in the field of Disaster Management.

Disaster Management has been included in the Bihar Secondary Board in Class-X as a part of its course curriculum.

Various training programmes for engineers and architects are being organized. They are being sent to IITs (Indian Institutes of Technology) for training on techniques for construction of seismic resistance buildings.

Besides the above, the GoI-UNDP Disaster Risk Management Programme is being implemented in the state of Bihar

since 2003 in 14 of the most multi-hazard prone districts of the state. The basic objective of the programme is to create community capacities in Disaster Risk Management at various levels. This programme is being implemented in the districts of Araria, Begusarai, Darbhanga, Khagaria, Kishanganj, Madhepura, Madhubani, Muzaffarpur, Munger, Patna, Samastipur, Sitamrhi, Supaul and Saharsa. At the state level, the State



Source : www.Biharfloods.wordpress.com

Steering Committee has been formed under the Chairmanship of the Chief Secretary and other heads of state line departments. Various Disaster Management Committees have been formed at the district level and below and plans are being prepared with the involvement of various stakeholders, particularly the elected representatives of a particular region. The main components of the Programme are:

- Awareness generation
- Training and capacity building
- Planning at national, state, district, sub-district and community levels
- Mainstreaming initiatives in development programmes of the state

23 The Indian subcontinent has a long history of devastating earthquakes. The major reason for the high frequency and intensity of the earthquakes is that India continues to drive into Asia at a rate of approximately 47 mm/year. Geographical statistics of India show that almost 54% of the land is vulnerable to earthquakes. The current earthquake zoning map of India divides India into 4 seismic zones (Zone 2, 3, 4 and 5) unlike its previous version which consisted of five or six zones for the country. According to the present zoning map, the highest level of seismicity can be expected in Zone-5 whereas Zone-2 is associated with lowest levels of seismicity (http://en.wikipedia.org/wiki/Earthquake_hazard_zoning_of_India)

24 www.disastermgmt.bih.nic.in/Reports/Report%20of%20NDMA.pdf

The programme, so far, has been confined to raising awareness at various levels. This is clear from the range of activities given below at the state, district and block levels:

State Level:

- Development of various manuals, information education and communication materials, and training modules for wider dissemination
- Observation of National Disaster Reduction Day on October 29 at the state level
- Regular review and follow up of the programme at the state level
- Sensitization of the corporate sector and other professional bodies
- Sensitization of District Magistrates
- 112 state level officials and 142 District Master Trainers were trained in ATI from 14 Programme Districts
- Massive awareness campaign through media, meetings and sensitization programmes on Disaster Management
- Consultations on Development of Awareness Strategies on Disaster Management of various stakeholders
- Organisation of a state level exhibition "Chetna-2006" with participation of the government, non-governmental agencies, corporate sector, paramilitary forces and other stakeholders including teachers, students, engineers and architects
- Organisation of a workshop on the "Role of the Insurance and Banking Sector in Disaster Management"

District Level Activities:

- 14 District Disaster Management cts;

Committees formed in the programme districts; training for all the committee members

- 10 district DM plans are approved
- Block officials are being trained at district level
- 832 Panchayati Raj Institutions (PRIs), NGOs and 1,307 National Service Scheme (NSS)²⁵ and Nehru Yuvak Kendra (NYK)²⁶ volunteers have been trained and involved in various activities
- 1,107 teachers have been trained on Disaster Management programmes
- Various awareness strategies have been chalked out at the district level for mass sensitization on preparedness
- 350 engineers have been trained at district levels on earthquake resistance technologies
- 270 masons are already trained on construction of earthquake resistant buildings
- 11 out of 14 districts have completed the construction of the EOC building and the rest are in the finishing stage
- Various equipment like computers with accessories, fax machines, mobile phones and generators have been sent to the districts, supported by MHA/UNDP
- 47 Master Trainers' training on Search and Rescue has been completed
- Training of 45 volunteers conducted for 7 days on ham radio
- Various Awareness Generation Campaigns conducted through development of IEC
- 1,909 panchayat committees have been formed along with training to 9,670 members
- 427 panchayat plans have been prepared

- 3,116 Village Committees have been formed, 16,539 members are trained and 1,115 plans have been prepared and approved
- Multi hazard preparedness planning at all levels, including mock drills
- Creation of a Mitigation Response Fund at all levels

Bihar has made considerable achievements in the following manner:

- Formation of Bihar State Disaster Management Authority
- Completion of State Disaster Management Plan
- Training of Volunteers on Search, Rescue, Evacuation and First Aid at all levels
- Formation and training of a State Search and Rescue team at the state level
- Effective functioning of the Emergency Operations Centre at the state and district levels



Source : www.sachasauda.com.

25 Launched On September 24, 1969, the National Service Scheme under the Central Ministry of Youth Affairs and Sports, is designed involve students in "national service" and also introduce urban students to rural areas. The cardinal principle of the programme is that it is organised by the students themselves and both students and teachers through their combined participation in social service, get a sense of involvement in the tasks of national development. (<http://nss.nic.in/intro.asp>)

26 Nehru Yuvak Kendra Sangathan (NYKS), an autonomous body of the Ministry of Youth Affairs and Sports, Government of India, was set up in 1972 as Nehru Yuvak Kendra under the erstwhile Ministry of Education. The NYKS today prepares over 11,000 youth leaders every year. It currently has 500 district level offices, 2.16 lakh village level youth clubs and 80 lakh rural youth affiliated to it in the 13-35 age group. (<http://www.nyks.org/>)

(iv) Orissa²⁷



The rate of urbanisation in Orissa at 14.91 percent is the lowest among the major states of India and is rising very slowly.

Orissa is a state on the eastern seaboard of India, located between 17°04'9" and 22°03'6" North latitudes and between 81°03'6" and 87°01'8" East longitudes. Spread over an area of 1,55,707 sq. km it is broadly divided into four geographical regions, Northern Plateau, Central River Basins, Eastern Hills and Coastal Plains. It has a 480 km coastline. Its population was 36,706,920 as per the 2001 census. Administratively, the state is divided into 30 districts, 58 sub-divisions, 314 blocks (administrative units in descending order of geographical area and population) and 103 urban local bodies. The average density of population comes to 236 per sq. km with significantly higher density in the coastal areas compared to the interior.

Orissa's population was 36.71 million in 2001. The population is predominantly Hindu (94.67 percent). It has the third lowest population density (236 persons per sq. km in 2001) among the major states of India, ahead of only Rajasthan and Madhya Pradesh; however, there is significant inter-district variation (coefficient of variation, CV: 64.20 percent in 2001) within the state, with the district of Khurda having a population density of 666 persons per sq. km at one end, and

Kandhamal district with a population density of only 81 persons per sq. km at the other. This has meant massive spatial concentration of the population. Coastal Orissa accounts for some 52 percent of the population of the state with an area share of 25 percent. The rate of growth of population in Orissa during the decade 1991-2001 was 15.94 percent as against 21.34 percent for all-India. This is the third lowest rate of growth of population among the major states of India, with only Kerala (9.42 percent) and Tamil Nadu (11.19 percent) having lower rates. This has been the result of a rather peculiar demographic regime: a relatively low and steadily declining birth rate going hand in hand with a relatively high and very slowly declining death rate.

The rate of urbanisation in Orissa at 14.91 percent is the lowest among the major states of India and is rising very slowly. But there is significant inter-district variation (73.29 percent in 2001) in this respect, with the district of Khurda in central coastal Orissa having an urbanisation rate of 42.93 percent at one end and Boudh, in south-central Orissa, having an urbanisation rate of only 4.82 percent at the other.

The sex ratio of Orissa's population was 971 in 1991, the third highest among major Indian states, lower than only Tamil Nadu (986) and Kerala (1,058). The aggregate sex ratio of Orissa in 1991 is, in fact, lower than the 0-14 years' age group sex ratio of 978. This implies that there is no upward bias towards aggregate sex ratio due to greater male out-migration as compared to that of females.

About 23 percent of the population comprises the indigenous tribal population, mostly concentrated in the north-western and south-western districts of the state. The north-western districts (Sundargarh, Keonjhar and

²⁷ This section is based mostly on the Government of Orissa's *Orissa Human Development Report (OHDR)*, 2004

Mayurbhanj) account for 35.3 percent of Orissa's tribal population and the south-western districts (Koraput, Kalahandi, Phulbani and Balangir) a further 39.4 percent. Their means of livelihoods continue to be heavily forest-dependent. The processes of modernisation have largely marginalised them in economic terms, threatening their livelihood security. Alienation of tribals, for various reasons, is emerging as a social problem.

The SCs form a little more than 16 percent of the state's population. Unlike the tribal population, they are mostly concentrated in the four (undivided) coastal districts of Balasore, Cuttack, Ganjam and Puri, which together account for 53.8 percent of the state's SC population.

Even though the inter-state disparity in the level of human development (as measured by the HDI) has declined between 1981 and 2001, Orissa's relative position has not shown any improvement. Amongst the 15 major states of India, the HDI for Orissa was the fifth lowest in 1981, fourth lowest in 1991, and again the fifth lowest in 2001, even though the absolute value of the index has risen between 1981 and 2001 by 51.3 percent, albeit from a rather low level.

Orissa possesses a varied physiography due to its rather peculiar geographical location and wide range of physical features. The extensive ranges of hilly forests, several lofty peaks, rolling uplands, long stretch of coastline, extensive riverine system, brackish waters, coastal mangroves, and coastal plains together have endowed the state with a wide range of ecological habitats for a diverse and broad spectrum of flora and fauna.

On the basis of physical features and agro-climatic conditions, it is possible to divide the state into four zones:

(i) Northern Plateau (constituting 18.3 percent of the state's area and comprising

undivided Keonjhar, Mayurbhanj and Sundargarh districts): This region is characterised by hill ranges rising to elevations of 2,000 to 3,000 feet above sea level.

(ii) Central Table Land (constituting 23.9 percent of the state's area and comprising undivided Balangir, Dhenkanal and Sambalpur districts): This region is generally flat with slightly undulating and folded topography, rising to an elevation of 1,000 feet.

(iii) Eastern Ghats (constituting 32.0 percent of the state's area and comprising the undivided districts of Kalahandi, Kandhamal and Koraput): This region is dominated by hill ranges along with some plains and valleys lying between them, with elevations of plateaus ranging from 900 feet to 2,000 feet.

(iv) Coastal Plains (constituting 25.8 percent of the state's area and comprising the undivided districts of Balasore, Cuttack, Ganjam and Puri): This region consists of a number of river deltas.

The agro-ecological conditions of the above-mentioned four zones are clearly differentiated by the distinctive topographical features of the land. It is significant to note that for the state as a whole, highlands constitute as much as 45.8 percent of the cultivated area. This is significantly higher in the Eastern Ghat region (64.2 percent). In the Northern Plateau and Central Table Land, highlands constitute half of the cultivated area. On the other hand, in the Coastal Plains, highlands constitute 29.2 percent and lowlands constitute 36 percent of the cultivated area.

The intrinsic fertility of the residual soil of the highlands is low, since these are predominantly lateritic, highly leached, acidic and low in nitrogen and organic matter. They are also shallow, sandy and susceptible to erosion. Because of the porous nature of the highland soil and its topography, its moisture retention

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capacity is rather low. Along with poor intrinsic fertility, this makes the highlands suitable only for low water-intensive crops. The transported alluvial soil of the lowlands is moderately fertile, less acidic, more productive than the residual soil, and has a higher moisture retention capacity. It is, thus, suitable for paddy cultivation. Highland Orissa is drained by a number of major rivers, which have given rise to fertile river valleys suitable for paddy cultivation.

The state normally receives about 1,500 mm (60 inches) of rainfall, with a variability of 25-30 percent. About 77 percent of the rainfall comes from the south-west monsoon (from June to September). However, the south-western districts of Kalahandi, Balangir and Koraput fall in the rain shadow zone of the south-west monsoon and hence receive highly erratic rainfall.

The coastal region presents a virtual mono-culture with the predominant crop, paddy, grown in two-crop combinations with pulses, oilseeds or jute. Paddy is also the most important crop in highland Orissa and is widely cultivated in river valleys. A large number of miscellaneous crops such as coarse millets, pulses, oilseeds, jute and sugarcane are also grown.

Barring the river basins, which are the fertile parts of the region, population density in much of highland Orissa is quite low compared to the coastal plains; this also broadly corresponds to the level of agricultural productivity.

The ecological conditions in Orissa have been conducive to large tracts of natural vegetation. Bamboo and sal (*Shorea robusta*) forests abound in this region. Forests yield a wide range of "minor" products that provide livelihood support to the original inhabitants of this region almost throughout the year. Beside forest resources, most of the major mineral deposits are also found in this region.

The specific agro-ecological conditions of the state define the broad contours of livelihood options for its people. These conditions, however, are not static and are liable to change according to the patterns of human intervention and modes of utilisation of natural resources. Thus, the destruction of coastal mangroves has probably increased the susceptibility of production, and livelihood security is under increasing threat due to deforestation and soil erosion, floods, water logging and soil salinity, as well as vulnerability to cyclonic storms.

The trend in effective forest cover (that is, closed forest area having crown density of more than 40 percent of the total geographical area) as against nominal forest cover (total forest land as a percent of the total geographical area) can be seen from the satellite data on forest cover, available from the early 1970s. Even by 1972-75, the effective forest cover was only 24 percent. In the course of the next 24 years or so, the nominal forest cover remained constant at around 30 percent, but the effective forest cover dwindled to less than 17 percent. This is due to the unchecked degradation of forest cover. This has resulted in a decrease in the closed forest area (as a percent of the total forest area) from 77 percent during 1972-75 to 30 percent by 1996. At the district level, it is only in the districts of Mayurbhanj and Kandhamal that the effective forest cover has remained at around 30 percent.

Increased degradation of forests has resulted in increased vulnerability to droughts and floods. The land is more prone to droughts due to the increased moisture stress as a result of more rapid run-off of rainwater. On the other hand, due to increased sediment load, the delta channels are unable to discharge the floodwaters to the sea, thus resulting in floods. Moreover, drainage congestion in the coastal deltas renders large areas of

land waterlogged throughout the year.

Finally, because of the geographical location, the coastal areas remain susceptible to cyclonic storms.

Growth, Poverty and Livelihood

Orissa has been one of the worst performers in the country, in terms of social and economic development. The relative per capita income of Orissa has declined vis-à-vis all other low-income states during the second half of the 1990s. When compared to all-India values, Orissa's per capita income was three-fourths of that of all-India at the beginning of the 1980s and became half by the end of the 1990s. The contrast becomes even starker when comparisons are made with the performance of states that experienced growth rates higher than the national average. For instance, the per capita income of Orissa is one-third that of Punjab (GoO, 2005: 18). For the period 1950-51 to 1988-89, Orissa's long-term rate of growth of the Net State Domestic Product (NSDP) was 2.98 percent and the per capita NSDP was only 0.99 percent; it is only in the 1980s that NSDP and per capita NSDP have grown relatively impressively, at 3.97 and 2.15 percent respectively (ibid.).

The long-term rate of growth of agriculture has been low, at 2.38 percent, lower than that of the secondary and tertiary sectors. Only the tertiary sector has shown consistent growth, at more than 3 percent through successive decades. It is a matter of concern that growth in agriculture and animal husbandry slowed down in the 1990s to about 2 percent. Within the primary sector, only the mining and quarrying sub-sectors have improved upon their already high rate of growth in the 1980s. The tertiary sector alone has been able to maintain its high rate of growth through the 1990s. Per capita NSDP has grown at about 2.4 percent per annum in the 1990s (GoO, 2005: 19).

Considering rural poverty alone, there was a steady decline in the poverty ratio in Orissa between 1977-78 and 1993-94. In the second half of the 1990s, the poverty ratio has remained almost stationary. This is quite unlike the experience of other low-income states and all-India trends and is perhaps due to the poor agricultural growth performance of Orissa. This stagnation is partly explained by the regional trends in Orissa during the second half of the 1990s (Table 10).

Table 10 : Decline in poverty ratio

Region	Year			
	1983-84	1987-88	1993-94	1999-2000
Coastal	57.50	48.40	45.30	31.80
Southern	80.80	83.00	68.80	87.20
Northern	75.20	61.00	45.80	49.80
Orissa	65.24	55.58	48.56	48.01

Source : GoO, 2005: 22

The poverty ratio in the southern and northern NSS regions of Orissa²⁸ has in fact increased between 1993-94 and 1999-2000, unlike the earlier period (1987-88 to 1993-94), and since almost 75 percent of the state's poor belong to these regions, this has influenced the overall poverty ratio.

Spatial and Social Dimensions of Poverty

Two spatial aspects of poverty are noteworthy. Firstly, poverty in Orissa is overwhelmingly a rural phenomenon. Thus, in 1987-88, the share of urban poor in the total number of poor in Orissa was 9.7 percent, the lowest among all the major states of India, except Assam. In fact, there were as many as seven major states in India where the incidence of urban poverty was lower than that of

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²⁸ These are regions of Orissa as demarcated by the NSS (National Sample Survey).

Orissa (namely, 37.4 percent), but the proportion of urban poor to total number of poor was much higher in these states (GoO, 2005: 21).

Second, there are very significant regional differences in the incidence of poverty within Orissa. This is brought out by the NSS region-wise estimates of poverty. As can be seen from Table 10, the poverty ratio in the southern region is more than two and half times that of the coastal region and the ratio in the northern region is more than one and half times that of the coastal region.

Table 11 : Poverty amongst social groups

Region	Social Groups			
	ST	SC	Others	All
Coastal	66.63	42.18	24.32	31.74
Southern	92.42	88.90	77.65	87.05
Northern	61.64	57.22	34.67	49.81
Orissa	73.68	52.30	33.29	48.01

Source : GoO, 2005:22

In the case of the rural ST population, the incidence of poverty in Orissa, at 71.51 percent (199394), was the highest among the 16 major states of India.

These regional differences in the incidence of poverty capture differences in the degree of economic deprivation of different ethnic groups and their spatial concentration. Thus, the incidence of poverty among SC and ST populations in the southern and northern region is very high it is in these regions that 88.56 percent of the state's ST population and 46.23 percent of the state's SC population reside. In the case of the rural ST population, the incidence of poverty in Orissa, at 71.51 percent (199394), was the highest among the 16 major states of India. It was 51.96 percent for all-India and, significantly, for MP (which has the highest concentration of tribal population followed by Orissa among the major states), the incidence of poverty was 56.90 percent.

Of particular concern is the fact that it is only in the coastal region of the state that the rural poverty ratio has steadily and significantly declined between 198384 and 1999-2000. This has happened to a lesser extent in the northern region, whereas in the southern region, the poverty ratio has been fluctuating around a high average value (Table 11).

Further, the intensity of poverty in the southern region of Orissa is almost twice as high as it is in the coastal and northern regions as measured by the rural poverty gap and squared poverty gap (see Table 12).

The HDR seeks to partly explain the differential poverty ratios by mentioning that, a) the irrigation base of the northern and southern regions is very small as compared to the coastal region, and b) the intensity of input use (as measured by the rate of fertiliser use) in the southern region is also about one-fourth, and in the northern region one-half of that in the

Table 12 : Poverty gap²⁹

Region	Poverty Gap	Squared Poverty Gap
Coastal	10.21	3.22
Southern	18.78	6.82
Northern	10.41	3.43
Orissa	11.83	3.95

Source : GoO, 2005:23

coastal region. According to the HDR, two other factors that might have had a high poverty-reducing impact are: the extent of rural non-farm employment opportunities and infrastructural development. These sharply set apart the southern NSS region of Orissa. Thus, other workers (that is, those in rural non-farm employment) constitute 22.86 percent of rural main workers in coastal

²⁹ Poverty Gap is the percentage difference between the poverty line income/consumption expenditure and the average income/consumption expenditure of the poor. Squared Poverty Gap takes into account expenditure of those below the poverty line.

Orissa whereas they constitute only 12.63 percent of rural main workers in southern Orissa. The infrastructure development index is 122.81 for coastal Orissa whereas it is only 65.87 for southern Orissa (taking Orissa as 100).

The inter-district disparity in poverty ratio has increased in Orissa from 1983-84 to 1999-2000, as suggested by the coefficient of variation values (GoO, 2005: 26). This means that inter-district disparity in absolute economic deprivation has been rising. An important indicator of the uneven development at the district level that may have a bearing on this disparity is the per capita district domestic product (DDP). The inter-district disparity in per capita DDP is fairly high (CV: 24.29). However, the level of per capita income and poverty ratio across districts of Orissa are weakly and negatively correlated (-0.31), suggesting that relatively high growth resulting in high per capita income does not always impact on poverty (ibid.).

It is interesting to note that there is no attempt in the HDR explain the differential poverty estimates across the regions in terms of natural or human made disasters nor to measure the impact of the disasters in terms of poverty creation, nor could any research on this be found. Further, such high and sharp inter-regional disparities point to the lack of successful implementation of the various developmental programmes or, to put it starkly, failure of policy. The HDR does recognise that “sustainable livelihood or livelihood security lies at the heart of food security because without the former, sufficient entitlement to food may not be forthcoming. Disruption of livelihood security with resultant non-sustainable livelihoods can come about in several ways: natural calamities such as drought and floods can destroy livelihoods and it can take a long time before livelihoods can be put back

on a sustainable basis; inability of non-food producers in agriculture to find a market for their produce; inadequacy of household income to meet minimum consumption requirements on a continuous basis; or mismatch between sustainable yield of a natural resource, and given certain institutional and technological conditions, the ability of a population dependent on such a resource to collect enough of it” (GoO, 2005: 26-27). However, there is no attempt to substantiate this empirically. Perhaps the only way is to conduct empirical studies, using both qualitative and quantitative techniques, at the micro, meso and macro levels.

In most of these cases, restoration of livelihoods requires community action backed by active intervention by state agencies. Given the close to five decade old history of such interventions, there is an urgent need to analyse the reasons and suggest ameliorative measures if the threat of climate change has to be met and adaptive capacities enhanced.

Natural Disasters

Orissa has long been prone to both natural and human-made disasters. Natural disasters like flood and drought have, however, been regular features in the state since 1965, though cyclones are less frequently observed: since 1965, Orissa has experienced floods for 17 years, droughts for 19 years, and cyclones for seven years. These natural disasters have not only led to loss of human lives but also resulted in damage to and loss of property. The value of properties lost and damaged due to natural disasters has also been increasing over the decades. During the 1970s, one estimate of value of property loss was around Rs 105 crore, which increased to nearly seven times in the 1980s and more than 10 times in the 1990s. Thus, natural calamities have become a problem for the poor people of

Since 1965, Orissa has experienced floods for 17 years, droughts for 19 years, and cyclones for seven years.

Orissa. Also they have led to serious fiscal imbalances by placing heavy demands on revenue expenditure, that is, expenditure on restoring assets and reduction of revenue in terms of taxes and duties because of loss of crops and property (GoO, 2005: 162-189).

Against the value of properties lost and damaged due to natural disasters in Orissa, the state has received very small amounts as grants from the Central government. The state government, on the other hand, is unable to provide relief for the full amount of the value of property lost and damaged. It has only made some addition to the grants received from the centre for natural calamities, which is insufficient to make up the loss of property due to natural



Source : www.news.bbc.co.uk

calamities.

The cause and effect of droughts is different from that of floods and cyclones. While in the case of the latter, the occurrence of the disaster is sudden and can be known only a few hours prior to its occurrence, the onset of drought is slow and not sudden. The possibility of

drought is known much earlier than its occurrence, and there is usually sufficient time for mitigation of the disaster. The experience of Orissa with different types of natural disasters is discussed below.

Drought

About 70 percent of the total cultivated area in the state is prone to drought. These areas not only lack irrigation facilities but also receive scanty rainfall. In some areas, rainfall, though plenty, is erratic. The severity of drought is measured by crop cutting experiments, and accordingly, declaration of the drought area is made.

Though Orissa receives an average annual rainfall of around 1,500 mm, there are wide variations from year to year. Less than 1,100 mm of rainfall has occurred seven times since 1951 in 1965, 1974, 1976, 1979, 1987, 1996 and 2002. All these are marked as severe drought years, which caused considerable reduction in *khari*³⁰ rice production. This suggests that there is at least one severe drought year in every decade, thus underlining the state's high vulnerability to drought.

Orissa has faced drought in most of the years in the latter half of the 1990s. During 1996-97, all districts (except Koraput and Malkangiri) were affected by drought. It

was so severe that more than 50 percent villages in the state had crop losses of 50 percent or more. The drought situation in 1997-98 was less severe, but the severity increased thereafter. The severely drought-affected districts in the state during the period were: Boudh,

Jharsuguda, Balangir, Sambalpur, Bargarh, Nuapada, Sonepur and Sundargarh in the western part of Orissa; Balasore, Jajpur, Nayagarh and Khurda in the eastern part; and Koraput and Malkangiri districts in the southern part. Villages in these districts had crop losses of 50 percent or more.

During 1996-97, almost all districts of Orissa, excluding Koraput and Malkangiri, were affected by drought. Around 84 percent of the blocks in the state were affected. All blocks were affected in 20 districts. The most severely affected districts (with more than 90 percent villages affected by drought) were Balangir (99.61 percent), Dhenkanal (95.71 percent), Jharsuguda (92.84 percent) and Nayagarh (90.64 percent). These were followed by Sambalpur (87.04 percent) and Boudh in the southern part; Mayurbhanj in the northern part; and Dhenkanal and Angul in central Orissa.

During 1997-98, though the drought was less severe, more than half the villages in Koraput had crop losses of more than 50 percent. This was followed by Gajapati district, with around 43 percent villages affected by drought. The drought of 1998-99 affected more than half the districts in the state. But five districts Balangir, Balasore, Boudh, Mayurbhanj and Sonepur were severely affected, with more than half the villages having crop losses of more than 50 percent.

During 2000-01, while almost all districts (except Bhadrak) were affected by

drought, it was severe in 11 districts, where more than half of the villages had more than 50 percent crop loss. Balangir was the worst affected district, with almost all (99.22 percent) villages affected by drought (more than 50 percent crop loss).

A comparison of the drought situation of different districts in the state in the second half of the 1990s reveals that Balangir and Boudh were the most drought-affected districts. During this period, more than 50 percent villages in these two districts were affected thrice by drought. The districts with more than 50 percent villages affected twice by drought during this period were Sonepur, Jharsuguda and Sambalpur in western Orissa; Mayurbhanj in northern Orissa; Angul and Dhenkanal in central Orissa; and Balasore and Jajpur in the coastal belt. Half of the most drought-affected districts were in western Orissa.

There is thus a need for concerted and intensive effort by the government to address this problem from a long-term perspective. The government has, however, identified contiguous patches consisting of the subdivisions of Padampur, Balangir, Titilagarh, Patnagarh, Nuapada, Khariar, Bhawanipatna and Kandhamal comprising of 47 blocks as chronic drought-prone zones.

Examining the situation historically leads to an interesting observation. Orissa, including western Orissa, that has been characterised as chronically drought-prone and the site of many interventions ranging from Oxfam projects in the 1980s and 1990s to the current DFID ones, had a long tradition of community forest management and also community water harvesting structures. There are instances of villages in Bolangir district, for instance, that did not face a single instance of drought because they managed their forests and water

There are instances of villages in Bolangir district, for instance, that did not face a single instance of drought because they managed their forests and water harvesting structures well (Mitra and Pattanayak, 1997). The inter-linkages between forests and water tables at the micro level are obvious, but what is more important is the role of the communities.

³⁰ There are two main cropping seasons in India: *kharif* and *rabi*. The term *kharif* means "autumn" in Arabic. The *kharif* crop is the autumn harvest (also known as the summer or monsoon crop) in India and Pakistan. *Kharif* crops are usually sown with the first rains in July, during the south-west monsoon season. The main crops are paddy, millets, maize, *moong* (pulses), groundnut, red chillies, cotton, soyabean, sugarcane and turmeric. In the *kharif* season, agricultural activities take place in both rainfed and unirrigated lands. (http://en.wikipedia.org/wiki/Kharif_crop)

The *rabi* crop is the spring harvest (also known as the "winter crop") in India and Pakistan. The term *rabi* means "spring" in Arabic, which is reflected in two months of the Islamic lunar calendar, *Rabi' al-awwal* and *Rabi' al-thani* (which usually span mid/late April to mid/late June), when the crop is harvested. The crops in this season are wheat, barley, sesame, mustard and peas. These are cultivated on irrigated lands. (<http://en.wikipedia.org/wiki/Rabi>)

harvesting structures well (Mitra and Pattanayak, 1997). The inter-linkages between forests and water tables at the micro level are obvious, but what is more important is the role of the communities. However, somewhere the focus on the role of the communities and their organisations in protecting forests and ensuring water security has been lost. Moreover, due to the onslaught of “modernisation”, including modernization through Joint Forest Management efforts, many of the community initiatives are fast breaking down.

Floods

Like drought, floods are also a major concern for Orissa. The 482 km long coastline of Orissa exposes the state to floods, cyclones and storm surges. Heavy rainfall during monsoons causes floods in the rivers. The storms that produce tidal surges are usually accompanied by heavy rainfall, making the coastal belt vulnerable to both floods and storm surges. People and livestock perish; houses are washed away; paddy and other crops are lost and roads and bridges are damaged. The floods of 1980, 1982, 2001 and 2003 were particularly severe, and property worth crores of rupees was destroyed.

The flow of water from the neighbouring states of Jharkhand and Chhattisgarh also contributes to flooding. The flat coastal belts with poor drainage, high degree of siltation, soil erosion and breaching of embankments and spilling over of floodwaters, cause severe floods in the river basin and delta areas. In Orissa, rivers such as the Mahanadi, Brahmani, Baitarani, Subarnarekha, Rushikulya, Vansadhara and their many tributaries and branches flowing through the state expose vast areas to floods.³¹ The

former three of these rivers have a common delta where flood waters intermingle, and when in spate simultaneously, they wreak considerable havoc. This problem becomes even more acute when floods coincide with high tides. The water level rises due to deposits of silt on the river-bed. Rivers often overflow their banks or water rushes through new channels causing heavy damage. Heavy rains in the upper catchment area as well as unusual rainfall in different districts cause floods in all major river systems of the state leading to heavy damage to life and property.

Orissa has thus faced many floods, with three severe floods since 1950 - in 1955, 1982 and 2001. The flood of 1955 (in the Mahanadi system) was so severe that till the 1982 flood, the water level of 1955 was the determining factor for laying the plinth of dwelling units of the affected Niali and Kantapada blocks of Cuttack district. Orissa's experience of floods since the early 1970s shows that their occurrence has increased over the decades. This indicates that vulnerability due to floods has increased over time, as they have resulted in not only human and livestock casualties, but have also affected cultivated area at an increasing rate. This can also be observed if we compare the two severe floods of 1982 and 2001.

During 2001, while the population affected by flood was almost twice that of 1982, the cultivated area affected by flood was more than six times. This suggests that flood control measures have not kept pace with increasing flood plain occupancy.

Considering the frequency of floods in different districts since 1994, it can be observed that coastal districts are major sufferers. Among the coastal districts, Bhadrak, Balasore and Jajpur are the

31 <http://v3.osdma.org/ViewDetails.aspx?vchglinkid=GL002andvchplinkid=PL006>

worst affected. Out of seven floods since 1994, these three districts were affected six times by floods, while the other coastal districts (excluding Ganjam and Gajapati) were affected five times. Even Angul, Kalahandi and Nabarangpur were also severely affected. Floods affected the districts of Sambalpur, Boudh, Sonapur, and Sundargarh in western Orissa and Koraput in southern Orissa about thrice in this period.

Cyclone

A cyclone is typically sudden and powerful, though there is sometimes some warning of its impending occurrence. It is often predictable to some degree but it is not seen as controllable. Orissa has a long history of cyclones. Nayak (2002) lists 26 cyclones in the state between 1891 and 1997; Orissa suffered from a series of heavy cyclones, mostly occurring during September-November, with the worst sufferer being Balasore district. Before Independence, a major cyclone occurred on September 22, 1885 (with a loss of around 5,000 human lives), another on October 31, 1931 (killing around 20,000 people, mostly in Balasore), and two in October and November 1942.

Although being repeatedly devastated by cyclones, the people of coastal Orissa made little effort to cope with disaster and were accustomed to see their economic condition deteriorate day by day (Bhatta, 1997). Even recently the state has faced two severe cyclones: one in 1971 and the other in 1999, the latter being so severe that it has been called the Super Cyclone.

The 1971 Cyclone:

The 1971 cyclone was the first major cyclone that the state faced after Independence. The cyclone affected the

inland area with a gathered speed up to 175 km per hour and wrought havoc over vast areas, destroying crops and blowing off roofs of houses and buildings over an area of 21,273 sq. km spread over the districts of Cuttack, Balasore, Puri, Mayurbhanj, Keonjhar and Dhenkanal. In the then Cuttack district alone, 520,438 houses were damaged, and 33.04 lakh people were affected in 38 blocks and six urban local bodies (ULBs), spread over 7,310 sq. km. Cultivated area of over 6,065 sq. km was affected and crops over 3,788 sq. km area were damaged. Around 7,397 human lives were lost and 77,921 cattle were killed in the district due to high tidal waves and devastating storms (GoO, 2005: 174). The Koteswaram Committee, appointed by the Central Government to look into various aspects of the 1971 cyclone, suggested certain measures to reduce loss and damage caused by cyclones, such as:

- Identification of coastal areas that are affected by high tide and cyclones
- Selection of stronger buildings by the district authority for shelter during cyclones
- Construction of two-storied cyclone shelter houses in high tide affected areas and one strong cyclone shelter house in areas affected by cyclone
- Construction of higher foundations for houses
- Construction of coastal embankment and afforestation in one kilometre width of the sea coast
- Issuing of advance warning by district authorities
- Provision of deeper tube wells in the area affected by saline water high tide
- Educating people about cyclone disaster management/mitigation
- Implementation of a model cyclone plan in the coastal areas

Orissa has a long history of cyclones. (2002) lists 26 cyclones in the state between 1891 and 1997.

- Issuing of a cyclone code by the state government, and formation of a National Fund for Calamity Relief (NFCR) by the Central government

It was a radical report by contemporary standards as it spoke of involvement of the community in both mitigation of disasters and also relief and rehabilitation.

Similarly, the Government of Orissa (Irrigation and Power Department) appointed a committee under the chairmanship of MC Pani in 1971 to estimate the loss and damage due to the 1971 cyclone and suggest possible arrangements to mitigate cyclones and to reduce human loss and loss to property. Important suggestions of the 31-page report, published in February 1974, included:

- One kilometre wide protective circle near the seashore through afforestation and declaring this area as Reserve Forest
- No permission to encroachers to settle in this protective circle and no entry for stray cattle
- No permission to people to own settlements in low-lying areas
- Fixation of sand dunes near the low-lying villages and two-storied or one-storied buildings by the government, which will serve as cyclone shelters
- Implementation of the gheri bandha system (enclosure embankments used to protect tanks or villages from saline water) around tanks (GoO, 174)

Some other suggested measures were:

- Maintenance of forest cover over the sand dunes
- Protection of the mangrove forest, and extending it further all along the coast, this being nature's own defence system

- Strengthening of the river embankments from the mouth of the river to a distance where the seawater reaches in the high tide period
- Construction of dykes in the creeks so that saline water cannot enter but the rainwater can easily flow into the sea
- Construction of cyclone-proof shelters in the cyclone-prone areas

Some of these recommendations were implemented; some coastal belt plantations were established and a few cyclone shelters constructed. However, with the passage of time, by the early 1980s, since there had not been any more cyclones and resources were scarce, the state decided not to allocate further funds to these measures. Also, as the HDR states, "there have been recently forces at work, which have disturbed the coastal eco-system, thereby increasing vulnerability to cyclones". The full impact of this was felt 25 years later, almost to the day and the hour, when the 1999 cyclone struck almost at the same place.

The 1999 Super Cyclone:

During 1999, two cyclones hit Orissa within a period of two weeks. The first cyclone, which occurred on 17-18 October, affected mostly the two districts of Ganjam and Gajapati. The worst affected was Ganjam, with 139 human casualties and 3.59 lakh houses damaged. The second cyclone, which occurred during 29-30 October, affected 12 districts, the most affected being Jagatsinghpur, where officially 8,119 human casualties resulted. Of these two cyclones, the second was much more severe compared to the first one and has been termed as the Super Cyclone.

The 1999 Super Cyclone, with speeds up to 300 km per hour, caused unprecedented loss of human lives,

Photo : Amit Mitra



livestock, public and private properties including vital infrastructure and houses. It hit as many as 97 blocks, 28 urban local bodies, 1,827 Gram Panchayats (GPs), and 15,676 villages with a total population of 1.26 crore. Nearly 10,000 human lives were lost, 15.80 lakh houses damaged and 17.86 lakh hectare agricultural land affected. More than three lakh cattle were lost and over 90 percent of school buildings, dispensaries, offices, government buildings and roads in rural areas were damaged. Total loss due to the Super Cyclone was estimated at Rs 50,000 crore.

The 1999 Super Cyclone The government relief works started as per the Orissa Relief Code. The cyclone-affected people received food materials (50,138 MT) for 15 days. House building assistance was given at the rate of Rs 3,500 for fully washed away houses, Rs 2,000 for fully collapsed houses and Rs 1,000 for partly collapsed houses. By June 30, 2000, Rs 270.65 crore had been disbursed for house building assistance. For ex-gratia payment to the next of kin of those who died in the cyclone, Rs 25,000 from the

national fund for calamity relief (NFCR) of the state and Rs 50,000 from the Prime Minister's Relief Fund (PMRF) were earmarked, thus amounting to a total of Rs 75,000. By June 2000, Rs 21.03 crores from the NFCR and Rs 38.41 crores from the PMRF were paid by the district authorities.

Around 20 international, 20 national and 100 state NGOs were involved in the relief and rehabilitation work in the flood/cyclone affected areas. Besides these, 49 public sector units and 12 states (namely, Andhra Pradesh, Delhi, Goa, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Nagaland, Rajasthan, Tamil Nadu and West Bengal) participated in various relief and rehabilitation activities. The West Bengal and Andhra Pradesh governments supplied Rs 6.13 crore and Rs 6.56 crore worth of relief materials respectively (Planning Commission: 176-177). The international response to the 1999 Super Cyclone, even without an SOS call by the Government of India to the international community, was tremendous. The role of international bodies such as Unicef and UNDP and that

As a policy measure, the Orissa Relief Code (ORC) is a comprehensive document which acts as a guideline for undertaking preparatory measures prior to the occurrence of the natural calamities and relief measures soon after their occurrence.

of international NGOs (INGOs) particularly the Disaster and Emergency Committee (DEC) Agencies, in relief and rehabilitation measures, was praiseworthy. "Mamta Gruhas" as rehabilitation centres for women and destitutes were innovative interventions.

Aid from various sources that poured in to the Government of Orissa after the cyclone/flood was, till 30 June 2000, Rs 828.15 crore from the Government of India under NFCR and Rs 826.01 crore from various departments of the Central government, Rs 45 crore from PMRF and Rs 36 crore from various states.

According to a study (Samal, Meher and Panigrahi, 2003) on impact and effects of the Super Cyclone of 1999 in three most cyclone-affected districts of Jagatsinghpur, Kendrapara and Puri, the cyclone has changed occupations of people in most sample villages. The significant decline in livestock population, plants/orchards and trees has adversely affected livelihoods of households dependent on these resources for their traditional incomes. Around half of the total humans lost were earning members.

The impact of the Super Cyclone was more disastrous on SC/ST and OBC, the landless poor, other vulnerable groups like women, aged persons and children, and on those families which lost all adult male members. In the first instance, help to the cyclone-affected persons usually came from their relatives. Subsequently, it was the state government that first reached the cyclone-affected persons in providing relief in the form of airdropping of food materials and then distributing relief in block and panchayat offices.

Around one-fourth of the total relief distributed by the government went to the severely affected Jagatsinghpur district, and especially its Ersama block.

The state government extended substantial rehabilitation support to the cyclone-affected households, such as ex-gratia payment for human deaths, financial assistance for damaged houses, financial help for fishing equipment, betel vines, loss of other income-generating assets, subsidised seeds for cultivation, PDS rice at concessional rates, waiving of school/college fees, compensation for crop insurance, house building materials, utensils, food for work programmes and so on. Despite some inefficiency in managing relief and rehabilitation measures, the state government did a tremendous job with regard to: (i) controlling the spread of any epidemic after many deaths of human beings and bovine population, and (ii) not having any starvation death in the cyclone-affected areas.

Disaster Management in Orissa

A number of initiatives have been taken by the state through planned interventions to combat natural disasters. During the First Five-Year Plan, river valley projects were initiated and Flood Control Boards constituted for major river basins, like Mahanadi and Brahmani, to counter flood hazards. To mitigate the impact of drought, the Drought Prone Area Programme (DPAP) was introduced in the early 1970s. In the cyclone prone areas, Early Warning Systems (EWS), cyclone shelters, and other protective measures have been introduced, particularly after the devastation of the 1999 Super Cyclone in the state.

As a policy measure, the Orissa Relief Code (ORC) is a comprehensive document which acts as a guideline for undertaking preparatory measures prior to the occurrence of the natural calamities and relief measures soon after their occurrence. Prior to the formation of the

ORC, the Bihar and Orissa Famine Code (with periodic revision) formed the longstanding guiding principle in mitigating natural calamities. The provisions of this code became obsolete in the post-Independence era due to a radical change in the concept of relief from just saving lives to providing both preventive and curative/ameliorative relief. After the catastrophic cyclone of 1971, the government



Photo : Amit Mitra

decided to frame a fresh Relief Code and the ORC, 1980, came into existence. After 1980, a number of instructions have been issued by the state government to enlarge the scope and content of the code in order to make it more relevant to the times. A number of long-term relief measures are suggested to help communities cope with the aftermath of natural calamities. These relief measures are undertaken subject to the directive of the Board of Revenue/Special Relief Commissioner and the scales of relief are given as per modifications to be effected by the government from time to time.

These relief measures include:

- Labour-intensive works including relief works, and ex gratia payments
- Nutrition supplementary feeding programme
- Relief measures by NGOs
- Helping orphans and destitutes
- Strengthening of the PDS
- Health measures and veterinary measures
- Agricultural measures including provision of credit supply

- Special relief to weavers and artisans
- Arrangement of food stuff and stocking of foodgrains at strategic places
- Provision of safe drinking water and immediate irrigation facilities
- Remission and suspension of collection of land revenue and loans
- Grants of educational concessions
- Enquiries into starvation cases and prompt action taken on such reports, and action on press reports

The ORC has specified assessment procedures for crop loss, starvation deaths, human casualties, loss of livestock and other damage caused by drought, cyclones, tidal waves and floods, to gauge the severity of the disaster, and has specified some norms for distribution of relief and rehabilitation measures. Besides, it has specified the community preparedness programmes and long-term measures to reduce disastrous impacts of calamities and to afford necessary emergency protection.

The ORC has specifically mentioned that the Collector is responsible for relief operations in the district and for

While taking preventive measures during floods, it is important to make a distinction between those who live near banks of rivers without embankment and those behind embankments of rivers.

coordination among different departments. The Collectors and Revenue Divisional Commissioners (RDCs) have the power to requisition the services of gazetted and non-gazetted officers working in the areas affected by the natural calamities for administration of urgent relief measures. In case the number of officers in a district affected by a natural calamity is found to be inadequate, officers from other districts can be requisitioned. It is also specified in the ORC that a block is the unit of a relief organisation and the Block Development Officer (BDO) shall be in charge of the unit. The officer-in-charge of the Relief Circles should see that the people's representatives are properly associated with all relief measures.

The Orissa State Disaster Mitigation Authority (OSDMA) was subsequently set up by the Government of Orissa as an autonomous organisation in 1999, with

The main objectives of OSDMA are to:

- Act as the nodal agency for disaster reconstruction works
- Coordinate with the line departments involved in reconstruction
- Coordinate with bilateral and multi-lateral aid agencies
- Coordinate with UN Agencies, International, National and State-level NGOs
- Promote disaster preparedness at all levels in the State Network with similar and relevant organisations for disaster management

Disaster Risk Management Programme

The Government of Orissa is implementing the Disaster Risk Management (DRM) programme in 16 disaster-prone districts in order to reduce the vulnerabilities, in two phases between 2002-08 with the support of the GoI (Ministry of Home Affairs) and the UNDP. This programme is also implemented in 16 other states. Prior to this, the UNDP sponsored Community Based Disaster Preparedness (CBDP) programme was implemented in ten blocks of seven coastal districts on a pilot basis. The overall goal of the programme is "sustainable reduction in disaster risk in some of the most hazard-prone districts". The names of the programmed districts are shown in Table 13.



Source : www.worldproutassembly.ranjan_water

the Department of Revenue as its administrative department.³²

³² For organogram of OSDMA see <http://v3.osdma.org/ViewDetails.aspx?vchglinkid=GL000andvchplinkid=PL000andvchslinkid=SL002>

Table 13 : Disaster Risk Management Programme: Districts in Orissa

S.No.	Name of District	ULBs Programmed	Blocks Programmed	GPs Programmed	Villages Programmed
1	Angul	3	8	209	1,637
2	Balasore	4	12	289	2,6474
3	Bhadrak	2	7	193	1,248
4	Cuttack	3	14	342	1,844
5	Ganjam (P)*	13	13	292	1,423
6	Jagatsinghpur	2	8	198	1,232
7	Jaipur	2	10	280	1,572
8	Kendrapara	2	9	230	1,405
9	Keonjhar (P)**	4	3	68	496
10	Khordha	4	10	168	1,527
11	Koraput	4	14	2265	1,915
12	Mayurbhanj (P)***	2	11	57	225
13	Nuapada	2	5	109	638
14	Puri	4	11	230	1,589
15	Rayagada	3	11	171	2,540
16	Sambalpur	4	9	148	1,325
	Total	58	155	3,210	23,263

* Covers cyclone prone blocks

** Covers flood prone Anandapur sub-division

*** Covers flood prone GPs and villages

In the sections below, specific details of the different natural disasters will be discussed, in terms of the mitigation efforts that have been undertaken.

Drought

Before Independence, "Famine Codes" framed and amended by successive Famine Commissions (1880, 1898 and 1899) took measures when there was apprehension of large-scale human mortality, and aimed at preventing deaths on account of calamities. After Independence, the word "famine" was replaced by the word "scarcity" and the famine relief codes of the erstwhile provinces (including Orissa) were replaced by "Scarcity Relief Manuals", which described scarcity as a marked deterioration of the agricultural season

due to failure of rains or floods or damage of crops from insects resulting in severe unemployment and consequent distress among agricultural labourers and small cultivators (Prakash, 1994).

Several programmes were implemented in the state during the 1980s, as Orissa faced drought disasters throughout that decade, including the Food For Work (FFW) programme, National Rural Employment Programme (NREP), Integrated Rural Development Programme (IRDP) and the Rural Landless Employment Guarantee Programme (RLEGP).

In the 1990s, the frequency of drought declined, but a major drought occurred in 1996. The drought of 1996 focused attention on the need for employment assurance, and as a result, the Employment Assurance Scheme (EAS) was introduced.

Some of these programmes were, however, ad hoc in nature and did not have a long-term perspective.

Long-term measures included DPAP, which was not, however, very successful, mostly due to the lack of an integrated approach. The watershed development approach, based on community participation, appears to be an appropriate approach to tackle droughts

According to one view (Pradhan, 2003), the annual rainfall has no relation to drought. The annual rainfall may be more than adequate but if it is not equally distributed during different seasons, there is every possibility of crop failure. This also reinforces the argument for revival of community based traditional water harvesting structures. In Orissa, since more than two-thirds of the cultivable land is utilised for paddy, drought usually refers to failure of the paddy crop. Several types of traditional paddy varieties were cultivated in the state in the past. Some of them had better climatic and regional adaptability and reduced the risk of crop failures. However, varieties of paddy have considerably reduced in recent times. High-yielding and high input varieties are usually at risk for crop failure.

According to the Orissa state government's HDR (2005), a single method cannot be followed in the case of risk reduction from droughts/ floods; some methods suggested are:

- Crop diversification (as per rainfall and soil) and conservation of biodiversity
- In the western part of Orissa, plantations, particularly of fruit-bearing trees (for example, mango and jackfruit), will help during drought, since people can sell the yield for livelihood.

Flood Mitigation

Flood mitigation measures can be carried out in three stages: (i) pre-flood stage: suggesting preventive techniques; (ii) action plan: when the flood has struck a particular area; and (iii) post-flood management stage: suggesting measures to reduce the suffering of the people affected. While taking preventive measures during floods, it is important to make a distinction between those who live near banks of rivers without embankments and those behind embankments of rivers. The inadequacy of action at the first stage accumulates pressure at the last stage. This brings the increasing problem of rehabilitation, the cost of which, in many cases, becomes as much as the cost of structural measures required to assure reasonable safety (Aich, 1999).

As early as 1928, a Committee was set up to study the flood problem in Orissa, which was followed by the Flood Advisory Committee (1938-39). The 1928 Committee considered the problem as basically requiring disposal of excess floodwater and the 1938-39 Committee viewed the problem as one of proper distribution and disposal of excess rainwater. The Committee broadly recommended a system of embankments to control floods. M. Visveswaraya, Chief Engineer of Hirakud Dam on the Mahanadi river, visited the Orissa delta during 1939 at the initiative of the Government of Orissa and estimated that a quarter of the delta water should be normally diverted to a necessary waterway. The Hirakud Dam was constructed in 1957 primarily to control floods. After the Srinagar conference of Irrigation Ministers, the Government of India made a plan to build two multi-purpose dams in Orissa with a total expenditure of Rs 45 crore for the Rengali (on Brahmani river) and Bhimakund (on Baitarani river) projects (GoO, 2005: 179).

While construction of Rengali Dam was started in 1973 and completed in June 1985 to impound 2.47 million acre-feet of water, the Bhimakund project was cancelled (Sahu, 2000). Increased run-off from the upstream catchment following deforestation seems to have rendered inadequate the original live storage capacity of Hirakud Dam, which was designed on the basis of past trends in the run-off from the upstream catchment (Satapathy, 1993). Added to this was the problem of siltation, which threatened to reduce the original capacity of live storage of the reservoir. Such a higher rate of siltation than anticipated in the original project on the basis of actual silt survey was indicative of increased soil erosion in the upstream catchment.

The Mahanadi delta region has been transformed over the 125 year (1803-1928) period from a flood dependent agrarian region to a flood vulnerable landscape a transformation affected by British colonial rule that not only instituted a new regime of property rights but also the deployment of numerous technical interventions. Over the period, there was a movement from embankments to a canal system and finally the construction of the Hirakud Dam on the Mahanadi River (D'Souza, 2000). Satapathy (1993) argues that the Hirakud Dam has drastically reduced large floods in the state. On the other hand, increased frequency of medium and small floods was seen as a joint result of flood moderation by the Hirakud reservoir and the contribution from the downstream catchment. It can be pointed out that the large flood of 1982 was not due to the Hirakud Dam but due to the downstream catchment. Therefore, there is increasing importance of run-off characteristics of the downstream catchment. Increased run-off from downstream seems to have been due to deforestation taking place in this catchment area. This could be crucial in perpetuating the occurrence of

medium/small floods as well as in producing a very large flood in case of abnormally high rainfall in the downstream catchment, as had happened in 1982. This shows the importance of afforestation and soil conservation measures in the downstream catchment, since such measures are particularly effective for checking small/medium floods, the frequency of which has increased in the post-dam period (Satapathy, 1993).

A post-disaster system management includes warning systems, emergency operations, evacuation, relief and rehabilitation, health measures and repair and reconstruction of infrastructure facilities. Since floods are frequent in the state, disaster management proves to be quite an expensive affair for the concerned bodies. Though it is the government's prime responsibility to rehabilitate victims of flood, public contributions can certainly be made to aid government efforts. Voluntary organisations having long experience in providing relief and rehabilitation should be invited to work for the purpose.

One of the crucial factors in rehabilitation is to keep in mind the post-traumatic psychological affect on the victims. It is not uncommon for the affected people to be gripped by hopelessness and apathy following a flood. If such an attitude is allowed to persist, chances are that it might make the victims over-dependent on welfare services and make them a permanent burden on the state.

A major problem of post-disaster management is the lack of community involvement. It is the people in the affected area who can help immediately, more than outside agencies. Therefore, their involvement is necessary for timely and better management. They can also be involved in the pre-flood management (preparedness) planning. It may be recalled that the Eleventh Schedule to the

A major problem of post-disaster management is the lack of community involvement.

The super cyclone of 1999 marked a paradigm shift in Orissa's approach to disaster management.

Indian Constitution has specified that as many as 29 items will be handed over to the PRIs. But surprisingly, natural calamities do not figure on this list. It follows that states that are prone to disaster should make sufficient provisions to transfer the management of natural calamities to PRIs since local action can be easily mobilised within a short time (Reddy, Thapliyal and Sastry, 2000).

Cyclones

It has long been accepted that planning for cyclone disaster management should be done in three stages: pre-cyclone, during cyclone and post-cyclone. Lack of preparedness and proper planning in the 1997 and 1999 cyclones in Orissa resulted in large-scale loss and damage. Further, in the earlier cyclones, the government and NGOs undertook management of disasters, and there was no participation from people. Since the people in villages are the ones affected, their involvement in the management at all three stages is crucial, particularly because they are available immediately and can be easily utilised for relief services.

Community effort is indispensable as far as disaster management is concerned. The government alone cannot cope with the disaster of the magnitude of the 1999 Super Cyclone. The widest possible mobilisation of various groups, organisations and institutions, including local, national and international bodies, should be initiated in a coordinated manner. It is desirable that all long-term measures be integrated under one unified plan in full consultation with local communities. Samal (2003) found that the affected people were able to save their lives during the Super Cyclone by adopting various coping strategies. For food, they depended mostly on green coconut, papaya and banana to save them from starvation. Those who were in

cyclone shelters had to rely on dry food, particularly pressed rice and puffed rice. Many could save their lives from high tide by catching hold of bamboo bushes, *kewada* bushes and cashew plants, and by staying on sand dunes. Thus, from these natural and spontaneous coping strategies of the people during the Super Cyclone, one can learn that it is advisable to have, besides mangrove forests, fruit-bearing trees such as coconut trees, papaya and banana plants, and bamboo, *kewada* and cashew plantations, or other such vegetation that can serve as anchors. The community should also see that sand dunes are maintained.

The super cyclone of 1999 marked a paradigm shift in Orissa's approach to disaster management. Emphasis was laid on "Planning, Preparedness and Prevention" along with "Relief, Restoration and Rehabilitation". Several preventive and preparedness measures were taken by the Government of Orissa for the mitigation of effects of natural as well as human-made disasters.

Repair and reconstruction of some of the cyclone damaged works of the Works Department, Rural Development Department and the Water Resources Department in the districts of Balasore, Bhadrak, Keonjhar, Mayurbhanj, Jajpur, Dhenkanal, Cuttack, Jagatsinghpur, Kendrapara, Khurda, Puri and Ganjam were taken up with loan assistance from the World Bank, with the OSDMA as the project management authority that coordinated between the World Bank and concerned Engineering Departments of the State Government. This was done to ensure specified quality standards for the work and facilitate centralised monitoring by OSDMA and the World Bank. Works at an estimated value of Rs 257.86 crore were taken up.

The concerned departments execute the works and OSDMA is responsible for monitoring and for issuing guidelines to

the departments from time to time regarding bidding, award of works, quality control and monitoring the progress of works from project identification till completion. Even though the departments are to function with their in-house arrangement of staff and resources to implement the project works, OSDMA has extended additional technical support to the departments for achieving quality of works as per Ministry of Road Transport and Highways (MORTandH) and BIS specifications. Technical support is given by OSDMA to the projects in the form of advice from Quality Monitoring Consultants based on site visits and field testing arrangements at the sites through a Mobile Quality Control Laboratory. The in-house capacity of the departments to handle externally aided projects has improved during the course of implementation of the project. It has been a new system of working in the state, where adherence to quality has been the hallmark.

The work of surveying and investigation along with providing estimates was done by the line departments. Bidding was done by the respective Chief Engineers after obtaining Administrative Approvals for the works from OSDMA, who is the "Employer", with the concerned Executive Engineer as the "Engineer", as per the bid documents. However, the contracts were signed by the Executive Engineers on behalf of OSDMA, and the responsibility for day-to-day supervision of works and adherence to quality parameters rested on the Executive Engineers of the line departments.

Three teams of Quality Monitoring Consultants were engaged by OSDMA to monitor the quality of works. Two Mobile Quality Control Laboratories were also called into service by OSDMA to work in coordination with the Quality Monitoring Consultants for checking the quality of

materials used at sites. The engineers of OSDMA also made regular visits to the work sites to coordinate, advise and ensure smooth execution of the works.

As per the system approved by the Government, the Executive Engineers passed the bills and sent those to OSDMA along with a payment advice and copies of Quality Control documents. The cheques are issued by OSDMA and paid to the contractors through the Executive Engineers. OSDMA subsequently submitted the reimbursement claims to the World Bank, New Delhi Office, for availing of the financial assistance. This delinking of payment from departmental jurisdiction and its linkage to quality control standards being met had a salutary effect on the quality of works.

Flood embankment for a length of about 877 km and canal embankment of 332 km has been raised/strengthened with World Bank assistance; 82 spurs and 19 sluices have been renovated/reconstructed; 72.47 km of irrigation embankment, which could not be completed with World Bank assistance in the stipulated project closure period, have been completed with assistance from the Calamity Relief Fund (CRF); 275 km of roads have been repaired and renovated under the Works Department, 448 km under the Rural Development Department (RDD) and about 85 km of urban roads under the Housing and Urban Development Department have also been reconstructed with World Bank assistance. Additionally, with CRF assistance, about 5 km of urban roads and 28.46 km of roads under the Works Department have been reconstructed and 10 km is under construction; 8.2 km of road works is under the Works Department; 66.6 km under the RDD, which could not be completed with World Bank assistance in the stipulated project closure period.

Works in respect of installation of pump sets, construction of bore wells and tube

Due to the active role of OSDMA, the loss of human life could be reduced to just 122 though nearly 97 lakh people in 18,790 villages and 68 urban local bodies in 24 districts were affected (GoO, 2005: 186).

wells and laying of pipe lines were undertaken in 20 urban locations in the cyclone-affected districts. Similar works were also undertaken in 64 rural locations with World Bank assistance. 500 Agro Service Centres have been set up with World Bank assistance.

The significance of hard resilience measures was proved when, during the Super Cyclone in 1999, it was observed that large scale loss of life was due to lack of shelters. IIT Kharagpur was therefore entrusted by the State Government with the job of identifying locations for construction of Cyclone Shelters in a 10 km zone of the High Tide Level (HTL) of the seashore. Based on their

recommendations, construction work of Multipurpose Cyclone Shelters (MCS) was taken up with funds made available from the Chief Minister's Relief Fund (CMRF, 60 shelters) and the World Bank (37 shelters) under supervision of the OSDMA. 95 MCSs have been completed and the rest are nearing completion, except two in the Kendrapada district. Local communities will be responsible for the sustainable maintenance and management of these large sized buildings. In addition, the Indian Red Cross Society (IRCS) has constructed 29 cyclone shelters, including 23 funded by the German Red Cross and 6 by the Spanish Red Cross. 37 more cyclone shelters are under construction by the IRCS from the German Red Cross fund. The Red Cross will facilitate formation of management committees for all the cyclone shelters constructed by them.

Moreover, OSDMA played a key supporting role in response to the floods in 2001. It prepared regular updates on the situation with the help of flood control cells and satellite pictures. It disseminated information among key government departments and civil society organisations, established communication links with vulnerable areas through

satellite phone/VHF/ham radio, and hosted information on its website.

Besides this, daily coordination meetings with UN agencies and NGOs were held, and volunteers were mobilised for evacuation and search and rescue operations. Some 457 volunteers, including 46 from the UN, worked at the block level, distributing relief materials. OSDMA coordinated the effort at the state level. Due to the active role of OSDMA, the loss of human life could be reduced to just 122 though nearly 97 lakh people in 18,790 villages and 68 urban local bodies in 24 districts were affected (GoO, 2005: 186).

Earthquakes

To address the vulnerabilities of populous urban agglomerations and to promote mitigation strategies, a sub-component to the DRM programme, the Urban Earthquake Vulnerability Reduction Programme³³ (UEVRP), has been initiated in forty cities around the country with populations exceeding half-million and falling in Seismic Risk Zones (III to V), along with seven North Eastern capital cities. In Orissa, the programme is being implemented in Bhubaneswar, Cuttack and Sambalpur towns.

The objectives of the UEVR Programme are:

- To create awareness on earthquake vulnerability and possible preventive actions
- Capacity building of Government functionaries and professionals
- Development of earthquake preparedness plans at city and ward levels
- Development of a techno-legal regime
- Networking knowledge on best practices and tools for effective earthquake risk management

National Programme for Capacity Building of Engineers in Earthquake Risk Management (NPCBEERM)

The Government of India-sponsored NPCBEERM programme is being implemented in Orissa for capacity building of civil engineers in earthquake preventive design and construction. Four engineering colleges have been identified as State Resource Institutions (SRI) for training of engineers. These are:

- College of Engineering and Technology (CET), Bhubaneswar
- Indira Gandhi Institute of Technology, Sarang
- University College of University, Burla
- National Institute of Technology, Rourkela

13 Faculty members from these four SRIs have been trained at IIT, Kharagpur, which has been declared as the National Resource Institute for Orissa. It has been programmed to train 320 engineers (190 Government engineers and 130 private engineers) in the State Resource Institutes. All the expenses of the training will be borne under the project fund. One such training programme for Government civil engineers has been conducted by CET, Bhubaneswar, during May 2-10, 2007. About 40 engineers participated in the programme.

National Programme for Capacity Building of Architects in Earthquake Risk Management (NPCBAERM)

The Government of India-sponsored NPCBAERM programme is being implemented for capacity building of serving as well as practicing architects in the state. Two State Resource Institutes (SRIs) have been identified to impart training to the architects, the College of Engineering and Technology,

Bhubaneswar, and Piloo Modi College of Architecture, Cuttack. Funds have been provided to the State Resource Institutes for conducting the training programmes.

To conclude, this analysis shows that Orissa is exposed to multi-hazards with floods, droughts and even cyclones of often devastating intensity. While there have been many measures put in place, much still needs to be done; in particular, the proper coordination between community efforts and governmental and other institutional initiatives is indispensable as far as disaster management is concerned, and needs to be institutionalised.

³³ <http://v3.osdma.org/ViewDetails.aspx?vchglinkid=GL003andvchplinkid=PL013andvchslinkid=SL008>

(v) Madhya Pradesh



Madhya Pradesh (MP) is the second largest Indian state in size, with an area of 308,000 sq. km. With a population of 60,348,000 persons (2001 census), it is India's fourth poorest state with a per capita income that is only 75 percent of the national average. Three fourths of its

population is rural and 37 percent of the rural population is below the poverty line. STs comprise 20 percent of the population while SCs make up another 15.5 percent. The STs and SCs remain the most vulnerable communities (see Table 14).

Table 14 : Population distribution in MP

Population (Census 2001)	60,348 (in thousands)
Male	31,444 (--" --)
Female	28,904 (--" --)
Scheduled Tribes (Census 1991)	12,233 (in thousands) (19.94 percent)
Scheduled Castes (Census 1991)	91,55 (in thousands) (15.40 percent)
Area (in sq.km)	308,000
Districts	48
Tehsils	272
Development Blocks	313
Total Villages	55,393
Populated Villages	52,143
Gram Panchayats	23,051
Literacy	64.1 %
Male	76.5 %
Female	50.6 %
Density of Population	196 per sq.km
Male-Female Ratio	920 : 933

Source: <http://www.mpinfo.org/mpinfo/new/english/factfile/mp.asp>

Agriculture

Agriculture is the mainstay of the state's economy and 74.73 percent of the people live in rural MP. As much as 49 percent of the land area is cultivable.underlying

Vindhyan ranges and the area to the south of Gwalior, 3) the Satpura ridge stretching across the state from the Maikal range in the east towards Nimar in the West; and 4) the Narmada valley, an area of gently undulating plains

Table 15 : Agriculture in MP

1. Ag. Land Utilisation (2004-05)	
Area according to Village Papers (hect.)	23,259
Area under Forest	8,585
Cultivable Waste Land	1,175
Total Fellow Land	1,192
Net Area Sown	15,078
Gross Cropped Area	20,306
Double Cropped Area	5,228
Net Irrigated Area (E)	6,042
Gross Irrigated Area (E)	6,193
2. Land Holdings (Agricultural Census, 2000-01)	
No. of Land Holdings	73.60 (In Lakh)
Area of Land Holdings	163.72 (Lakh hect.)
Average size of Land Holdings	2.2 (hect.)
3. Agriculture Production (2004-05) (P)	
Food Grains Production	142.4 (lakh MT)
Soyabean	37.5
Total Oil Seeds (Including Soyabean)	48.9
Sugar Cane (In terms of Gur)	1.79
Cotton (Each bale = 170 kg)	6.09

E = Estimates; P=Provisional

Source : <http://www/mpinfo.org/mpinfo/new/english/factfile/mp.asp>

MP lies mainly on the central Indian tableland with altitudes ranging from 50 m to 1,400 m above mean sea level. The topography is strongly influenced by the underlying geology, in which basalts predominate, giving rise to well defined plains interrupted by undulating areas and deeply incised rivers in hilly areas. The state can be divided into four physiographic regions: 1) the grid region to the north and north-east of Gwalior; 2) the Malwa Plateau between the

bounded by the Vindhyan hills in the north and the Satpura range to the south. The mean annual rainfall varies between 700 mm in the west to about 1,500 mm in the east and south-east. Almost 90 percent of the precipitation occurs between June and September.

MP can be divided into two bio-climatic zones (see Table 16), eleven agroclimatic zones or eight crop zones.

Table 16 : Bio-Climatic zones of MP

Bio-Climatic Zone	Districts
Semi-arid Region	Badwani, Bhind, Dewas, Khandwa, Jhabua, Khargone, Ratlam, Shajapur, Shivpuri, Shahdol, Sidhi, Umaria
Dry Sub-Humid	Betul, Chhindwara, Damoh, Guna, Jabalpur, Panna, Rewa, Raisen, Rajgarh, Seoni

Source : Enterplan, 2006

The state is one of the most diverse in India, divided into 11 agroclimatic regions. Most of the districts are fully covered in one agro-climatic zone but there are a few that fall under two or three zones. Sidhi, Jhabua, Sehore, Shivpuri and Raisen districts come under two agro-climatic zones. The agro-climatic zones are given below (Enterplan, 2006):

1. Chhattisgarh Plains³⁴
2. Northern Hill Region of Chhattisgarh
3. Kymore Plateau and Satpura Hills
4. Central Narmada Valley
5. Vindhya Plateau
6. Gird Region
7. Bundelkhand
8. Satpura Plateau
9. Malwa Plateau
10. Nimar Plains
11. Jhabua Hills

The ability of the rural poor to enhance their livelihoods is constrained by a range of inter-related structural, social, economic and institutional barriers. The situation of the poor is characterised by marginal and under-productive landholdings, periodic droughts, insecure land tenure and a reliance on seasonal agricultural and wage work for the Forest Department. The low population, relative isolation and inadequate reach of infrastructure in some districts increase the costs of delivery, resulting in poor

access to agricultural inputs, extension services, credit and markets. The rural poor in forested areas, particularly tribal populations, are dependent on forest resources for subsistence, income and employment.

Districts with considerable tribal and scheduled caste populations typically represent the most deprived areas. Preliminary poverty and livelihoods assessments suggest three major challenges:

- 1) Land based livelihood strategies are under-productive and insecure
- 2) The poorest depend upon daily wage labour and face difficulty in obtaining sufficient days of work in either their villages or in neighbouring areas to which they migrate
- 3) Poor access to resources, markets, information and services, presents a significant constraint to realising the potential of available opportunities and hinders diversification of livelihood strategies.

These challenges are made more difficult by the comparative lack of integration of tribal populations into mainstream Indian economy and society. In addition, funds available for rural development and poverty reduction are limited, tied (that is, linked with a specific project or expenditure head) and spread too thin, not allowing for the necessary scale to be effective.

Due to the scale of poverty in tribal districts, the need for funds is acute. The

³⁴ Zones 1 and 2 are now in Chhattisgarh state

existing funds available (mostly under GoI schemes) are tied and do not allow prioritisation at the state or district level. MP introduced District Planning Committees in the 1990s; from 2002 onwards, there have been District Level Plans. In 2007, these were prepared with Unicef support, with reference to Planning Commission and Backward Regions Grant Fund guidelines. In 2008, the planning process was to be taken to the *gram panchayat* level. Considerable progress has been made with regard to transfer of funds, functions and functionaries. Public-private partnership is being encouraged and facilitated in rural areas. However, structures notwithstanding, the shortage of funds, especially public expenditure, does act as a constraint to removal of poverty.

As such, livelihoods have been a major thrust area for the government. A major DFID and World Bank project is ongoing. The State Livelihood Forum, chaired by the Chief Minister, has been set up. Similar fora are being set up at the district and block level, looking to converge with every scheme. Presently 1.1 million persons in 31 districts are covered under the NREGS; the number is to go up to 2 million in the course of 2008. Further, skills development is to be linked to livelihoods programmes. There is a large programme on skill building in textiles, for which there is a tie-up with NIFT (National Institute of Fashion Technology). But from the various documents perused for this study, the aspect of climate change and livelihoods does not seem to have got the attention due.

The lives of the poor are further impacted by disasters, both natural and human made. The data on MP suggests that the state is prone to droughts, floods, earthquakes, hailstorms, fires, industrial and chemical disasters, accidents and epidemics.³⁵

MP has a comprehensive disaster management policy. However, not much information could be gathered for this study about its efficacy and implementation because of the lack of secondary data and research and documentation on the subject. From discussions with some key persons in New Delhi, the following could be gathered about the disaster management scenario.

It seems that presently, the focus is on natural and chemical disasters. The MP disaster management unit was set up in the aftermath of the Bhopal gas disaster.³⁶ Mapping of hazardous industries in the state has been undertaken. However, it was not possible to obtain a copy of this study.

With the help of Unicef, community based disaster management plans are being prepared in ten districts at present.

A Climate Change Cell seems to have been set up has been set up to address climate change and adaptation issues. Details of its structure and functioning were not available on the various MP government websites or with key persons. An analysis of the disaster management plan shows that climate change does not find any mention. This needs to be incorporated. Further, though the disaster management plan does mention health, public health emergencies, including those induced directly or indirectly by climate change, need to be given greater emphasis.

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³⁵ <http://www.mp.gov.in/relief/introduction.htm>

³⁶ The Bhopal disaster was an industrial disaster that occurred in the city of Bhopal, Madhya Pradesh, India, resulting in the immediate deaths of more than 3,000 people, according to the Indian Supreme Court. A more probable figure is that 8,000 died within two weeks, and it is estimated that an additional 8,000 have since died from gas related diseases. The incident took place in the early hours of the morning of December 3, 1984, in the heart of the city of Bhopal in the Indian state of Madhya Pradesh. A Union Carbide subsidiary pesticide plant released 42 tonnes of methyl isocyanate (MIC) gas, exposing at least 520,000 people to toxic gases. The Bhopal disaster is frequently cited as the world's worst industrial disaster. The International Medical Commission on Bhopal was established in 1993 to respond to the disasters. (http://en.wikipedia.org/wiki/Bhopal_disaster)



Conclusion

3 CONCLUSION

1. Climate Change Effects

Climate change is a reality in India now. As discussed previously, the projected impacts are an increase in average temperatures by 2-4 °Celsius and marginal changes in rainfall during monsoon months but large changes during the non-monsoonal months. The number of rainy days during the monsoons is projected to decrease by more than 15 days while the rainfall intensity is expected to rise by as much as 1-4 mm/day. Cyclonic storms are likely to increase in frequency and intensity.

Overall, inter- and intra-annual (seasonal) variability is going to increase; in fact, this has already started happening in many parts of the country. Falling winter temperatures has led to, for instance, a reduction in the production of wheat and other winter crops. Climatic changes manifest themselves, amongst other things, through variability in water availability. The impact on agriculture, in a country like India, where most of the crop cultivation is through rainfed farming, is disastrous. Increasing pest attacks accentuate the crises being felt by millions of marginal and small farmers. Human health is affected due to increasing vector-borne diseases like malaria: the incidence of malaria has gone up by about 10 percent over the last few years. Other water-borne diseases too are on the rise. The coastal areas of the country are threatened by a rise in sea

level, leading to crises of drinking water caused by saline ingress and infrastructure and flow losses. In some areas, like coastal Tamil Nadu, marine stocks too, according to fisherfolk, are declining.

Climate change potentially increases the vulnerability of the poor and those dependent on natural resources for their livelihoods. It leads to less secure livelihoods due to depleted social, financial, physical, natural resources and human assets; increasing health risks due to diseases like malaria, dengue, cholera, dysentery, malnutrition and exposure to extreme climatic conditions, and constrained economic opportunities due to short and long term impacts of droughts, floods and other extreme events. Taken together, all these factors render attaining the MDGs difficult.

2. Adaptation and Disaster Risk Mitigation

Adaptation can be viewed as the response to actual or expected climate stimuli that moderates harm or exploits beneficial opportunities. In brief, adaptation is the ability of people and systems to adjust to climate change. In natural systems, adaptation is reactive by definition, but in human systems it is anticipatory and reactive, implemented by public and private actors.

As was discussed in the first part of the report, though adaptation and disaster risk reduction have gained acceptance in common parlance, greater clarity is needed in the use of these concepts. Disaster risk reduction need not be the same as adaptation. Central to the conceptualisation of adaptation or enhancement of adaptive capacities is the notion of vulnerability and resilience. In the literature surveyed, the term vulnerability has been used in many ways, but essentially the concept



describes a condition of susceptibility shaped by exposure, sensitivity and resilience.

Resilience can be of two kinds, hard and soft. Hard resilience generally includes options that involve construction/ have physical characteristics.³⁷ Soft resilience options refer to skills, processes, institutions, social systems, policies and programmes.

As such, there is no dearth of options to build up hard resilience, and indeed, that is the usual approach to disaster risk mitigation. In the confusion that prevails between disaster risk mitigation and adaptation, such hard options alone are often considered sufficient. However, what is missing is the emphasis on the soft options or the need to have a judicious mix of the hard with the soft, in participatory ways. This research reveals that the latter is lacking in the Indian context.

3. The National Situation

Nationally, the review revealed that some capacity has been built, in about a quarter of Indian states, for single rapid onset (such as earthquakes) and long onset (droughts) disasters and risks. By and large, they rely on the options to build hard resilience. But managing a complex portfolio of both risks and vulnerabilities is beyond the current institutional setup (comprising public institutions and the nascent private re-insurance and insurance).

What is needed is a geographical estimation of probabilistic hazard risk, vulnerability and the imputed composite multi-hazard economic risks. This has to be accompanied by risk prioritisation by hazard; subsequently, elements at risk and location can undertaken and used for creating evidence based investment, as well as building regional, rural and urban development policies, and building a bridge between public agencies, communities and the private sector.

The two aspects of climate change will have to be kept in mind in building the kinds of partnerships implied above: i) the inter-annual variability (extreme intensity and frequencies, both low and high) and ii) gradual changes in temperature and precipitation, which has implications for ecosystems to shift to higher altitudes, for instance crops that are grown in a particular area (or particular altitude) will no longer be suitable in those areas. These kinds of changes will need "incremental" treatment, calling for responsive institutions and knowledge generation,

³⁷ Hard options include flood control structures (dams/ barrages) or drought mitigation measures such as the whole gamut of physical water harvesting structures and watershed development, cyclone and flood shelters or resilient technology retrofitted buildings. Additionally, hard options may include innovative agriculture practices/ crops/ irrigation technology. Indeed, there could be hard options for each sector: health (more hospitals, dispensaries), education (retrofitted school buildings), sanitation (elevated toilets), irrigation (efficient technologies), water supply (elevated handpumps), agriculture/ ecosystem, ICT technology and so on.

on both scientific and social dimensions. Static analyses, including the linkages with poverty alleviation, might not work as in the contemporary situation of climate change, historical trends in temperature and precipitation may not be valid for future projections. There are elements of uncertainty and there will be surprises (such as long duration droughts, droughts in conventionally flood prone areas and vice versa). The essential thing is to analyse the inter-linkages between the natural, physical, social, financial and human capital in a given area at a given point in time and then predict the possible changes in these, individually as well as in conjunction with each other, with a view to reducing or mitigating the impacts on individual/household/societal levels and at the same time enhancing capacity to recover from impacts. At the very least, this requires an integrated approach and not the kind of piecemeal and isolated planning that prevails today. This would be possible with detailing in participatory ways the mix of hard and soft options relevant to each region and sub-region, backed by proactive action research and the setting up of monitoring mechanisms that have built-in corrective mechanisms. These propositions become apparent in the detailed review of the seven UNDAF states considered for this study.

4. The State Level Realities

The 7 UNDAF states, that is, UP, Bihar, Jharkhand, MP, Chhattisgarh, Orissa and Rajasthan, are at the bottom of the Indian states in terms of HDIs, gender development indicators, percentage of population below the poverty line and indeed every other indicator of growth. These states are also chronically drought and flood prone, but increasingly over the years floods have occurred in areas traditionally drought prone and vice-

versa. The overall adaptation and disaster risk mitigation situation is rather grim.

While all the states have in place some kind of machinery to deal with natural disasters such as floods, major droughts or earthquakes, some of the states, like Jharkhand, do not have a disaster management policy. Moreover, the stress is more on post-disaster ameliorative measures and not on taking preventive steps for mitigation. The approach is generally reactive and the emphasis, by and large, is on hard resilience interventions. Soft resilience efforts, mainly undertaken through the UNDP DRM programme, have been in the form of creation of some awareness amongst the communities and governments. So far the notion of disasters, especially of the slower kind, like temperature changes, or changes in the rainfall pattern, droughts in the flood plains or floods in the typically drought prone areas, have not received the attention due to them though they have already become a reality in many areas.

Health issues, already in a major crisis due to weak supply and delivery systems, are in a greater crisis, with new vectors coming up in many places due to climate change.

In all the states there are various central programmes such as those for watershed development, command area development, drought prone areas programme, crop diversification, expansion of irrigation and integrated water management, flood control and mitigation, NREGA and other programmes for poverty alleviation. For environmental regeneration there are numerous programmes for watershed development and soil conservation. There are programmes too for agricultural development. Some of the programmes and interventions are decades old. Yet, despite the existence of these programmes, the ground realities reveal

large sections of the population deprived of their entitlements. As such, natural disasters disproportionately affect the poor; climate change will exacerbate poverty and pose challenges for the MDG in these states.

There is an urgent need to revisit the existing interventions and programmes. The various programmes have the potential of being modified and of course better implemented to meet the challenges posed by climate change for it is a fact that the latter will impact the poor the most.

The conceptual frameworks and documented evidence that underpin disaster risk reduction theories and practices have long emphasised that disasters disproportionately affect the poor and that poverty is a key factor in shaping and configuring disaster risk. Recurrent and major disaster impacts would seem to perpetuate poverty outcomes. In addition, the immediate and longer term impacts of disasters challenge the progress made towards achieving poverty reduction goals and sometimes (re)create conditions in which marginal communities are likely to be perpetually “at risk”. Most programmes address only the specific target population, excluding large sections of the population whose needs are not addressed. Apart from the well-recognised BPL population, where chronic food shortages prevail, even households not normally deprived of food are rendered vulnerable in the regions prone to droughts.

Evidence also shows that poverty would



Photo : Amit Mitra

seem to be a key factor in increasing disaster risk. Poverty outcomes, determined by various socio-economic, political and environmental factors, often manifest in the livelihood options people adopt, and in the kind of built environment they live in. Livelihoods actively shape a community's “context of vulnerability”, and in turn determine the mutual interactions between poverty and disaster risks.

Poverty plays a key role in the accumulation of extensive risk over time and space and acts in both directions dynamically. Thus, poverty is a factor in processes such as urbanisation and environmental degradation that generate extensive risk. Simultaneously, the outcomes of extensive risk, particularly the livelihood impacts, contribute to perpetuating or exacerbating poverty. Yet, there is very little systematic investigation into the relationship between poverty and extensive patterns of risk. While mortality and economic loss is intensively concentrated in a few large-scale catastrophes, losses in livelihoods and assets would seem to be extensively distributed in space and time and

manifested as frequently occurring small scale disasters or even day to day disasters.

Significant social and economic consequences of major recent natural hazards in different parts of the world have highlighted the need to place hazard concerns higher on the global poverty agenda. In India, there is mounting evidence that global climate change is catapulting the recurrence and virulence of climatic hazards in various regions of the country; this necessitates urgent action.

Yet, as the present study found, comprehensive and holistic conceptualisation and the requisite empirical evidence is lacking. It is essential to analyse the relationship between natural hazards and poverty through quantitative and qualitative approaches. This would then strengthen the argument for hazard risk reduction as a key instrument to reduce poverty and for poverty reduction strategies in turn, to contribute to reducing people's susceptibility to hazard events. This would also facilitate a better understanding of adaptation strategies at all levels, locally and at the state and the national levels.

Fulfilling this lacuna is an urgent imperative, for this will also then form the basis of comprehensive modelling for vulnerability assessment mapping. This study found that there is a serious lack of vulnerability mapping and assessment in most of the states, a necessary precursor for designing and implementing programmes for poverty reduction, disaster risk mitigation or climate change adaptation.

5. The Research Gaps

The above discussion points to substantial research gaps. In sum, the following research needs could be identified:

- Systematic investigation of the linkages between vulnerability due to climate risk (in each distinct agro-economic zone within each state) and environmental, socio-economic and political factors
- Estimating potential losses (both stock and flow)
- Scientific and technical research to understand the links between climate change and inter-annual variability at smaller resolution, such as by downscaling global climate models (GCM)
- Identification of the drivers of poverty in climate change in specific contexts; that is, research on changing patterns and types of poverty dimensions due to climatic extremes, through quantitative and qualitative approaches
- Mapping of current and future vulnerability, taking into account the different dimensions across states
- Identification of priority sectors and cities
- Financial mechanisms for risk spreading and pooling, such as insurance instruments with public-private partnership in the agricultural sector
- Indigenous technologies of, not only water harvesting, but also crop management and indeed the whole gamut of agrarian practices, that can be supported to enhance adaptation strategies
- Indigenous water harvesting systems and management patterns
- Traditional seed varieties requiring less water and other pest resistant crop systems
- Upscaling successful examples of NGOs working on bringing about change through soft options or

institutional mechanisms, essentially giving primacy to people's participation and process ownership. These projects can be researched with a view to understanding the required structural changes in the state-level institutional mechanisms

- Research on the locale specific impacts of climate change on the industrial sector and vice-versa; this would also enable better locating of the industries
- Researching low cost technologies that promote employment but at the same time mitigate global warming and promote climate change adaptation

The above research would also enable the determination of the optimum mix of the hard and soft options for building up resilience, and also help determine realistic time lines for the actualisation of the mix of options in an informed way.

6. Actions, Experimentation and Demonstration

At a pragmatic level, we present two matrices (Figures 6 and 7) for floods in flood prone areas and droughts in drought prone areas, that can be used to enhance not only programme effectiveness but also used to collect information to analyse why the interfaces are not delivering in their present form. This model, though developed in the UP context, can be generalised for other states too, according to what is applicable in a particular context

Actualising the matrices will require substantial structural and institutional changes and a paradigm shift towards climate change, development and poverty.

Thus, for instance, at the national level, the development of a climate change

adaptation framework for both rural and urban India is critical and requires the reopening of the debates and dialogues on development models for both locations. This would include issues like urban growth and its causes, rurbanisation, understanding vulnerabilities and the nature and direction of investments, both public and private. The existing momentum of hazard risk management and efforts that is underway in some states needs to be built on further to link them to development issues and grassroots mobilisation through NGOs/CBOs or even PRI institutions. Many of the stakeholders are unfamiliar with climate change processes so the setting up of a framework to link dialogue, engagement and action would be a useful step (Revi, 2008). Such a framework or common platform would have to provide a link between national, state and district/city level policy with political institutional arrangements and interventions at city/village and neighbourhood levels. It would also serve as a platform for dialogue between government functionaries, political leaders, CBOs and NGOs who are active in trying to channelise citizen and community energy towards productive ends, and private entrepreneurs who could provide the motive power for adaptation implementation.

This underscores the need to develop a National Programme of Action (NAPA) to include both rural and urban climate change risk reductions and adaptations. The primary responsibility for climate change policy currently lies with the MoEF. Development is the responsibility of a plethora of other ministries ranging from the Ministries of Rural Development and Employment, Agriculture, and Urban Development to Women and Child Welfare and the Ministry of Health. At present the MoEF does not have much of an interface with the other ministries.

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Figure 6 : Matrix for droughts

Adaptation	Cross Cutting Issues						
	Organisation	Education and Skill Development	Communication for Adaptation	Adapted Infrastructure	Financial and Risk Spreading	Livelihood and Economic Diversification	Ecosystems Management
Targeted Specific Interventions	<p>Strengthen PRIs</p> <p>Include and strengthen traditional institutions (including cultural and religious organisations) in developing and implementing adaptive strategies</p> <p>Link with ATMA/NAIP/ other agricultural interventions</p>	<p>Awareness/ Education programmes targeted at policy makers, training of trainers</p> <p>Capacity building to focus on community response to disasters and attitudinal change, targeting most vulnerable communities for adaptation education</p> <p>Build awareness on crop insurance schemes and provisions</p> <p>Gap analysis of why existing (adaptation, disaster risk reduction) programmes are not working</p> <p>IEC promotion through Growth Centres</p> <p>Knowledge on new/improved agro-technologies</p>	<p>Climatic predictions made available to communities in a timely manner</p>	<p>Maintenance of irrigation systems</p> <p>Water storage facilities, including traditional water harvesting systems</p>	<p>Target marginal farmers in crop insurance schemes</p> <p>Review of compensation rate in crop insurances</p>	<p>Develop community agri-business plan</p> <p>Livelihood activities:</p> <ul style="list-style-type: none"> - Dairy farming with improved fodder management - Epiculture 	<p>Promote agricultural practices which are more adaptive to drought conditions</p> <ul style="list-style-type: none"> - cultivate short cycle crops - less water intensive varieties - appropriate horticulture crops/ varieties - double cropping systems with soil enriching crops - better soil and water conservation practices - improve soil quality <p>Promote afforestation (increases availability of fuelwood and fodder, etc.)</p> <p>Multi-tiered biofuel plantations (agroforestry)</p>
Underlying systems	<p>Resources/organisations for research on crops and innovations</p> <p>Agricultural universities and research organisations to validate local practices</p> <p>Monitoring of development activities through District Magistrate (i.e. involve local government)</p> <p>Improved governance at the local level (e.g. PRIs)</p> <p>Financial resources for PRIs, local organisations to operate effectively</p>	<p>Improve extension (education) programmes to promote drought resistant agricultural practices and varieties</p> <p>Strengthen community capacity to negotiate with private industry</p>		<p>Improved technologies to increase capacity of canals and ponds/ traditional water harvesting structures</p>	<p>Improve access of farmers to, and delivery of, crop insurance</p>	<p>Promote sustainable and equitable community - private and public-private partnerships</p>	<p>Document good agricultural practices and replicate</p> <p>Review animal husbandry policies</p> <p>Ministries and Departments to promote species relevant to local needs</p> <p>Policy to regulate cultivation of water-intensive crops</p> <p>Promote LEISA (Low External Inputs for Sustainable Agriculture)</p> <p>Co-ordinate with Watershed Development Programme, Wasteland Development Programme</p>

Figure 7 : Matrix for floods

Adaptation	Cross Cutting Issues						
	Organisation	Education and Skill Development	Communication for Adaptation	Adapted Infrastructure	Financial and Risk Spreading	Livelihood and Economic Diversification	Ecosystems Management
Targeted Specific Interventions	Operationalise State and District Disaster Management Authorities Strengthen PRIs Include and strengthen traditional institutions (including cultural and religious organizations) in developing and implementing adaptive strategies Link with ATMA (extension wing)/NAIP	Awareness/ Education programmes targeted at policy makers, training of trainers Capacity building to focus on community response to disasters and attitudinal change, targeting most vulnerable communities for adaptation education Conduct mock drills Gap analysis of why existing (adaptation, disaster risk reduction) programmes are not working Build awareness on crop insurance schemes and provisions IEC promotion through Growth Centres Knowledge on new/improved agro-technologies	Identify appropriate modes for information dissemination (e.g. loudspeakers) Village information centres	Transition shelters (safe places) Small boats (and improve availability) Link bridges Machan* toilets	Target marginal farmers in crop insurance schemes Review of compensation rate in crop insurances Extend crop insurance scheme to non-loanee farmers	Develop community agri-business plan Livelihood options: <input type="checkbox"/> fish farming <input type="checkbox"/> aquaculture <input type="checkbox"/> poultry <input type="checkbox"/> rice-fish farming <input type="checkbox"/> epiculture <input type="checkbox"/> horticultural crops <input type="checkbox"/> medicinal herbs Improved processing at local level of agricultural products	Promote agricultural practices which are more adaptive to flood conditions - cultivate short cycle crops - water standing crop varieties - soil and water management (bunds, check-dams) - rice cultivars Plant multi-purpose species on bunds Promote water harvesting Desilting after floods Promote afforestation for erosion control (increases availability of fuelwood and fodder, etc.) Multi-tiered biofuel plantations (agroforestry)
Underlying systems	System for regular and timely provision of relief material Revising relief codes of state government Co-ordination among different government departments Monitoring of development	Improve extension (education) programmes to promote drought resistant agricultural practices and varieties	Strengthen use of radio to disseminate relevant and accurate information Decentralize information flow and broadcasting	Strengthen urban infrastructure (design of roads, bridges, dams)	Improve access of farmers to, and delivery of, crop insurance Transparency in implementation of financial mechanisms		Document good agricultural practices and replicate Review on animal husbandry policies Ministries and Departments to promote species relevant to local needs
	activities through District Magistrate (i.e. involve local government) Agricultural universities and research organisations to review and/or validate local practices Improved governance and planning at the local level (e.g. PRIs) Financial resources for PRIs, local organisations to operate effectively						

ATMA=Agricultural Technology Management Agency; NAIP=National Agricultural Innovation Project
*Toilets built on stilts in flood prone areas

The National Disaster Management Authority (NDMA), situated within the Ministry of Home Affairs, is the apex disaster management agency, even though the bulk of the responsibility for implementation and action lies with state governments.

To integrate a crosscutting climate change agenda into the overall planning and investment process of the GoI would imply a possible relocation of this function to the Cabinet Secretariat or the Planning Commission, with strong support from the Finance Ministry. This would require an Amendment of the Allocation of Business Rules, 1961 (GoI, 1961) and the establishment of a Climate Change Secretariat to address crosscutting and high-level policy questions. This will enable the coordination of adaptation policy and programmes across key line Ministries (Urban and Rural Development, Home Affairs, Finance, Energy, Environment and Forests) and functions (national security, disaster management, fiscal and expenditure management and coordination) and the mobilisation of state governments and cities to enable adaptation planning and implementation. A re-examination of the 73rd and 74th Constitutional Amendments in this light may be in order.

The Ministry of Finance could play a central role in defining fiscal and financial measures to incentivise both mitigation and adaptation, based on a “NAPA-like” rollout schedule. This could include the creation of a domestic market for carbon-credits linked via appropriate institutions to the global carbon market, enabling the financing of state-led pro-poor adaptation (Revi, 2008).

The National Disaster Management Authority (NDMA), situated within the Ministry of Home Affairs, is the apex disaster management agency, even though the bulk of the responsibility for implementation and action lies with state governments. It would be useful to use the climate change agenda to build a bridge between current NDMA priorities and medium and long-term climate adaptation. NDMA manages important programmes, such as the National

Cyclone Risk Mitigation Programme (NCRMP), that have a number of climate adaptation features.

Similarly, at the level of the states, the SDMAs need to be established/revamped with appropriate changes in their objectives, powers and responsibilities to address climate change adaptation. This can be built on existing flood, cyclone and surge and drought risk reduction efforts. Considerable capacity building will be required to prepare these agencies to take on these additional responsibilities and develop actionable state-level Adaptation Programmes of Action.

The State Departments of Finance and State Planning Boards will need to integrate climate change adaptation into their medium-term planning and expenditure frameworks and enable synergy between cross-sectoral adaptation and mitigation investments.

An important issue relates to the strengthening of regional and rural-urban linkages. Conventional development models and also disaster management and mitigation planning have typically focused either on urban areas or villages (Revi, 2008). The increasing integration of the Indian economy has led to the strengthening of the forward-backward linkages between urban and rural settlements. The risks that cities and their embedding countryside are exposed to, therefore need to be addressed together. This can be operationalised by integrating climate change related adaptation into the regional and rural sectoral investment planning.

This is particularly important in India where agriculture is highly sensitive to monsoon variability, as 65 percent of the cropped area is rainfed. A rise in temperature of 2-3.5 °C, accompanied by a 7 to 25 percent change in precipitation, has been estimated to cause a loss of 9 to 25 percent of net output to farmers. This could, in turn, lead to a 2 to 4 percent

reduction in GDP growth, which could have significant impacts on the over 350 million people who are dependent on rainfed agriculture.

Over 55 million people depend on Non-Timber Forest Products (NTFPs) for their livelihoods and would be significantly impacted by climate change induced changes in the forest cover (Ravindranath et al., 2006). A large number of fishing communities along India's coast could experience significant livelihood shifts due to sea level rise and extreme weather events.

Changes in the flows of food and biomass availability are especially important because Indian cities are still characterised by a metabolism dominated by substantial flows of unprocessed food and traditional bio-fuels. Similarly, drinking water and renewable bio-fuels, hydropower and possibly wind energy flows, could be affected by climate change, causing moderate to severe disruption in urban systems. Hence, instead of an exclusive focus on cities or rural areas in isolation, it would be necessary to develop regional climate change risk adaptation strategies and action plans, especially for mega-urban regions and metropolitan cities.

The MoEF, along with the Department of Ocean Development, engages with the Coastal Zone regulation, in coordination with state level ministries. This is another locus of convergence that a Cabinet Secretariat-based Climate Change cell could address.

The Departments of Urban Development and Poverty Alleviation, which jointly manage the JNNURM, should ideally be the fulcrum of urban climate change risk mitigation at the national level, and the primary agency for urban climate policy and programme design, once appropriate capacities are built. An integration of concerns into long-range City

Development Plans (CDPs), infrastructure development and poverty reduction interventions at city-levels is crucial.

Disaster management is one of the many elements of the JNNURM that is poorly resourced at city-levels. It needs to be upscaled in terms of resourcing and institutional capacity, and broadened to encompass a wider climate adaptation agenda.

The creation of a National Technical Mission on Urban Climate Change adaptation to deliver time-bound outcomes may be a useful way to focus energies and bring the climate crisis onto the public policy agenda. Specific tasks could include the development of a National Risk and Vulnerability Atlas that includes climate change related risks and estimates of potential losses to economic activity and capital stocks as a priority by the GoI. This will enable the identification of priority cities and sectors for intervention and thereby open appropriate windows of opportunities within the JNNURM. A new series of national building and lifeline infrastructure risk mitigation standards will be necessary, taking into account climate related risks. This can be taken forward by the NDMA, MoUD and the BIS based on the pattern of the National Earthquake Mitigation Standards (NDMA, 2007).

A series of insurance instruments to provide short and medium term risk coverage to urban infrastructure enterprises and incentives for public-community-private partnerships need to be put into place, similar to initiatives being developed in the agricultural sector. However, it is an open question as to what extent insurance companies will be willing to or be able to cover risks in the agriculture sector, all the more so in a situation where the probability of risks are on the rise.

Changes in the flows of food and biomass availability are especially important because Indian cities are still characterised by a metabolism dominated by substantial flows of unprocessed food and traditional bio-fuels. Similarly, drinking water and renewable bio-fuels.

Apex institutions that bring together public and private sector enterprises, civil society, and academic institutions (particularly those involved in science and technology, management and social science research), will need to be activated at the national level to build research and action-oriented networks in and between their sectors of competence. Education, training and capacity building at school and university levels for public functionaries, managers and the media will need to be launched.

An important issue relates to the role of NGOs and other civil society organisations. A large number of NGOs are doing good work in the seven states in various fields related to disaster risk mitigation and empowerment of the people. They work in almost every field, from agriculture to health and education, women's empowerment to bio-diversity management to watershed development. Useful lessons can be learnt from some of them, like the SPWD in Rajasthan, the SPS in Madhya Pradesh, the GEAG in UP and the AAA and PRADAN in Jharkhand. Of course, it has to be mentioned that ultimate responsibility lies with the state, not only to remove poverty but also for the promotion of adaptive strategies. In this context, it would be useful to analyse the strategies used by these NGOs particularly those involved in promoting indigenous adaptive capacities and technologies, such as indigenous water harvesting systems, promotion of traditional seed varieties that require less water and are less disease prone, or even adjustments made by farmers in terms of crops that have shorter/different cycles to combat the impact of droughts and floods.

In sum, the agenda for change would include:

- Identification of practical actions for vulnerability (and poverty) reduction such as provided in the

matrices above

- Development of climate change adaptation and vulnerability analysis frameworks at various levels, national, state and local, through a series of consultative processes (Shared Learning Dialogues)
- Developing a national adaptation framework (e.g., for LDCs/NAPAs)
- Developing inter-ministerial coordination, since climate change is cross-cutting and across-scales
- Finding ways to integrate the 73rd and 74th amendments in the climate change adaptation frameworks³⁸
- Linking mitigation with adaptation, for instance by using the revenue model of Carbon credit-Forestry financing adaptation³⁹ that would entail a closer coordination between the Ministry of Finance and the Planning Commission
- Upgrading NDMA (MHA) to address climate change adaptation (for instance, working out ways to upgrade and implement the National Cyclone Risk Mitigation Programme, NCRMP, to address climate change issues)
- Promoting demonstration models for operationalising the integration of climate change adaptation into regional and rural sectoral and investment planning
- Developing regional climate risk reduction (adaptation) models, considering both rural and urban areas and inter-linkages (for example, ecosystem services, drinking water, pollution), especially around megacities
- Capacity building to address climate extremes: for example, how SDMAs could be capacitated to address climate change impacts, possibly

through state level AAPs

- Integrating adaptation interventions with existing structures (for example, with JNNURM)
- Education, training and capacity building at schools and universities for public functionaries, managers and the media
- Preparing a National Risk and Vulnerability Atlas
- Developing new building and infrastructure codes (with BIS)

Needless to say, fulfillment of this action agenda requires active cooperation between public and private sectors and involvement of all sections of the population, including civil society organisations.

38 The 73rd and 74th Constitutional Amendments, passed by and act of Parliament, paved the way for local self rule as exemplified through elected urban local bodies and *gram panchayats*, also known as *panchayati raj* institutions (PRIs). The need is to involve the lowest tier of these hierarchies, that is, the ward and the village *sabha*, which is the body that elects the representatives, in the climate change adaptation processes.

39 Simply put, governments and companies in developed countries “purchase” project-based greenhouse gas emission reductions in developing countries or in other developed countries mostly to meet their obligations under the Kyoto Protocol or to trade them on the market for a potential profit. An emission reduction is defined as a measurable reduction of release of greenhouse gases into the atmosphere from a specified activity or over a specified area, and a specified period of time. Emission reductions are typically measured in tonnes of carbon dioxide equivalent (tCO₂e). Some examples of Clean Development Mechanism (CDM)/Joint Implementation (JI) projects are renewable energy projects that include wind, solar hydro, biomass and biofuels; methane reduction, mostly from landfill gas flaring, energy efficiency including building efficiency, and bio-sequestration through afforestation and reforestation projects. Thus afforestation/reforestation that mitigates climate change impacts can be traded for carbon credits.

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