



# Adaptation to Climate Variability and Change

PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON  
ADAPTATION TO CLIMATE VARIABILITY AND CHANGE  
January 5-7, 2006, New Delhi

Organized by  
Institute for Social and Environmental Transition, and  
Winrock International India

Supported by  
U.S. Environmental Protection Agency

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Institute for Social and  
Environmental Transition



**WINROCK**  
INTERNATIONAL  
INDIA

PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON ADAPTATION TO CLIMATE VARIABILITY AND CHANGE  
(JANUARY 5-7, NEW DELHI)

PREPARED BY  
Institute for Social and Environmental Transition (ISET), and  
Winrock International India (WII)  
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# LIST OF ABBREVIATIONS AND ACRONYMS

AKDN	Aga Khan Development Network	ICT	Information and Communication Technology
AKF	Aga Khan Foundation	IFRC	International Federation of Red Cross and Red Crescent Societies
AKRSPI	Aga Khan Rural Support Program – India	IGA	Income Generation Activity
AWS	Alternative Water Supplies	IIM	Indian Institute of Management
BCAS	Bangladesh Centre for Advanced Studies	IISD	International Institute for Sustainable Development
BPG	Best Practice Guidelines	IITM	Indian Institute of Tropical Meteorology
CARD	Centre for Advanced Research and Development	INR	Indian National Rupee (1USD = Rs. 46)
CBO	Community-based Organizations	IPCC	Intergovernmental Panel on Climate Change
CICERO	Center for International Climate and Environment Research	ISEC	Institute for Social and Economic Change
CIG	Common Interest Groups	ISET	Institute for Social and Environmental Transition
CISED	Centre for Interdisciplinary Studies in Environment and Development	ITDG	Intermediate Technology Development Group
CLTS	Community-led Total Sanitation	IWDP	Integrated Watershed Development Program
COP	Conference of the Parties	IWMI	International Water Management Institute
CPWC	Cooperative Programme on Water and Climate	IWRM	Integrated Water Resource Management
CWS	Community Water Supplies	KB	Krishak Bandhu
DA	Development Alternatives	MDG	Millennium Development Goals
DDP	Desert Development Program	MMRDA	Mumbai Metropolitan Region Development Authority
DFID	Department for International Development	MT	Metric Tonne
DPAP	Drought Prone Area Program	NABARD	National Bank for Agriculture and Rural Development
DRDA	District Rural Development Agency	NAPA	National Adaptation Programme of Action
DRSL	Disaster Resistant Sustainable Livelihoods	NCEA	National Center for Environmental Assessment
DWC	Dialogue on Water and Climate	NGO	Non-governmental Organization
EC	European Commission	NIDM	National Institute of Disaster Management
EPA	Environmental Protection Agency	OBC	Other Backward Communities
FM	Frequency Modulation	OSDMA	Orissa State Disaster Management Authority
FRP	Fiberglass Reinforced Plastics	PFT	Project Facilitation Team
GCM	General Circulation Model	PRADAN	Professional Assistance for Development Action
GCRP	Global Change Research Program	PRA	Participatory Rural Appraisal
GEF	Global Environment Facility	PRI	Panchayati Raj Institutions
GFDL	Geophysical Fluid Dynamics Laboratory		
GHG	Greenhouse Gases		
GSDMA	Gujarat State Disaster Management Authority		
GPS	Global Positioning System		
GWA	Groundwater Authority		
ICRC	International Committee of the Red Cross		

RRCAP	Regional Resource Centre for Asia and the Pacific	USD	United States Dollar
Rs.	Indian Rupees (1USD = Rs. 46)	USEPA	United States Environmental Protection Agency
RTI	Right to Information	USGCRP	United States Global Change Research Program
SC	Scheduled Caste	VCA	Vulnerability and Capacity Assessment
SEI	Stockholm Environment Institute	VIKSAT	Vikram Sarabhai Centre for Development Interaction
SEWA	Self-employed Women's Association	WASH	Water, Sanitation and Hygiene
SGP	Small Grants Program	WASMO	Water and Sanitation Management Organization
SH	Self Help	WDF	World Development Federation
SHG	Self-help Groups	WEAP	Water Evaluation and Planning
SJSY	Swarna Jyoti Swarojgar Yojna	WHS	Water Harvesting Structures
SKTGSM	Sri Kundla Taluka Gram Sewa Mandal	WII	Winrock International India
SL	Sustainable Livelihoods	WMO	World Meteorological Organization
SSS	Sramika Sakti Sangha	WORLP	Western Orissa Rural Livelihoods Project
ST	Scheduled Tribe	WSSCC	Water Supply and Sanitation Collaborative Council
TERI	The Energy and Resources Institute	<i>Panchayat:</i>	In India, a local, village-level self-governing body
TGCS	Tree Grower Cooperative Society		
UNDP	United Nations Development Programme		
UNEP	United Nations Environment Programme		
UNFCC	United Nations Framework Convention on Climate Change		
UNISDR	United Nations International Strategy for Disaster Reduction		

# INTERNATIONAL CONFERENCE ON ADAPTATION TO CLIMATE VARIABILITY AND CHANGE

January 5-7, 2006  
India Habitat Centre, New Delhi, India

Organised by



With support from



From left to right: Dr. Kinsuk Mitra, Dr. Marcus Moench, Dr. R.K. Pachauri and Dr. Michael H. Glantz

## Executive Summary

These conference proceedings summarize the intensive discussions held in New Delhi (January 5-7, 2006) on Adaptation to Climatic Variability and Change. The conference, which was financed by the U.S. Environmental Protection Agency (USEPA) and organized jointly by the Institute for Social and Environmental Transition (ISET) and Winrock International India (WII), brought together a unique set of participants that included high-level governmental decision-makers, development organizations, physical and social scientists, and field practitioners. While presenters spoke in their individual capacity rather than as representatives of organizations or governments, they brought a wealth of perspectives and practical experience to the meeting.

Climatic variability and change are among the greatest challenges that society at global, regional and local levels will face over the coming decades. Until recently, virtually all work on climate change has focused on basic scientific questions regarding the nature of – and factors driving – change processes. Now global scientific consensus indicates that change is occurring and, that, whatever the causal factors and level of success in mitigating change processes, adaptation will be essential.

The topic of adaptation to climatic change and variability is both relatively new and complicated. While there is increasing evidence that changes in climate are likely to increase variability and the intensity

of extreme events and may also result in more incremental changes to basic climatic parameters, existing scientific information provides relatively little guidance regarding specific changes likely to be experienced at both local and regional levels. Some changes may occur incrementally over periods of decades or longer while other changes, such as those related to extreme events, could have immediate implications for populations living in vulnerable regions. As a result, while the importance of adaptation is increasingly recognized, the specific changes human society will need to adapt to are far less clear.

In addition, climate change processes are occurring in parallel with fundamental changes in social, economic,

environmental and technological systems. India is transiting from a rural agricultural society to one where non-farm activities play a much larger role in livelihoods than ever before. Dependence on agriculture as a primary livelihood form is decreasing but, however far this transition proceeds, India is unlikely to become another United States where less than one percent of the population depends on agriculture for their livelihood. The context in which adaptation needs to occur will, as a result, differ greatly between regions such as India and the United States. Overall, the topic of adaptation needs to address changes that may occur across differing time scales, differing geographic scales, and under differing assumptions regarding social and economic conditions.

Not surprisingly given the complexity of the topic, discussions at the conference addressed a wide variety of conceptual as well as more narrowly applied issues. They also highlighted very different perspectives regarding the courses of action that will be required to respond to climatic variability and change. This diversity was reflected in the four keynote talks by Dr. R.K. Pachauri (Chairman, Intergovernmental Panel on Climate Change) and Dr. Michael Glantz (Director,

Center for Capacity Building, NCAR) on the first day, and Dr. Pradipto Ghosh (Secretary, Ministry for Environment and Forests, Government of India) and Mr. John Furlow (U.S. Environmental Protection Agency) on the second day. It was also a core part of the wider discussions that occurred throughout the conference.

In his keynote address, Dr. Pachauri highlighted the implications of emerging climate science for adaptation. He emphasized the need for international collaboration to identify effective strategies for improving understanding of adaptation processes. Knowledge was identified as a critical driving factor supporting the development of effective courses of action. From his perspective, interventions that build off existing courses of action and respond to existing problems within the larger context of vulnerability and poverty eradication represent an important starting point. This approach is important because many of the likely consequences of climatic change – such as increases in water stress and climate related disasters – are already major challenges. Strategies to address such problems would, as a result, address immediate as well as future needs. Moving forward on this requires integration of community



*The Great Deluge: A scene from the Mumbai flood 2005*

responses, strengthening of social capital, pilot implementation activities, and the development of long-term collaborative programs to share insights and build capacity across many regions on problems that are ultimately common to all.

In the second keynote address, Dr. Glantz focused on the concept of climate affairs as an organizing principle. His core point, which in many ways echoed Dr. Pachauri's call for knowledge generation, was that the challenges society faces in responding to climatic variability and change represent a focal point where insights from a very wide variety of disciplines intersect. While individual social or natural science disciplines often generate new bits of knowledge that are related to climatic variability and change, in the absence of a core disciplinary focal point this knowledge remains isolated. No social mechanism exists that enables it to come together into an aggregate body of knowledge that can influence policy and behavior. Building "climate affairs" as an interdisciplinary focal point for research, education and training would provide this mechanism. Doing so would have a major impact on the applied capacities society brings to climate issues both immediately and

over the longer-term process of climate change. Development of climate affairs as a focal point for education, training, research and applied policy could be used to develop the social capital – the large groups of professionals and informed actors – that will be required to incorporate climate considerations into the day-to-day activities of local governments and businesses.

In his keynote address, on the start of the second day of the conference, Dr. Pradipto Ghosh, focused on the central role of economic development in climate adaptation. In comparison to mitigation (greenhouse gas reduction), adaptation has been the "neglected step-child" in global negotiations and debates over climate change. This must change. Dr. Ghosh emphasized that the resource requirements for mitigation and adaptation are equal. From his perspective, developing effective strategies for adapting to climate change will require meaningful responses, resources and political capital. He emphasized that many such meaningful responses will involve enhancements to existing programs such as those that already exist for drought and flood mitigation. On a more fundamental level he highlighted the particular vulnerability of the poor to climatic variability and change and framed the challenge of



*Aftermath of a natural disaster*

adaptation to climate change largely in terms of sustainable development. Key levers for adaptation included moving people out of poverty and supporting progressive change in economic structures away from primary (agricultural) livelihoods and into secondary and tertiary (knowledge-based) forms of economic activity that are less vulnerable to the direct impacts of climate.

Mr. John Furlow, in the final keynote address, highlighted both commonalities and differences in adaptation issues in the United States and India contexts. Some issues, such as the basic design criteria for water structures under changing climatic conditions are common. Other issues, such as the impacts on livelihoods, have large differences due to the divergent nature of livelihood and economic conditions. Finally, other issues have yet to be explored. Sleeper issues such as urban drought and the factors determining the adaptive capacity of different groups may be of fundamental importance but are poorly understood. Given the great diversity of issues he emphasized the importance of stakeholder-driven responses – a strong point of commonality with issues in India. He also emphasized that many of the core strategies (from socially-driven patterns of mobility and diversification to more planned interventions in specific sectors, such as water) for adaptation are common.

Beyond the keynote addresses, presentations at the conference illustrated both the importance of adapting to climatic conditions and the complexity of separating climate adaptation from other socioeconomic, environmental and development issues. Conceptually, changes in complex systems occur through a combination of incremental adjustments (such as the gradual decline of groundwater resources or improvements in agricultural technologies) and sudden “pulsed” fluctuations (such as those associated with a major disaster or economic downturn). Where incremental changes are concerned, adaptation requirements are likely to be very similar to – in some cases indistinguishable from – existing attempts to improve basic management of water and other resources or support processes of sustainable development. Where sudden changes are concerned,

adaptive processes will be closely related to disaster relief and the responses individuals and households make when subjected to disruption. As a result, discussions of adaptation to climatic variability and change may often appear, as they did at many points during the conference, to be addressing basic existing issues rather than relating to climate change *per se*.

In both the incremental and sudden cases, however, climate considerations introduce an additional element of risk and often increase the potential for climate or water related disasters. This link between adaptation to climatic change and disaster risk management is, as the presentation by Professor Santosh Kumar of the National Institute of Disaster Management emphasized, increasingly well recognized in India. As a result, the need to understand and manage risks represented a strong unifying element in the discussions.

This was presented as a central issue in understanding differences in vulnerability and ability to respond to climatic variability and change between communities and groups. It was also discussed as the factor underlying the differing worldviews and, as a result, strategies market actors, governments and social groups bring to the climate debate. Governments tend to be driven by the practical demand to “do something” and the fact that departments are structured to respond through hierarchically designed projects or programs. Market actors respond to economic opportunities and risks. They respond where they see business opportunities and by reducing/pooling their risks through insurance. Social groups have widely differing origins (whether religious, political, cultural) and the perspectives they bring to climate issues differ as a result. At a societal level, bridging such gaps depends on mechanisms such as freedom of information, “data democratization,” and strategies for stakeholder involvement. These mechanisms bring the risks that are identified or perceived by different groups into public dialogue and policy debate. They are, as a result, central to risk management and to the link between adaptation to climate change and disaster risk reduction.

On a more specific level, the role of risk management as a central strategy for responding to climate issues was

highlighted through discussions on the following:

1. The role and importance of early warning systems (both the immediate need for warning regarding extreme climate events and longer-term indicators of vulnerability).
2. The role of financial mechanisms for risk spreading and pooling (insurance as a core point where private sector involvement in adaptation may be supported by market forces).
3. The importance of management and design strategies in the water sector that are adapted and resilient to higher levels of variability and uncertainty in stream flows, drought frequencies, flood volumes, etc
4. The need to integrate climate variability and change into both pre-disaster risk management and post-disaster rehabilitation processes (rehabilitation being a key period when systems that have been disrupted can be re-built in ways that are resilient to future climate impacts).
5. Economic diversification as a mechanism for spreading risk within livelihood and regional economic systems.
6. The distinction between “planned” adaptation and “socially-driven” adaptation. The former is reflected in formal planning processes (the National Adaptation Plans of Action) and formal attempts to reduce disaster risk as opposed to the latter which reflects the courses of action individuals, households and communities take (such as livelihood diversification, migration, etc.) to respond to the risks and opportunities they face in the course of daily life.

In many ways, the keynote addresses and subsequent presentations highlighted many of the core issues that will need to be addressed as society attempts to respond to climatic variability and change. The ability to adapt will depend on knowledge and understanding of changes in the climate system and how they relate to



*Drought proofing by building water tanks*



equally pervasive changes in social, economic and other systems. Mechanisms for developing this common understanding – through collaborative activities within and between regions and within disciplinary focal points such as climate affairs – are essential. Beyond understanding, adapting to climatic variability and change will require a combination of targeted “planned” interventions and more lateral, less specifically targeted, approaches that build adaptive capacity. Targeted interventions can address specific constraints, such as the design of water structures, or issues such as vulnerability to extreme storms, in specific situations. Equally importantly, however, adaptive capacity and the ability to respond to surprise depend on broad questions of social capital, financial systems for risk pooling, and the flexibility and diversity of economic systems. As a result, responses to climate change are intimately tied to wider questions of sustainable economic development. Although this was not addressed in detail at the conference, it implies that larger questions regarding trade, global and local financial institutions, migration, the role of markets and the private sector, etc., are likely to become central points of discussion in debates over adaptation to climatic variability and change. Accountability is also a key issue, as Kamal Kishore from the United Nations Development Programme pointed out in relation to the links between disaster and climate response: “Assessments after disasters are not done well and there is no accountability for the lack of advance planning even where risks are well known. Building models and rhetoric of disasters and development will not be of any use. *Accountability has to be improved in a tangible way not in a conceptual way.*”

### Ways forward

In many ways, the discussions at the conference could be seen as a call for greater collaboration on attempts to understand and respond to the challenges emerging as a consequence of climatic variability and change. The need for this was explicitly emphasized in the keynote addresses and many of the individual presentations. Many of the issues facing the development of effective responses to climate change are the same in the West

and South Asia and across borders within South Asia. Core points where collaboration could be of great benefit include the following:

1. Improvement of basic shared understanding regarding the basic social as well as physical science issues that must be addressed to adapt to existing and changing climatic conditions.
2. Development of methodologies, indicators and techniques for analyzing climate impacts, patterns of vulnerability and building adaptive capacity.
3. Development of improved systems for mitigating risks associated with climatic change and variability, including:
  - a. Mechanisms that can address the specific needs of vulnerable communities (the poor and socially marginalized groups);
  - b. Financial mechanisms for risk pooling and spreading;
  - c. Early warning systems and data sharing;
  - d. Systems for climate disaster risk reduction in development and post-disaster recovery programs;
  - e. Risk management in the water sector, particularly adapted structure design and resilient management approaches; and
  - f. Risk management within local, regional and global economic systems through economic diversification and improved understanding of the role appropriate trade, migration, communications and other policies may play;
4. Sharing of experiences and testing, through pilot activities, strategies to support adaptation and resilience to climatic variability and change.
5. Development of professional and other networks necessary to hold key actors – in governments, NGOs and the private sector – accountable for using existing knowledge to take effective action to reduce risks.

These kinds of activities could contribute both to practical courses of action within countries and to the development of shared perspectives in global debates. They are, as a result, of fundamental importance to the ultimate evolution of any consensus regarding responses to climate change.

# DAY-1

## Inaugural Session

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10	Key Points Raised in the Discussions

Dr. Marcus Moench, *President, Institute for Social and Environmental Transition (ISET)*

Marcus Moench opened the conference by welcoming all participants. Following this, his introductory remarks focused on the key issues the conference was intended to address. He highlighted the broad range of basic social and scientific questions that will need to be understood in order to develop effective strategies for adapting to climate change. He also pointed out that many of the issues are of equal importance in all parts of the world. Adaptation to climate change raises issues that cross, and often make irrelevant, the historical division between “developed” and “developing” regions. Many of the issues, including some that have historically been viewed as applying to developing regions (such as the ability of poor populations to respond to climate change) are, as events such as Hurricane Katrina highlighted last year, common. As a result, the development of strategies for supporting adaptation and responding to the consequences of climate change will require collaboration at local, regional and global levels, across disciplinary boundaries and between different sectors of society. He closed his welcoming remarks by emphasizing that the conference was intended as a first step in catalyzing collaboration and clarifying some of the core issue areas that adaptation strategies will need to address.

Dr. Kinsuk Mitra, *President, Winrock International India (WII)*

Kinsuk began by welcoming everyone on behalf of the organizers. In his introductory remarks, he emphasized that this conference was a collaborative venture to address climate change and adaptation. The purpose of the meeting was to serve as a platform for the identification of approaches that would help develop a long-term and sustainable responses to climate impacts based on grassroots experiences. This approach would hopefully bring together attempts to reduce greenhouse gas emissions with the impacts of climate change on the poor.

Adaptation to global climate change is a relatively new topic and, therefore, little has been done to prioritize the different courses of action required, Kinsuk added. Scientifically, the degree to which climate change will affect regional conditions and the connection with extreme events has not been established universally and scientifically. It follows that little attention has been paid to adaptation and coping. Coping mechanisms must have a basis, both in technology and local practices, to enable effective risk reduction and diversification opportunities, he stressed.

Kinsuk hoped that one of the many outcomes of this conference would help sharpen the current thinking and help in building capacities and fostering partnerships. He pointed out how WII had already taken a few steps in this regard through a project Vulnerability to Climate Change and Adaptation Strategies in India: Droughts and Floods. Under this project, WII reviewed local coping strategies for adapting to droughts and floods and suggested incremental adaptation measures that might be required to reduce the adverse impacts of climate change.

WII has also been involved, along with USAID-OFDA-ISET, in earlier programs to understand local coping strategies for adapting to the impacts of floods and droughts in selected areas of India and Nepal, he added. WII has also been involved on other levels. WII has been appointed by the Ministry of Environment and Forests (MoEF) as the facilitating agency supporting the preparation of India's second national communication to the UNFCCC.

In his concluding remarks, Kinsuk introduced WII's activities in brief. Through its three program areas – Natural Resources Management, Climate Change and Energy and Environment – WII builds sustainable multidisciplinary projects by consolidating innovative concepts, sound research, new technologies, and indigenous knowledge to achieve long-term success and accomplish its mission to develop and implement solutions that balance the need for food, income and environmental quality. WII's focus is on integrating environmental priorities into mainstream development planning, management and implementation, at the local, state and national levels, especially in these programmatic areas. One of WII's thrust areas is to reach out to involve people, communities and institutions to strengthen their efforts to develop and implement sustainable solutions.

# Perspectives of IPCC on adaptation

Dr. R.K. Pachauri, *Chairman, Intergovernmental Panel on Climate Change (IPCC), and Director General, The Energy and Resources Institute (TERI)*

The Intergovernmental Panel on Climate Change (IPCC) was founded in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) as an intergovernmental body comprising 192 members. The purpose of the IPCC is to assess all aspects of climate change, using the best available talent and information to maintain a scientific and geographical balance. It limits its work of assessment to published peer-reviewed literature. Because so much of the work on development and social issues is not published in this manner, perhaps social scientists have not yet been adequately involved in the assessments of the IPCC on the impacts of climate change. Therefore, the assessment of climate change faces some gaps on the social dimensions of climate change.

The Fourth Assessment Report of the IPCC is yet to be completed. It will, however, include assessment of the socioeconomic dimensions of climate change. It will also address specific issues, including the regional dimensions of climate change (“the reality in specific locations”). It will also evaluate mitigation and adaptation issues from an integrated perspective using a combination of technological and sustainable development

approaches. The Third Assessment Report evaluated the impacts of climate change at international, regional, national and sub-national levels and, therefore, to an extent at the local level where much adaptation actually must ultimately occur. At the international level, adaptation issues first emerged in a substantive manner at the Eighth Conference of the Parties (COP-8) in New Delhi. Recognition of these issues has continued to grow and they were prominent at the recent COP-11 in Montreal. A central theme in these debates is the need to react and respond to climate change in the larger development context relating to economic growth, vulnerability and poverty eradication. The financial implications of adaptation have also emerged as a central issue at the global level, and will be addressed by the Fourth Assessment Report. Knowledge in this field can, however, only move forward if knowledge is available regarding adaptation measures and associated costs. Knowledge has to be the driving factor. Frameworks for adaptation have not been defined, and there is a clear need to develop the knowledge base required to identify effective responses to climate related problems. This will require international collaboration and better linkages between macro and grassroots perspectives,

Knowledge has to be the driving factor. Frameworks for adaptation have not been defined and there is a clear need to develop the knowledge base required to identify effective responses to climate related problems

involving a range of initiatives and actions. Opportunities for these are particularly available within a regional context, such as in South Asia, and the time has come for regional activities in this area on a larger scale. In addition, opportunities exist where current activities can be strengthened in ways that address present needs as well as the larger impacts anticipated as a consequence of climate change in the future.

International collaboration has not yet received enough attention. This is needed for bottom-up initiatives that feed common grassroots experiences into plans and programs. The problems facing different regions are often very similar and relate to long-term as well as future climate related development challenges. In the case of water, for example, a workshop was held in 1992, New Delhi, just before the Rio Conference, where it was stressed that it was time to act at the national and sub-national levels. There are 1.7 billion people who are water-stressed in the world today, and it is projected that the numbers could reach 5 billion by 2025. As climate changes, water quality in both surface and groundwater sources will be affected. The magnitude and frequency of extreme events such as floods will also increase. Collaboration at local, national, regional and international levels is required to address challenges, such as those in the water sector that already exist and could be exacerbated by climate change.

Common challenges are also present in other areas. Higher incomes and consumerism will, for example, lead to imbalances between demand and supply and this will be reflected in agricultural patterns. Food security will be threatened due to the pressure on supply of food grains. Research is important to counter this threat by developing more drought-resistant strains of different crops, particularly those in rainfed areas, as a large number of marginal farmers are dependent solely on precipitation for irrigation. Extreme weather and climate will result in adverse effects, especially in the South Asian region and the worst affected will be the poorer sections of society. Warning systems are limited and these need to be strengthened. This requires foresight and planning. The costs involved in the provision of these are minimal. There are gaps in scientific, institutional and socioeconomic knowledge that can be filled by scientific collaboration across the South Asian region. Effective early warning will, however, require sharing of successes and information across borders. There is also a need to explore and innovate for solutions using scientific knowledge.

What is the way ahead? Identifying effective strategies for responding to climate change will require:

1. location specific research and pilot implementation activities;
2. integration of community responses (the building blocks) into higher level analyses and strategies; and
3. strengthening of social capital.

There are gaps in scientific, institutional and socioeconomic knowledge that can be filled by scientific collaboration across the South Asian region. Effective early warning will, require sharing of information across borders

During the recent heat wave in Andhra Pradesh, India, 3,364 persons lost their lives. They were poor who, as a group, often have few alternatives and little knowledge regarding ways to reduce the impact of heat on their bodies. In spite of the heat wave, due to the need for generating some income to survive, they continued to work in extremely high temperatures. After work they returned to ill-designed and poorly constructed dwellings where the temperature was often higher than the outside. This caused many deaths that might have been avoided.

Climate change projections suggest that a proactive approach to all forms of adaptation would have great merit. Food security will also be threatened. International collaboration needs grassroots experiences to be incorporated in plans and programs. Warning systems have to be set up, communities must work together, and their capacities must be strengthened. There is a need for long-term development projects as the future will face a high degree of danger, not only through climate change but also in other areas.

Overall there is a need to define a long-term collaborative program at a regional level. Adversity throws up challenges that are unique to specific areas but that have common root causes. During Hurricane Katrina, though there were warnings well in advance, the response was not adequate. Mumbai also was not adequately equipped to handle the torrential rains that occurred in 2005, and therefore the response was not adequate, though the societal response was far better than in New

Orleans. Ultimately, communities must work together and their capacities must be strengthened to address both existing challenges and those that will be faced in the future. To do this, experiences derived through pilot projects must be used. There is a need for long-term development projects, conceptualized to face new and existing challenges. The future could involve high degrees of danger, not only through climate change, but also due to other factors.

Ultimately, communities must work together and their capacities must be strengthened to address both existing challenges and those that will be faced in the future

# Climate affairs program: usable science for society

Dr. Michael H. Glantz, *Director, Center for Capacity Building (CCB), National Center for Atmospheric Research (NCAR)*

## ABSTRACT

### Understanding climate variability, change and extremes: a societal need

Although the focus in this talk is on climate affairs, it refers more generally to “climate, water and weather affairs.”

The first and foremost goal of establishing a “climate affairs” activity is to develop an awareness among educators and trainers in a variety of disciplines on how climate affects all aspects of life in industrialized and developing countries alike. Educating educators of students at various levels and training trainers of people already in the workforce can catalyze a cascade of awareness throughout society about the growing importance of improved understanding of climate in its societal context.

Decision-makers, too, in those countries can influence the way their climate-sensitive activities are affected by variables in addition to changing climate as a result of enhancing their understanding of climate affairs. In essence, this will build the institutional as well as individual capacity of countries to deal with a host of climate-related issues (agriculture, energy, water, health, public safety, education).

If the worldwide media reports are taken as an indicator, there was a heightened interest and awareness of climate and climate-related issues during the 1990s. There was also an improved awareness of the need for a better understanding of how climate variability and change affect ecosystems and the affairs of individuals as well as nations on a variety of time scales, from seasons to decades. Societies are increasingly coming to realize how their activities (e.g., industrialization processes and land-use activities) can alter the chemistry of the global atmosphere, which in turn can raise its average temperature by a few degrees Celsius. An increasing number of government, individual, and corporate decisions are being made where knowledge of climate affairs is necessary. There is, however, at the same time a lack of human and institutional capacity in developing countries to impart effectively relevant knowledge to such decision-makers now and in the future. This situation calls for national capacity-building efforts by academic institutions, international agencies and scientific organizations.

Educating educators of students at various levels and training trainers of people already in the workforce can catalyze a cascade of awareness throughout society about the growing importance of improved understanding of climate in its societal context



Glantz opened his presentation by talking about which countries had dominated, generally speaking, in earlier centuries. It seems that historians have suggested that the 1800s was the British century, the 1700s the French century, and the 1600s and 1500s the Spanish and the Portuguese centuries, respectively. Some have argued that the 20th century was the American century, and speculation has begun for the 21st century. Some have suggested that the 21st century will be the Chinese century. However, Glantz said that he felt that no government will dominate the 21st century. While there will be wars and other kinds of conflicts through the century – political, economic, ideological and religious – he argued that the century will be dominated by climate issues of variability, extremes, and deep climate change (global warming) and their impacts on societies and ecosystems.

He noted that scientists now believe that climate anomalies are becoming

more frequent, costly and deadly and global warming has been implicated. At the same time, demographic changes appear to be putting population pressure increasingly with regard to weather and climate extremes. Thus, climate issues have become important to governments, corporations, the public and to humanitarian organizations, especially non-governmental organizations (NGOs) because they are often the first to respond at the local level.

He introduced the notion of “climate affairs” as a way to educate educators who educate students, and train trainers who train professionals in the workforce, about how climate knowledge can improve the quality of climate-sensitive decisions. The purpose is to foster a multidisciplinary approach to climate issues for purposes of awareness, understanding and making climate science “usable” by the public as well as by policymakers at all levels of social organization. Climate

Scientists and policymakers alike must accept that society is now an integral part of the physical climate system, as potentially influencing as vegetative land cover, sea ice, clouds, and the like



affairs encompasses climate science, climate impacts, climate policies and laws, climate economics, and climate ethics and equity.

There was, therefore, a need to catalyze widespread interest in education on climate-society-environment issues by understanding how climate, society and environment interplay. Climate impacts are felt on ecosystems – terrestrial and marine; and on societies – industrialized and agricultural, North and South. The human impacts on the atmosphere are both direct and indirect. The methods to assess impacts are both quantitative and qualitative. It is imperative to make climate science more “usable” by educators and trainers, the public, policymakers and industry.

Scientists and policymakers alike must accept that society is now an integral part of the physical climate system, as potentially influencing as vegetative land cover, sea ice, clouds, and the like. There is a need to improve society’s understanding of science. People have to be educated and public awareness increased through information dissemination. Glantz provided examples like the Venezuelan mud slides (1999) and Hurricane Mitch in Honduras (1998) as examples highlighting the conflicting relationship between disaster response and long-term community development. Disaster managers tend to try and bring things back to normal as soon as possible while the

development community focuses on long-term needs and not present ones. Industries have become increasingly interested in learning how climate shifts and extremes are affecting their activities. For example, the reinsurance industry has begun to consider the effects of climate change on their climate-sensitive investments.

American ecologist Barry Commoner wrote in the early 1970s about society’s debt to nature that was owed by America and other industrialized and industrializing countries. Thus, an analogy of “Natures Bank” has been used. Banks lend money, and money borrowed must be paid back in time. The borrower and the lender know this well because funds that are returned are available for others to borrow. Industrialized countries have borrowed from nature for their development. They have borrowed natural resources and environmental quality. It is time to pay back “Nature’s Bank,” so that others can borrow from it. Global warming, increased greenhouse gases (GHGs) emissions and deforestation are driven in large measure by demands of the rich countries. They, therefore, have the responsibility to take the first steps in reducing their GHG emissions and their large imprint on adverse environmental change globally. The “polluter pays” principle should be invoked, though this very rarely works, as polluting countries do not heed it.

Global warming, increased greenhouse gases (GHGs) emissions and deforestation are driven in large measure by demands of the rich countries. They, therefore, have the responsibility to take the first steps in reducing their GHG emissions and their large imprint on adverse environmental change globally

# Key points raised in the discussions

## Inaugural Session

### **1. Lack of coordination between the government departments working in the water sector.**

Given the complex and multi-sectoral implications of climate change discussed in the keynote presentations, discussions focused on concerns regarding the lack of coordination on climate between many government departments, particularly those working in the water sector. In addressing these concerns, respondents pointed out that similar situations existed in the energy sector. There are many agencies and it is difficult to coordinate efforts. The government is now planning a process where a single agency will handle all energy issues. Many actions in response to climate change are also taking place through civil society organizations, and mechanisms are required that support interaction between these and government efforts. As a result, those involved in the discussion also emphasized that for coordination to occur, bureaucracy has to work together with civil society.

### **2. Role of media, industry, civil society and government in addressing climate change.**

Many initiatives that respond to the impacts of climate change will have to come from outside the government. The government needs social science assessments to be carried out. Some of the lessons learned can be put to use either in government programs or through those implemented by civil society. In some cases, strategies for responding to climate change are likely to conflict with other social goals. As a result, such conflicts need to be studied. Potential sources of conflict between different actors involved in climate responses also exist. To avoid such issues, these sources of conflict have to be identified and studied.

### **3. Involvement of social scientists in climate change.**

A large part of the discussion focused on the need for greater involvement of social scientists in studying the impacts of climate change and developing response strategies. Climate debates have, to a large extent, been

dominated by physical scientists. Responses depend, however, on a wide variety of social factors within different sectors of the economy. Climate change has huge socioeconomic implications that will affect large numbers of people. These implications have not, however, been adequately studied.

### **4. Concept of “Nature’s Bank” and the response of developing countries to climate change.**

The “Nature’s Bank” concept focuses attention on the tremendous environmental and resources costs that industrialized countries have incurred in the process of development. During the period of their development, climate and environmental factors were disregarded – they, in effect, withdrew huge amounts of accumulated environmental capital to finance development. Much of this is still occurring. The United States and many other industrialized countries are, for example, as several participants emphasized in their comments, still using unsustainable practices and the process is being emulated on a global scale. While developed economies should be more proactive in addressing climate change, developing countries should not compound the problem by emulating the historical models of unsustainable development. Lessons learned have to be used and new models of development have to be created, taking into account environmental and climatic factors. Even now, in developing countries, very little attention is paid to public transport and building bylaws, which are part of many strategies for adaptation to climate change. Over 17 years, there has been a loss of credibility in global responses to climate change. Despite major statements in 1984 and 1992 regarding the willingness of developed countries to take measures to address climate change, little is actually being done. The Kyoto Protocol’s targets are, for example, unlikely to be met. Developing countries must work at the local level, especially in energy and transport, and these can contribute to a global solution.

# DAY-1

## Session 1

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16	POLICY PROCESSES IN WATER RESOURCE MANAGEMENT AND CLIMATE CHANGE Tony Allan, <i>King's College</i>
17	RESILIENCE AND VULNERABILITY IN NESTED SOCIAL-ECOLOGICAL SYSTEMS: IN IWRM'S CONTEXT Victor Galaz, <i>Centre for Transdisciplinary Environmental Research (CTM)</i>
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28	DEVELOPMENT ISSUES IN RAJASTHAN Rajinder Singh, <i>Tarun Bharat Sangh (TBS)</i>
29	KEY POINTS RAISED IN THE DISCUSSIONS

# Practical implications of climate change

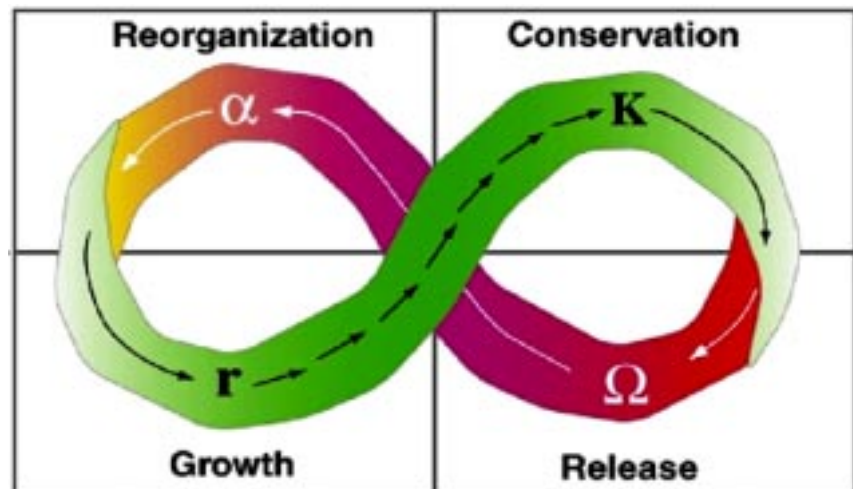
Marcus Moench, *Institute for Social and Environmental Transition (ISET)*

## ABSTRACT

Over the last two decades, research on the dynamics of complex interlinked systems has highlighted fundamental similarities in ways that social and ecological systems evolve. Organizations, economies or organisms often start out in a resource-rich environment and expand rapidly. As a result, resources become scarce. At some point, external disruptions exceed system resilience and fundamental changes occur. This difference between the process of continuous small adjustments and transformative/disruptive change is central to understanding the challenges climate change poses for human society. Risk is reflexive, and the probability of an event and the consequences depend on the interaction of social and behavioral factors over time. Managing risk is a multilevel process that requires mechanisms for spreading and pooling the impacts of smaller-scale disruptions on the system as a whole so that growth and conservation phases do not increase rigidity and ultimate vulnerability. Attention needs to be paid toward risk reduction in the long-term, incremental, process of development (the growth and conservation phase). As a result, financial and other techniques are needed for mitigating the impact of disruptions.

Difference between the process of continuous small adjustments and transformative/disruptive change is central to understanding the challenges climate change poses for human society

Over the last two decades, research on the dynamics of complex interlinked systems has highlighted fundamental similarities in ways that social and ecological systems evolve. In most situations, as illustrated in the diagram, systems pass through clearly recognizable loops of increasingly structured growth, conservation, disruption and reorganization.



Source: Resilience Alliance

During the “r” growth phase, entities (whether organizations, economies or organisms) exist in a resource-rich environment and expand rapidly. Expansion eventually leads to increased competition as resources (energy, nutrients, commodities, money, etc.) become scarce or locked up by existing entities. This leads in the “K” conservation phase to organizational patterns that are increasingly efficient and specialized but generally less flexible. The system becomes more and more structured – and momentarily predictable – as entities specialize to capture any resources that remain available and to hold on to the resources they have already accumulated. Increasing efficiency and specialization reduce flexibility and the resilience of the system to external disruption declines. At some point, external disruptions exceed system resilience and, during the “W” release phase, fundamental change (which is often equivalent to destruction) occurs. Reorganization occurs in the “a” phase.

In ecological systems, the r-K phase might represent the gradual transition over decades from pioneer species to a climax forest cover where most nutrients are locked in existing biomass. The K-W phase could represent a major fire or storm and the release of nutrients it enables, while the W-a phase would involve the initial establishment of pioneer species that “prepare the ground” for a return to structured – and much more gradual – growth. In social systems, parallel processes can easily

be identified at multiple levels from organizations to nation states. Processes of growth, conservation, release and reorganization are common and range from the relatively innocuous (a firm reorganizing in response to changing market conditions) to the transformative (the fall of the Roman Empire and the centuries it took following that for society to reorganize toward productive growth). This difference between the process of continuous small adjustments and transformative/ disruptive change captured in this analogy is central to understanding the challenges climate change poses for human society.

Research on the dynamics of complex systems suggests that the more highly structured and rigid a system becomes during the K conservation phase, the more disruptive its eventual failure will be during the inevitable W phase of release and transformation. Continuous exposure to small disruptions helps to maintain the flexibility and ongoing processes of release and reorganization that form the basis of adaptation and overall system resilience. When systems are insulated from exposure to minor sources of disruption, they tend to become increasingly specialized, structured and rigid. If disruptions exceed their stability threshold, the resulting collapse and the probability of it resulting in fundamental restructuring of the systems involved is far higher.

To shift this into other terms, consider a standard engineering

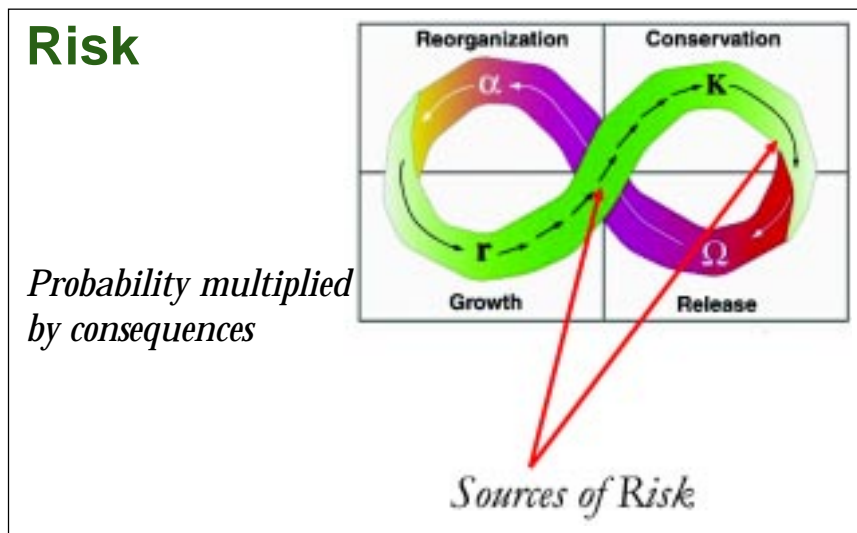
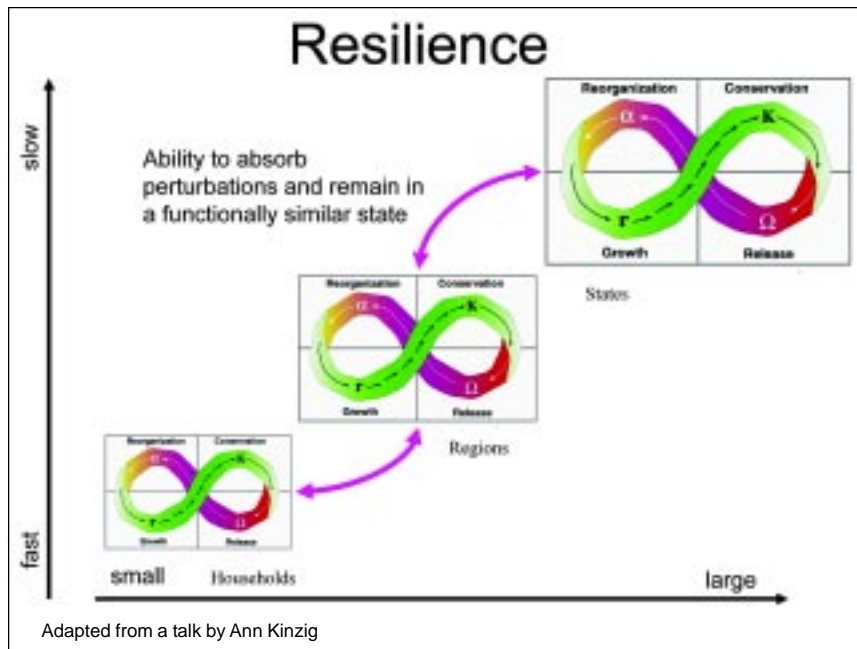
Processes of growth, conservation, release and reorganization are common and range from the relatively innocuous (a firm reorganizing in response to changing market conditions) to the transformative (the fall of the Roman Empire and the centuries it took following that for society to reorganize toward productive growth)

definition of risk as the probability of a given event multiplied by the consequences. If the probability of flooding is reduced through flood proofing measures, then society will generally make large, individually unprotected investments in the protected areas. If floods are sufficiently large that they exceed the design capacity of the protective structures, the consequences in terms of life and livelihoods from a single event can, as Katrina demonstrated, be huge. If, instead, areas remain exposed to flooding and investments in vulnerable areas are designed in ways that minimize the impact regular flooding has upon them, then the consequences of any given event are much lower.

Increases in the intensity of extreme climatic events projected as a consequence of climate change point to the trade-offs inherent in the above alternate approaches to risk management. Take the case of floods. Climate change complicates the design of protective structures because there is little basis for predicting the magnitude and frequency of extreme events. As a result, society may not be able to do much to reduce the probability that floods will exceed the capacity of protective structures – at least not over the long term. Uncertainty, and surprises related to the occurrence of unanticipated extreme events are almost certainly inevitable as a consequence of ongoing climate change processes. This implies that approaches that do not attempt to fully protect areas from floods and that instead encourage households, communities and regions to make

on-going adjustments that reduce the consequences of flooding, may ultimately produce lower levels of risk. Similar arguments could be made in the case of drought, the impact of extreme storms and other changes that may occur as a consequence of climate change.

Risk is a reflexive concept. Both the probability of an event and the consequences depend on the interaction of social and behavioral



factors over time. Flexibility, diversification, continuous adjustment, reorganization and learning in response to recurrent release events enable adaptation to occur with less probability of disruption and fundamental transformation of complex systems. Managing risk is a multilevel process that requires mechanisms for spreading and pooling the impacts of smaller-scale disruptions on the system as a whole and directing the reorganization process so that growth and conservation phases do not increase rigidity and ultimate vulnerability.

In practical terms, this means that attention needs to be paid toward risk reduction in the long-term, incremental, process of development (the growth and conservation phase), that financial and other techniques need to be developed for mitigating the impact of disruptions and that much greater attention needs to be paid to the process of reorganization following extreme events as a key period shaping patterns of future growth.

### Key issues for adapting to climate change

To improve understanding of change and link that in a practical way to:

- disaster risk reduction and the implications of “pulsed” change processes;
- long-term development processes;
- activities within specific sectors, particularly water;

## Findings from the field

The ability to adapt to floods and droughts depends on:

- the extent to which people are able to shift to livelihoods that are less vulnerable to disruption by water and climatic fluctuations;
- the ability to access labor markets (migration and commuting);
- the ability of information, goods and services to flow into and out of affected areas;
- the nature of physical infrastructure;
- secure domestic water supplies;
- the condition of key resources (groundwater);
- the institutional environment (markets, community organizations, etc.); and
- access to financing for non-agricultural activities and non-conventional structures.

- changes in the approach to water management;
- changes in core scientific tools (data, modeling);
- changes in the approach to physical structures;
- changes in approaches to institutions (scale, water rights, organizations);
- changes in the “institutional silos” separating key activity areas (water management, disaster risk reduction, climate change, etc.);
- changes in approaches to risk;
- changes in our approaches to insurance and risk pooling;
- changes in our attempts to “control” as opposed to “live with” daily risk; and
- changes in our institutional silos – risk reduction in the water sector may depend as much on activities outside water as it does on water management.



# Policy processes in water resource management and climate change

Tony Allan, *King's College*

The main purpose of the session was to highlight the types of knowledge that determine resource use and water policy. It was argued that constructed knowledge is much more important than observed science. Such knowledge reflects the interests of those who manipulate the policy discourse. Sometimes there are economically invisible and silent processes that enable a community or nation to be environmentally and economically sustainable and secure. Political processes determine whether these silent processes are taken into account by the resource-using and policy-making communities.

A second purpose was to show that the river basin is not a sufficient analytical framework. The “problemshed” is much more likely to provide useful explanations than the watershed. For example, international trade in water intensive commodities enables the soil-water surpluses in the temperate zones to be moved to the water deficit regions such as the Middle East and North Africa. Such trading has alleviated the water scarcity within countries and cities for millennia.

A third purpose was to show that sustainability needs to be understood to have three dimensions – with contending voices coming from society, from the economy, and the environment. The dominant notion in currency on sustainability is the outcome of this discursive political process. The red lines identified by the environmental scientist and the economist are no match for the politically constructed knowledge.

It was also pointed out that many very important problems relating to the availability of water resources and climate change impacts occur in the domain of uncertainty. Scientists are uncomfortable dealing with uncertainty. They cope well with risk, which can be understood via the concept of probability. Politicians, on the other hand, are expert in dealing with the ambiguities of uncertainty. They are especially expert in integrating new uncertainties, such as climate change, into the existing landscapes of uncertainty. Scientists have to learn how to communicate effectively in this world of constructed knowledge.

Scientists are uncomfortable dealing with uncertainty. They cope well with risk, which can be understood via the concept of probability. Politicians, on the other hand, are expert in dealing with the ambiguities of uncertainty. They are especially expert in integrating new uncertainties, such as climate change, into the existing landscapes of uncertainty

# Resilience and vulnerability in nested social-ecological systems: in IWRM's context

Victor Galaz, *Centre for Transdisciplinary Environmental Research (CTM)*

## ABSTRACT

The present and future threats to water resources create an increasing challenge to existing water policy and institutions around the world. Integrated Water Resource Management (IWRM) has been proposed by a number of key international actors (such as the World Bank, Global Water Partnership, United Nations Environment Programme) as the solution to the challenges facing nation states. In this paper, I argue that the current promotion of IWRM could reduce rather than enhance the resilience of social-ecological freshwater systems, hence creating vulnerability to climate change and variability, and extreme weather events. The paper summarizes insights from an emerging research field dealing with resilience and vulnerability in nested social-ecological systems, and uses examples from the implementation of IWRM in Europe (Sweden) and Latin America (Chile).

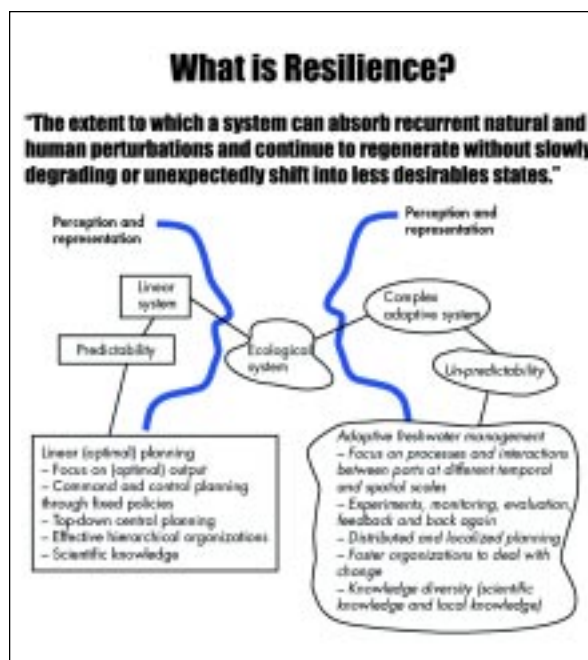
The present and future threats to water resources create an increasing challenge to existing policy and institutions around the world. Integrated Water Resource Management (IWRM) has been proposed by a number of key international actors, including the World Bank, Global Water Partnership and the United Nations Environment Programme (UNEP), as the solution to the challenges facing nation states.

IWRM, however, seldom acknowledges issues that are crucial in enhancing the resilience of nested

social-ecological systems.

Resilience is “the extent to which a system can absorb recurrent natural and human perturbations and continue to regenerate without slowly degrading or unexpectedly shift into less desirable states.”

Conventional water policy and



management tends to be based on predictability, fixed policies based on scientific expertise, and implemented by effective organizations with a rigid chain of command.

Yet, water policy decision-making is mainly about uncertainties, interactions and scales. Understanding of how to deal with change, uncertainty across scales is weak in the water sector. Precipitation patterns will change and therefore risks will change. Plans will then be irrelevant. Extremes are also risks that are outside the planning process.

The key issue, therefore, is how to harness surprises, uncertainty and change in freshwater management and policy. There must be a focus on uncertainties, interactions and scales. Nonlinear behavior (e.g. threshold effects, surprises) must be identified. There is a need to reach out to professionals with down-to-earth practical approaches and promote joint learning processes of system dynamics, which include “experiments” to both the natural and social system.

Insights from the implementation of IWRM in Sweden and Chile demonstrate how in the water planning process social and ecological uncertainties are assumed

### IWRM in Sweden and Chile

	IWRM in Sweden and Chile	Adaptive freshwater management and policy
<b>Water Planning</b>	Social and ecological uncertainty assumed away.	Strategies and institutions designed to harness uncertainties.
<b>Stakeholder participation</b>	To secure stakeholder input and secure legitimate decision making.	Promoted to understand system dynamics (thresholds, uncertainties etc.)
<b>Policy Implementation</b>	Homogenous in principle, allows local solutions and initiatives.	Diversified deliberately to enhance possibilities of learning from policy-experiments.
<b>Global Environmental Change</b>	Non-issue/ reactive strategies build on planning.	Proactive, strengthening social-ecological resilience of the system (both communities, ecosystems and institutions.)

away. Participation must include stakeholder input and promote learning processes. Implementation of policies must allow local solutions and initiatives at the same time as they treat policy as experiments from which managers can learn. An adaptive planning process based on uncertainty and learning should be adopted. Adaptive freshwater management and policy incorporates strategies designed to harness uncertainties. It promotes an understanding of system dynamics (thresholds, uncertainties, etc.) It is diverse enough to enhance possibilities of learning from policy experiments. It is a proactive approach to strengthen the social-ecological resilience of the system including communities, ecosystems and institutions.

Participation must include stakeholder input and promote learning processes. Implementation of policies must allow local solutions and initiatives at the same time as they treat policy as experiments from which managers can learn. An adaptive planning process based on uncertainty and learning should be adopted

# Coping compendium on water related risks

Henk van Schaik, *Cooperative Programme on Water and Climate (CPWC)*

## ABSTRACT

The Dialogue on Water and Climate (DWC) evolved into the Cooperative Programme on Water and Climate (CPWC) in 2004, to research local coping actions at the national, basin and regional levels and see if they have a basis in science.

The compounding nature of climate, socioeconomic, demographic and other changes has increased risks and altered perceptions. The cost to livelihoods and economies, and the number of victims are increasing. The response to changing risks calls for “adaptive management” that needs assessments of vulnerability on regional, national and urban/rural scales and evaluation of hazards along with the level of protection available, resilience and the capacity to cope. Organized coping actions are measures that include: mitigation or the removal of the hazard; resistance or the building of impoundments, dams and dikes and changing land use patterns; preparation or insurance and establishing early warning systems; response which consists of evacuation and control of the situation; and recovery and aftercare or rehabilitation. In Europe, a multistakeholder approach, involving science, politics, government, private and NGOs, is being used. Comprehensive water related risk management approaches need to be developed by adapting and using appropriate technologies to protect people, economies and ecosystems against disasters.

Comprehensive water related risk management approaches need to be developed by adapting and using appropriate technologies to protect people, economies and ecosystems against disasters

## Observations

The occurrence of climate related disasters is increasing with a huge cost in terms of lives lost as well as to livelihoods and economies. Extreme events are becoming more frequent and water solidarity is at stake at local and international levels. It is not climate change alone but the compounding nature of

changes that has increased risks and altered perceptions. Demographic changes, changes in land use patterns in urban and rural areas, changes in cultivation systems, changes in demand (scarcity, quantity and quality), all such changes compound the impacts of increasing climatic variability and extremes. Due to better

information, awareness of risks is increasing. The willingness of society to accept such risks is, however, decreasing.

### From DWC to CPWC

The Dialogue on Water and Climate (DWC) was initiated in 2001. It was a response to the Third Assessment Report (TAR) of the Intergovernmental Panel on Climate Change (IPCC), which stated the following:

“Climate change will lead to an intensification of the global hydrological cycle and can have major impacts on regional water resources, affecting both ground and surface water supply for domestic and industrial uses, irrigation, hydropower generation, navigation, in stream ecosystems and water-based recreation.”

In addition, the TAR acknowledged the compounding nature of water related risks by stating that:

“The impacts of climate change will depend on the baseline condition of the water supply system and the ability of water resource managers to respond not only to climate change but also to population growth and changes in demands, technology, and economic, social and legislative conditions.”

The main objective of the DWC was to bridge the disciplinary divide between climate science and water management by initiating dialogues at the national, basin and regional levels. It involved collecting evidence, and studying impacts,

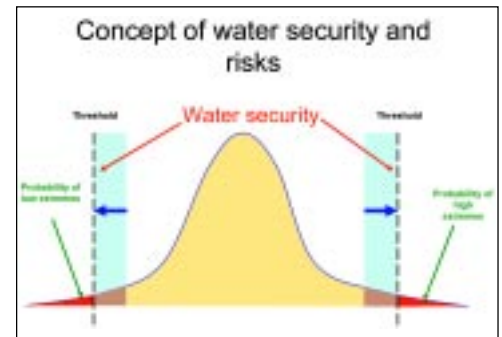
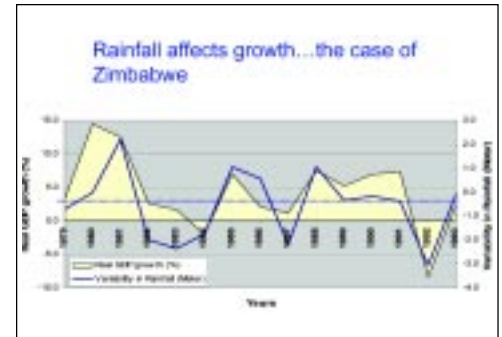
vulnerabilities (hot spots) and coping measures to establish that “climate changes the water rules.” The DWC evolved into the Cooperative Programme on Water and Climate (CPWC) in 2004 to stimulate local coping actions at the national, basin and regional levels and ensure that they have a basis in science. The other components in the CPWC are education and training, information and communication, and event organization.

One of CPWC’s main objectives is to ensure that climate change impacts and the risks associated with them are incorporated in development strategies, particularly for water resources and water services. The CPWC is concerned that there is no mention of climate change risks in the Millennium Development Goals (MDGs). The base criteria in the MDGs for water security is 500 cubic meter per person per year and the goal is to achieve this through structures including impoundments, dams and dikes. These structures are being designed using historical hydrological data and demand projections that do not reflect the impacts likely to occur as a consequence of climate change.

In conclusion, the present designs for water structures and also water legislature and water institutions cannot be considered “climate proof.”

### Adaptive management

The response to changing risks is leading to calls for “adaptive



management.” This requires assessments of vulnerability on regional, national and urban/rural scales. Evaluation of hazards including floods (both riverine and coastal), droughts and storms along with the level of protection available, resilience, and the capacity to cope is essential. Adaptive management also needs to evaluate organized coping actions using the safety chain concept and how that could contribute to resilience. Organized coping actions are measures that include: mitigation or the removal of the hazard; increasing the resilience of structures, or the building of impoundments, dams and dikes and changing land use patterns; preparation or insurance; and establishing early warning systems. It also includes measures such as disaster response planning as well as recovery and rehabilitation following disasters.

To achieve these ends, risk policies and strategies need to evolve. Traditional strategies aim at increasing water security, resilience and solidarity at a local level. The United Nations Framework Convention on Climate Change (UNFCCC) advocates a no regret approach since many of the strategies required for adapting to climate change also meet immediate needs. In this context, it argues for water conservation and discourages non-reversible measures for water extraction. It also espouses the “polluter pays” principle. In addition to the UNFCCC, the UN has advocated the development of national and local disaster risk

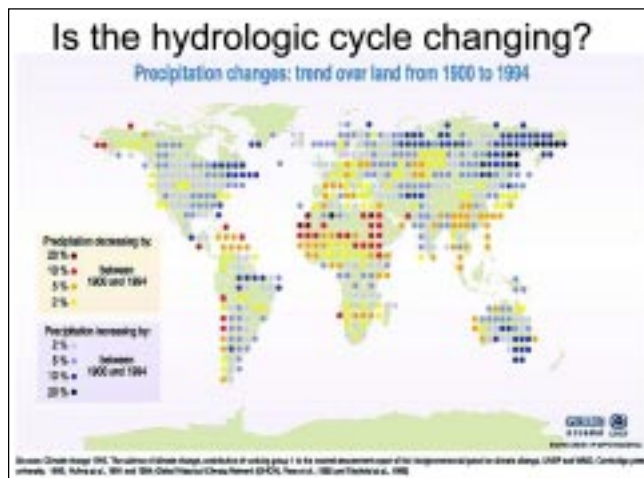
reduction strategies. And at COP-11, climate proofing was introduced as a concept for national development planning. Some bilateral interest is emerging to support Official Development Assistance (ODA) countries to carry out “climate proofing.”

### Risk management in Europe

In Europe, a comprehensive approach for floods is under development. It uses a multi-stakeholder approach involving science, politics, government, private and NGOs. It takes up the issues of demography, climate and economy, and works at different levels – local, municipal, district, riparian, national, basin and global.

### Conclusions

Risks are increasing in nature and have compounding effects. They have a greater magnitude and the impact is of a longer duration. Efforts to reduce water related risks must be increased. Comprehensive water related risk management approaches need to be developed by adapting and using appropriate technologies to protect people, economies and ecosystems against disasters. The coping compendium is to contribute to the capacity of water managers to cope better.

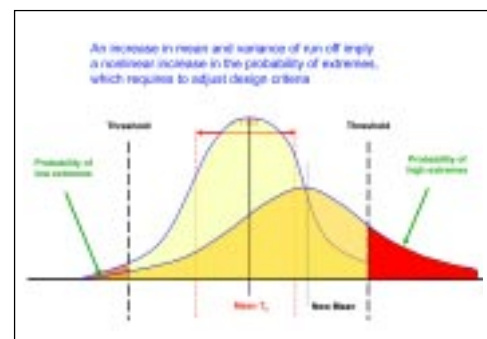


MDGs: Reduce half the proportion of people without sustainable access to safe drinking water by 2015.

WSSD & WEHAB: Reduce by half the population without access to basic sanitation by 2015.

Prepare country Integrated Water Resource Management plans by 2005 to ensure water security.

No mention of risks.



# Hazard, risk, vulnerability and climate change in India

Santosh Kumar, *National Institute of Disaster Management (NIDM)*

## ABSTRACT

India is among the world's most disaster-prone areas, and most disasters are mainly water related. During the last year, India has been impacted by floods, cyclones, drought and the tsunami. The population, affected by disasters, is huge in number when compared to the number of deaths. This socioeconomic cost includes loss of public and private property, loss of access to livelihood, distress sales of poor people's assets, adverse effects on local-state-national economy, damage to environment and biodiversity, violence and discrimination against women, malnutrition and increase in school dropouts, and psychosocial trauma and stress. The recent change in the concept of vulnerability requires a new approach. Until recently, the focus of disaster management was on relief and rehabilitation. This has shifted to prevention, preparedness, response and recovery.

The incidence of reported natural disasters has increased substantially between 1900 and 2004, and Asia suffers from the maximum impacts. Of the total number, Asia has been affected by 43 percent of the disasters worldwide, 69 percent of lives have been lost, and 54 percent of the estimated damages are in Asia. India is among the world's most disaster-prone areas. Disasters are mainly water related. During the last year, India has been affected by floods, cyclones, droughts and the tsunami. The connection between disasters and water management has not been made internationally or locally.

In India, 40 million hectares are prone to flood with 8 million hectares being affected every year. The Brahmaputra and Gangetic basin are the most flood-prone areas. The rivers flowing west – Krishna, Cauvery and Mahanadi – are also major flood-prone areas. The population affected by floods in 2005 was 32.03 million, and 1,504 lives were lost. In addition, about 96,713 livestock have been killed and 1,683 houses damaged. The crop loss has been Rs 4,600.7 million (US \$103 million), and the damage to public utilities is Rs 3,772.48 million (US \$85 million).

India is among the world's most disaster-prone areas. Disasters are mainly water related. During the last year, India has been affected by floods, cyclones, droughts and the tsunami

India has a 7,200 km-long coastline with two cyclone seasons, during the southwest and northeast monsoons. The coastal districts of Orissa, Andhra Pradesh and Gujarat are most prone to the impacts of cyclone. Most casualties are caused by tidal waves, storm surges and torrential rains.

Of the net area sown in the country, 68 percent is prone to drought, and of this 33 percent is chronically drought-prone, receiving rainfall of less than 750 mm per annum, while 35 percent receives rainfall between 750-1,125 mm per annum.

The population affected by a disaster is huge in number when compared to the number of deaths which may also be large. The Tsunami affected 1,561,874 persons, while 647,599 shifted to safer places. The number of deaths was 10,749 in five states in India.

Landslides can affect large areas of the country every year during monsoons. They can also be caused by earthquakes. The areas that suffer from landslide hazards are located in the hilly tracts of the Himalayas, Northeast India, Nilgiris, Eastern Ghats and Western Ghats.

A map of India has been prepared showing multi-hazard zones based on earthquakes, wind and cyclones, and floods. This will help in preparedness, quick risk assessment and action as well as being an invaluable tool for proactive planning. A vulnerability map, developed by the Building Material and Technology Promotion

Council, has given enough warning regarding possible hazards that might get converted into disasters in the future. We need to learn from these warnings and start taking measures to reduce risk. We also need to revisit the vulnerability atlas in the context of the new phenomenon of extreme weather events that India has faced, in the current year and also in the past on intermittent basis.

The definition of disaster as in the Disaster Management Act, 2005 states that it is “a catastrophe, mishap, calamity or grave occurrence affecting any area from natural and man-made causes, or by accident or negligence, which results in substantial loss of life or human suffering or damage to and destruction of property, or damage to or degradation of environment and is of such a nature and magnitude as to be beyond the capacity of the community of the affected areas.”

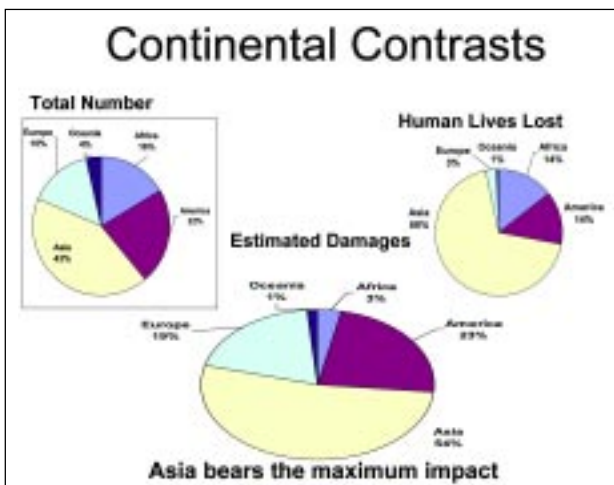
The average annual loss of human lives due to disasters is 4,350. The cultivated area affected is 1.42 million hectares, and 2.36 million houses are damaged. This loss is Rs 250,000 million, which is 2 percent of the GDP of India. The expenses on emergency response and relief are over Rs 150,000 million. There are also indirect losses, which include loss of output, and disruption in trade and commerce, undermining future profitability and infrastructural damage. Secondary losses, both short and long-term are intangible in nature and difficult to quantify.

A vulnerability map, developed by the Building Material and Technology Promotion Council, has given enough warning regarding possible hazards that might get converted into disasters in the future



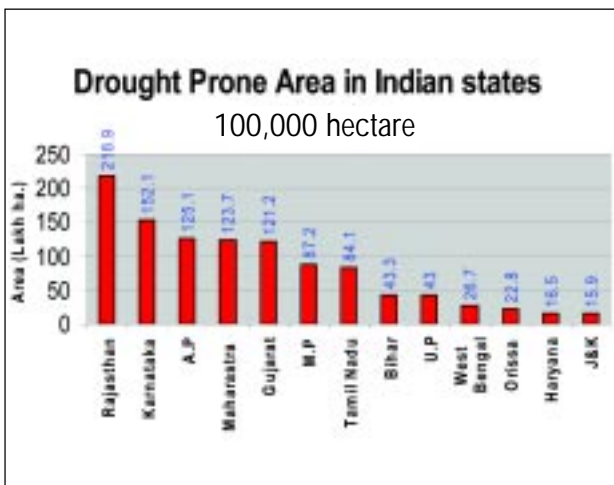
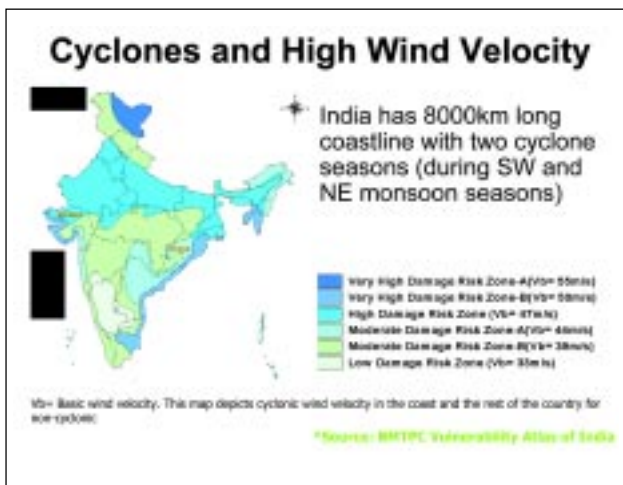
### Disaster Impacts in Various Regions (1963 -1992)

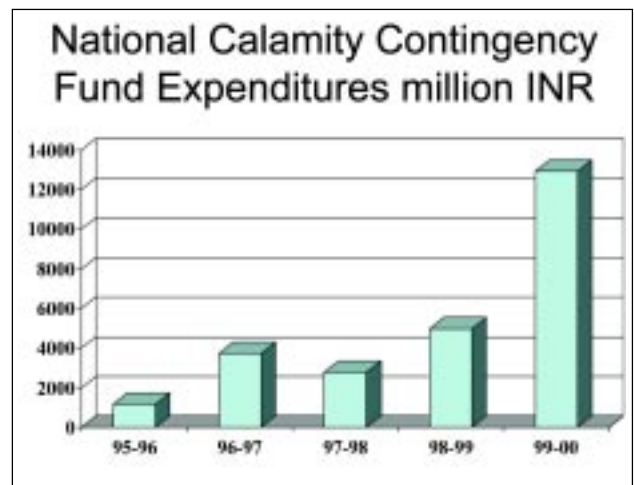
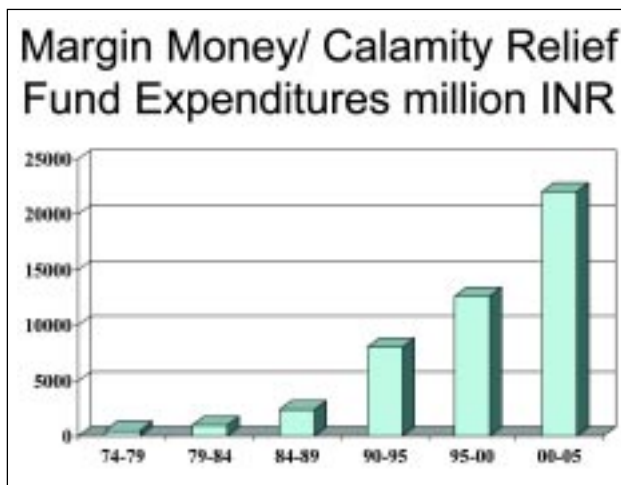
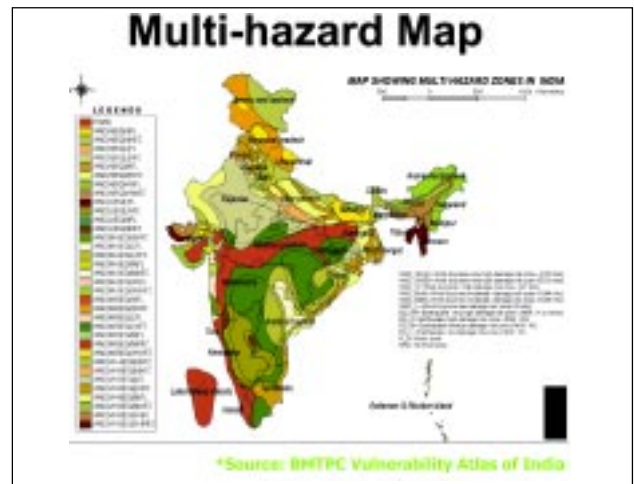
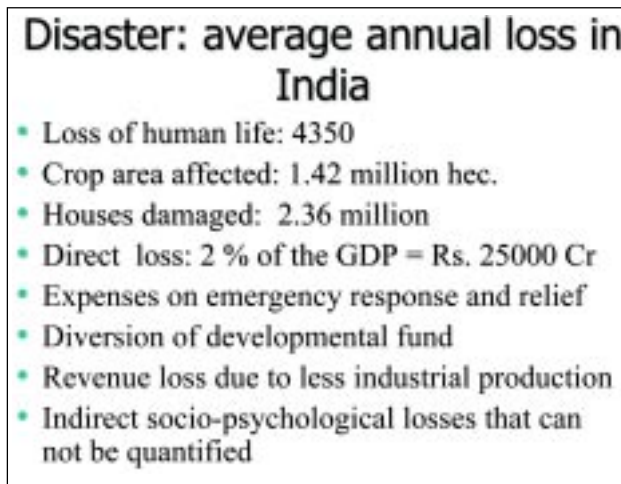
	Asia	America	Europe	Africa	Caribbean	Pacific Islands
Flood	133	35	10	18	2	6
Drought	8	0	0	15	0	0
Famine & Death of food	1	0	0	3	0	0
Tropical cyclone	64	13	0	5	11	40
Rain storm, etc.	27	10	1	4	0	4
Earthquake	34	20	22	22	0	4
Landslide	26	20	3	3	1	1
Epidemic	41	16	1	74	0	0
Others	31	21	7	5	1	7



### Annual Average Floods Damages in India

Area Vulnerable	40 million hectare
Land area affected	7.56 Million hectare
Population affected	32.03 Million
Human Lives Lost	1504
Live Stock lost	96713
Houses damaged	1683
Crop damaged	460.07 crore
Public Utilities damaged	377.248 crore





These include diversion of funds, deferring development plans, and loss of skilled manpower.

The socioeconomic cost includes loss of lives, public and private property, access to livelihood, distress sales of poor people's assets, adverse effects on local-state-national economy, damage to environment and biodiversity, violence and discrimination against women, malnutrition and increase in school dropouts, and psychosocial trauma and stress.

There have been changes in the concept of vulnerability recently, and this requires a new approach. India has a different vulnerability profile and each disaster affects the other. The poor are the most affected as they are unable to break the cycle.

Extreme weather events occur more often and are becoming more severe, and vulnerability will increase. Trends in India show that rescue and rehabilitation do not solve problems, prevention and planning are required. Communities must be made more resilient. Strategies and policies must cope with climate change and adaptability and increasing vulnerability. The top-down approach has been left with very minimal impact. A proactive risk reduction bottom-up driven approach is required and the government should work as a facilitator, for which political will is necessary. Development and climate must be integrated into hazards and disasters and direct and indirect costs recovered.

Until recently the focus of disaster management was on relief and rehabilitation. This focus has shifted to prevention, mitigation, preparedness, response and recovery. The logical approach to the disaster management cycle should be mitigation as the first priority; rehabilitation and reconstruction must also include mitigation in the disaster risk reduction cycle. In a non-disaster scenario, planning, prevention, mitigation and preparedness are all required to address hazard risks and vulnerability reduction. Only this will be relevant in the context of development and environment sustainability.

Planning requires critical inputs and it is necessary to integrate regional experiences into the global scenario. A global initiative, at the World Conference on Disaster Reduction in 2005, was the Hyogo Framework for Action 2005-15. This framework seeks to

- ensure that disaster risk reduction is a national and a local priority;
- identify, assess and monitor disaster risks and enhance early warning;
- use knowledge, innovation and education to build a culture of safety and resilience;
- reduce the underlying risk factors; and
- strengthen disaster preparedness for effective response at all levels.

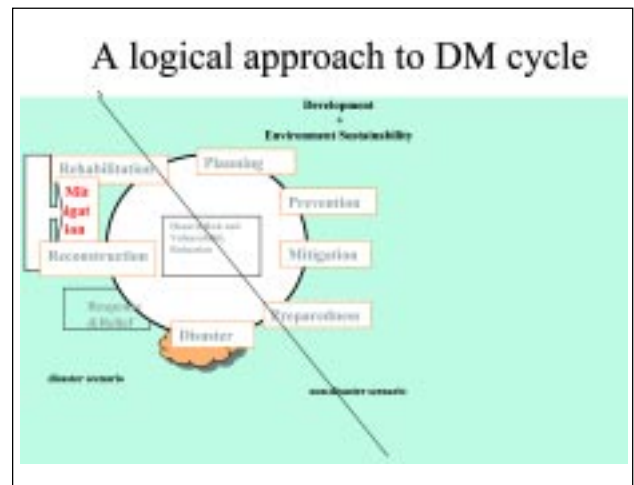
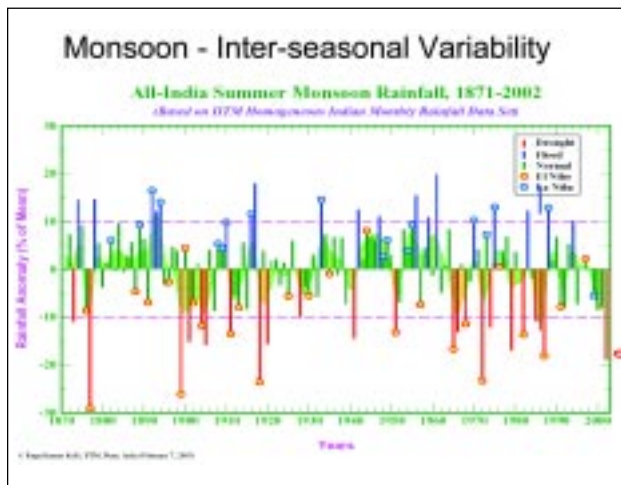
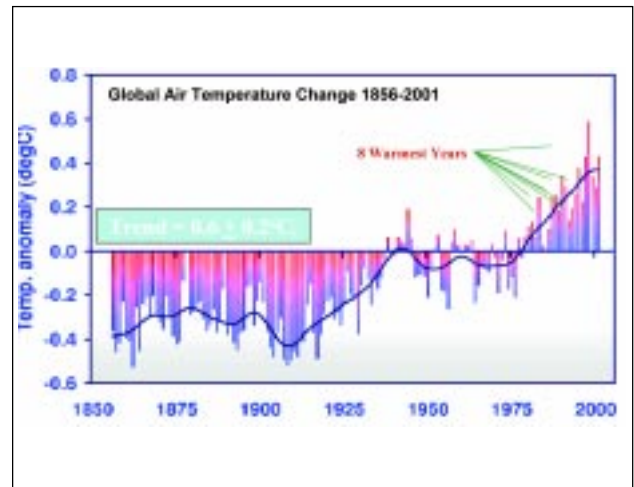
In India, disaster management in the context of development has been included in the Tenth Five-year Plan. There is now a

Trends in India show that rescue and rehabilitation do not solve problems, prevention and planning are required. Communities must be made more resilient

framework, a draft national policy, an act and a national disaster management authority. The National Institute of Disaster Management (NIDM), set up in 2003, provides assistance in national level policy formulation, formulates and implements comprehensive human resource development plans, develops training modules, undertakes research and documentation, and mainstreams disaster management in education at every level.

## Local approach

The scientific method of dealing with water is hydrology. However, local communities use different methods to forecast climate. Holes are dug and women place jewels in them. If the jewels sink, they predict water scarcity. Children playing in agricultural fields, and migration, are also indicators of increased threat perception.



# Development issues in Rajasthan

Rajinder Singh, *Tarun Bharat Sangh (TBS)*

**D**isaster has both direct and indirect impacts. In some cases the indirect influences are as severe as the direct. In Rajasthan, it has been observed that the psychological aspects of famine are, in some cases, as bad as its actual physical effects. There have been advances in technology, and the extensive use of some of these advancement for economic development has increased the pressure on nature. The scenario of disaster has changed; it no longer includes only events caused by nature. Development has led to exploitation of natural resources, and development using inappropriate technology is a major cause of disasters.

Rajasthan has been left behind both in terms of development and the protection of its natural resources. Man's relationship with nature must be changed and this change can alter the entire scenario. Development should be through society-based and decentralized systems. This is now being attempted through the Panchayati Raj system of local government institutions. As environmental destruction generally starts from causes at local levels and then grows to have large impacts, improvement

must also start at a local level even if the ultimate objective is to have a global impact. As a result, decentralization is essential to address the location-specific roots of larger problems. But there are vested interests against this improvement of communities and society.

As environmental destruction generally starts from causes at local levels and then grows to have large impacts, improvement must also start at a local level even if the ultimate objective is to have a global impact



# Key points raised in the discussions

## Session–1

**1. Decentralized Policy.** The highly localized dynamics of water systems and adaptation options will necessitate decentralized strategies to address climate change. Policies for responding to droughts, floods and disasters must match with emerging realities. Local actions are fluid and versatile. Therefore, community-driven, decentralized, natural resource management systems need to be revitalized. In India, local initiatives have been very successful. However, there should be a national model. The government has realized that decentralized structures like the *pachayats* have an important role to play in community-based initiatives. Approaches for integrating climate considerations into action within the water sector are also essential. As a result, water specialists need to be involved in the development of strategies for supporting adaptation. In some cases, this will require action at the central level. To achieve this, strategies for connecting decentralized and central action need to be developed.

**2. Capacity Building.** To provide services and protect the interests of the people, the government must find mechanisms to enhance community development and build skills of vulnerable communities. Vulnerable communities also include those, such as farmers who depend on climate sensitive sources of irrigation water, who may be unable to adapt to situations where water availability is likely to decline.

**3. Dialogue.** In many situations the current “dialogue,” over climate and water management is, in reality, a monologue – it is not two-way communication. In the current, regional geopolitical situation, knowledge exists at multiple levels and these levels need to be addressed in more ways than one. Therefore, it is necessary to create a forum in which diverse views can be effectively expressed, communicated and responded to, that is, to enable a “dialogic dialogue.” Experience has shown that authoritative, top-down approaches do not work, and

when this is attempted dynamic dialogue cannot take place. Civil society has included this factor in their approaches. However, there is a lack of will at the state level to initiate changes. Dialogue is necessary, because isolated local initiatives and partial governmental actions will not be able to address the multiple factors that create risk in relation to climate change. In addition to the need for broad-based dialogue on climate per se, similar forms of dialogue are needed to address other risks and issues such as disaster management. At present, there is no management model to ensure that institutional mechanisms for such dialogue are built at the local level. Most responses to climate and disaster have used top-down approaches.

**4. Convergence.** Solutions to complex problems such as those likely to emerge as a consequence of climate change require the convergence of knowledge and institutional mechanisms across sectors and scales. Risks and perspectives are different at the community and government levels and in the water and other sectors. It is necessary to deconstruct and reconstruct problems with community perspectives in mind in order to identify potential solutions. While searching for institutional mechanisms, it is important to recognize that new institutions, such as insurance, are emerging that can serve as a foundation for catalyzing convergence across sectors. Similarly, approaches that use post-disaster reconstruction activities to reduce future risks are increasingly recognized as important institutional mechanisms to address adaptation needs.

**5. Approaches.** Dialogue has to be established between professionals and non-professionals and across different sectors in order to develop effective approaches to respond to complex problems such as climate change and disaster. The gap between those involved in developing approaches or strategies and those directly involved in implementation

activities has had a major impact on situations such as the recurring floods in Bihar and drought in Rajasthan. Concepts are available to address these endemic problems – but they rarely reflect the field realities under which implementers work. Similarly field implementers are often operating without any larger strategic vision. Overall, improving the link between academic knowledge and practical knowledge is very important. In Nepal, all sectors worked together on recent issues, such as the report of the World Commission on Dams, and arrived at a broad approach, applicable to everyone. Convergence between sectors can be structured through dialogue and education. At present, courses of action within different sectors or

organizations – government, funding agencies, NGOs and the private sector – are often repetitive and water centric. The majority of disasters, today, are floods and droughts and most responses are water-centric. Avenues for responding to such disasters, however, cross many sectors in addition to water, and for convergence to occur, both dialogue and extensive social (as well as physical) scientific knowledge is needed by water managers. As a result, educational inputs are required in the water sector. This will need new training material and the building of a long-term corps of “water” professionals which is able to engage in dialogue across sectors.

# DAY-1

## Session 2

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# Understanding vulnerability: implications for community-led adaptation

Sara Ahmed, *Independent Researcher*

## ABSTRACT

The growing frequency and magnitude of the impacts of climate variability such as droughts, floods, storms and extreme events pose enormous developmental challenges for poor and vulnerable communities, particularly in developing countries. Although poverty is a core dimension of vulnerability – all poor people are vulnerable – not all vulnerable people are poor. Poverty measures the current status of deprivation: the lack of access to resources (material, political, cultural) and capacities necessary for full participation in economic and social life. Vulnerability, on the other hand, is a more dynamic concept than poverty as it captures the changing degree of susceptibility to loss caused by exposure to disaster or unequal risk of individuals, communities and systems. The contextualization of climate change within *everyday*, overlapping “geographies of vulnerability” recognizes the role of pre-existing, interlocking systems of physical and social space in structuring vulnerability. That is, *where* small and marginal farmers reside in a flood-prone village in Eastern Uttar Pradesh is as important to our understanding of vulnerability as the intersection of gender and caste as determinants of *who* has access to *which* water during drought in Gujarat or Rajasthan.

However, while the concept of vulnerability is important as it draws attention to the multiple dimensions of deprivation, including social exclusion, gender and human security, and to established patterns of coping and resilience, there is no consensual definition or agreed approach to its operationalization. Vulnerability assessments typically raise questions of *what* to measure, *how* (instruments and indicators), *by* and *for whom* on the one hand, while on the other, the political expediency of disaster mitigation, planning or rehabilitation does not adequately take on the discourse on vulnerability. In this institutional vacuum, praxis (or the linking of knowledge to practice through institutional design) becomes important. Civil society actors are increasingly recognized as a bridge between scientific and social research, policymakers, planners and communities at risk. But while multidisciplinary collaborations and interdisciplinary approaches are no doubt necessary, critical questions remain about the capacity of development organizations to understand

Although poverty is a core dimension of vulnerability – all poor people are vulnerable – not all vulnerable people are poor

vulnerability, facilitate adaptation, and develop strategic partnerships with the state at different levels.

Drawing on insights from policy and field research on adaptive strategies in South Asia, this paper looks at the political economy of vulnerability underlying community-led adaptation. What are the different strategies which NGOs, for example, as one set of civil society actors, have used to *enable* vulnerable communities, particularly women and the socially excluded, to diversify livelihoods, access resources, information and services? How effective have such strategies been not only in terms of developing empowered and resilient communities but equally in addressing the larger concerns of human security, rights and entitlements as well as engaging with the state and questions of governance in linking the disaster-climate change-development continuum?

**V**ulnerability is said to be a multidimensional concept based on specific change.

There is internal change that deals with coping and external change that deals with risk impact. However, there is no consensual definition or approach to understanding vulnerability. It defines essentially the ability of a community, household or individual to anticipate, cope with or adapt to an external risk, whether environmental, socioeconomic or political.

Vulnerability is multidimensional, differential, scale dependent and context specific. It is a dynamic concept that portrays a changing degree of susceptibility to loss by exposure to disaster by individuals, communities and systems.

The formal methods for coping with internal aspects of vulnerability include the crisis and conflict theory, models of access to assets, and action theory approaches. The methods for dealing with external aspects of vulnerability are political economy approaches, human

ecology perspectives and the entitlement theory.

### Three types / patterns of vulnerability

1. Physical or material vulnerability includes the location of community settlements in hazard-prone areas that lack infrastructure such as roads or disaster-proof shelters and where there is little access to information or communication services and lack of control over productive resources such as credit or land.

2. Social factors that increase vulnerability are lack of skills, knowledge, literacy, time and other personal endowments, along with poor institutional structures of the family and community, and power relations. Governance and decision-making, including conflict resolution, are also social factors that affect vulnerability.

3. Psychological/attitudinal factors that affect vulnerability are people's resistance toward change, dependency, trauma, lack of social

Vulnerability is multidimensional, differential, scale dependent and context specific. It is a dynamic concept that portrays a changing degree of susceptibility to loss by exposure to disaster by individuals, communities and systems

or physical mobility, and lack of self-autonomy.

Vulnerabilities include poverty, though not all vulnerable people are poor. Vulnerability is exacerbated by social exclusion, whether due to caste, gender or by virtue of being indigenous. Women, who often lack access to or control over resources and opportunities, young girls, old people, and those who are physically or mentally challenged are particularly vulnerable.

Measuring vulnerability is complex – the what, how, by and for whom aspects have to be factored in. The predictive analysis only focuses on current circumstances rather than prospects for recovery. Measuring vulnerability must take into account quantitative (secondary goals) and qualitative (narratives of change) indicators. Several models have been developed, including disaster risk index projects at the global level, hazard or risk mapping and economic analysis at the national or regional level, and assessing participatory capacities and vulnerability tools at the community level. Measuring vulnerability, therefore, requires an intersectional analysis and multidisciplinary tools.

### Addressing vulnerability

The core challenge for development policy is to build the adaptive capacity and resilience of disaster-prone communities. While some adaptation is self-driven and includes migration, social networks and individual risk-taking capacity, households and communities require access to skills, assets and

other resources necessary to adapt to ongoing change processes and to restructure their livelihoods.

The role of civil society actors, including non-governmental and community-based organizations, is important in building the adaptive capacities of communities. Some insights from water-stressed environments are cited below, for which a process approach was used to enable and empower the communities:

- Supporting livelihood diversification (non-farm enterprises, skills, access to markets)
- Facilitating access to resources (credit, loans and insurance, often through SHGs)
- Developing physical infrastructure (housing, community shelters, participatory risk mapping)
- Facilitating community natural resource management institutions

### Challenges

Disasters need to be treated as an opportunity for transforming unequal power relations and structures. The operationalizing of the concept of vulnerability must use simple and practical indicators to link science and society. There is a need to move beyond community/family approaches to the household as a disaggregated unit of analysis and understand gender and generational inequity. Human security and human rights must be addressed. Lessons learned, strategic partnerships, and advocacy must be promoted while mainstreaming vulnerability discourse in disaster management policy.

Disasters need to be treated as an opportunity for transforming unequal power relations and structures. The operationalizing of the concept of vulnerability must use simple and practical indicators to link science and society

# Successful adaptation to climate change in South Asia critically depends on regional collaborative research for interdisciplinary water systems knowledge

Jayanta Bandopadhyay, *Indian Institute of Management (IIM)*

**T**he economic importance of the Himalayan water systems for South Asia is well established. Hydrological changes expected in these water systems due to climate change is also becoming increasingly clear. The draft papers of the Fourth Assessment Reports of the Intergovernmental Panel on Climate Change have strengthened the earlier assessment that the hydrological changes caused by climate change on the Himalayan water systems will be quite significant – various scenarios have indicated the extent of such changes.

The Himalayan water systems feed several large international rivers, notably the Brahmaputra, the Ganges and the Indus. A comprehensive, eco-hydrological understanding of the water in these large river basins has been obstructed by hydro-nationalistic approaches so characteristic of the countries sharing Himalayan rivers. This has led to imposition of

restricted access to hydrological data which in turn has led to a stagnation of comprehensive scientific knowledge on these river systems. Based on a narrow and confidential knowledge base, governments in South Asia have undertaken major structural interventions in these rivers, and many regional water transfer projects between these rivers are being discussed and proposed of which the interlinking of rivers in India is one.

The present gaps in the comprehensive knowledge base on these rivers have, by itself, been the reason for friction and disputes over the river waters among the different governments. In order to manage these rivers toward achieving the Millennium Development Goals, the governments of the region will have to undertake collaborative research and joint action, and the issue of adaptation to climate change needs to be internalized in such an action. There have been

several initiatives toward this, but with little effect. There is a critical role for a systemic knowledge base and collaborative development of the Himalayan rivers. Adaptation to climate change cannot be addressed successfully without regional collaboration in water systems research.

Such a knowledge base would create diverse possibilities for adapting to climate change. The lack of interdisciplinarity in the individual national management of these rivers has, for example, led to suboptimal use of the recurring floods and to viewing extreme events only as disasters. Both floods and droughts in South Asia are expected to intensify and become more frequent with climate change. In the context of the Himalayan rivers, an ecological understanding of floods and droughts is required to manage and adapt to them, and, for this, regional, multinational collaboration and research is necessary.

# Livelihood services for rural migrants in South Rajasthan

Sudhir Katiyar, *SUDRAK (Aajeevika Bureau)*

**L**arge-scale migration is a reality. It goes largely unreported and there is no verified census of rural to urban migration. Official policy on migration does not exist. Although short-term migration for wage labor is rapidly emerging as the dominant mode of labor in the unorganized sector, it remains an area of neglect in development policy. The poverty alleviation strategy of the state revolves around natural resource development and promotion of off-farm income generation activities in rural areas. Urban public opinion is downright hostile to the plight of migrant workers.

South Rajasthan lies at one end of a tribal belt that stretches from Khandesh in Maharashtra through Gujarat and Madhya Pradesh. It is inhabited mainly by the Bheel tribe. Most of the area is hilly with very little fertile land and no coastal area. The only activities are mining and tourism. Livelihoods are under stress due to a poor agricultural base: small land holdings, semiarid conditions, and a recent history of heavy deforestation. There is inadequate fodder or water for livestock, and pastures are degraded. Employment outside the farm sector in the region is

negligible – seasonal migration for wage labor has become an annual feature.

Migration is no longer a response to extremes such as drought. It is estimated that there are 80 million seasonal migrants every year. Adult males are the primary migrants; however, whole families also migrate every year with children in tow. These migrants undertake low-end, low-value, unskilled, hard and risky manual labor in farms, factories, ports and urban centers. They are poorly paid, have no job stability or social security, and work throughout their productive adult life before going back to their

Migration is no longer a response to extremes such as drought. It is estimated that there are 80 million seasonal migrants every year



*Low value, unskilled manual labor in urban centers*

villages. They live in crowded shelters with inadequate toilets, water and health facilities. They work long hours, suffer from loss of freedom, and have no communication with their families. They frequently get into debt, are exploited by intermediaries, employers and contractors, and have no legal recourse.

In the textile markets of Surat, for example, migrants are engaged at all levels as traders, wholesalers, agents, salesmen, accountants, labor contractors and workers who cut and drape raw cloth. Large numbers of tribal adolescents are also employed in this textile market. In the cotton fields of North Gujarat, it is estimated that hundreds of thousands of adolescents aged 8 to 14 years, both girls and boys, are employed for three-month periods during which they live in the fields. Recruitment is carried out by local agents in villages who offer cash advances to parents in exchange for their children's labor. There is significant movement of child labor from all border areas across this tribal belt.

The Aajeevika Bureau was formed in early 2004 with a small start-up grant as an institutional response to the high level of migration among the rural poor in Udaipur district in South Rajasthan. Aajeevika Bureau's overall mission is to substantially upgrade and improve labor- and migration-based livelihood opportunities for rural poor households in South Rajasthan. Its major areas of involvement are:

- training and upgrading unskilled

migrant youth in new and higher value skills so that they are able to earn higher incomes;

- placement and job search services for migrants and laborers;
- registration, preparation, tracking and photo-identity services for migrants;
- financial services for seasonal migrants;
- destination services, particularly for migrants in Gujarat; and
- research into migration patterns and processes across various blocks of South Rajasthan in order to better define interventions at scale.

Seven hundred migrants are registered with Aajeevika Bureau for whom photo-identity cards have been provided.

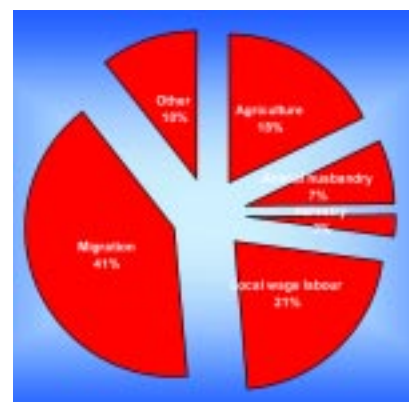
### Lessons learned

- Migration is growing and needs urgent attention
- Rapid training of unskilled migrants is possible
- Migrants need information, counseling and placement assistance to get started in new labor markets
- Social networks in new occupations are essential to enable mobility
- Schooling and improving the learning environment can help prevent early child migration
- The number of organizations working with migrants needs to increase rapidly and these should broaden the scope of their activities
- Migrant laborers need government support and social security measures for long-term protection.

## Migration facts

In a study of 810 households in 68 villages across South Rajasthan, almost 75 percent of households reported migration. Migration generated 41 percent of household income compared to 18 percent from agriculture.

Migration is rapidly increasing amongst children, who drop out of schools in order to work – it is estimated that hundreds of thousands of adolescents, boys and girls, are currently employed as migrant labor.



Migration contributes significantly to household income



Aajeevika Bureau's migration photo-identity card

# Adaptation research: scalar and disciplinary aspects

Preety Bhandari, *The Energy and Resources Institute (TERI)*

## ABSTRACT

The first generation of adaptation research was very linear in nature and focused primarily on impacts, beginning with development of emission and climate change scenarios, leading to determination of impacts and identification of adaptation options. It resulted in a macro-level assessment of regions, resources and sectors impacted, and a broad analysis of policy options. This, however, has evolved into an approach where vulnerability is central, and adaptation is considered in response to economic, social, political and environmental circumstances, requiring a multidisciplinary analysis as also a finer resolution of assessments.

In this context, The Energy and Resources Institute (TERI), Centre for International Climate and Environmental Research (CICERO), and International Institute for Sustainable Development (IISD) undertook a study based on the concept of double exposure, mapping the dual impacts of climate change and economic globalization on different regions in the country at the macro level and different social groups at the micro level. After developing the vulnerability profile of the agriculture sector in the country, with the district as the spatial dimension, five case studies were conducted in “doubly exposed” regions to assess coping capacities and their determinants thereof. This work and methodology is now being honed further to assess vulnerability of and adaptation options in two drought-prone and one flood-prone region of the country. At another level, TERI has also initiated research on the role of a specific instrument, that is crop insurance. The relevance of weather-indexed insurance to protect the overall income of farmers, improve their risk profile and enhance access to credit, are issues that are currently being examined in the context of vulnerability to climate variability and climate change. A presentation of key results of these studies will highlight the multi-pronged approach required to further adaptation research.

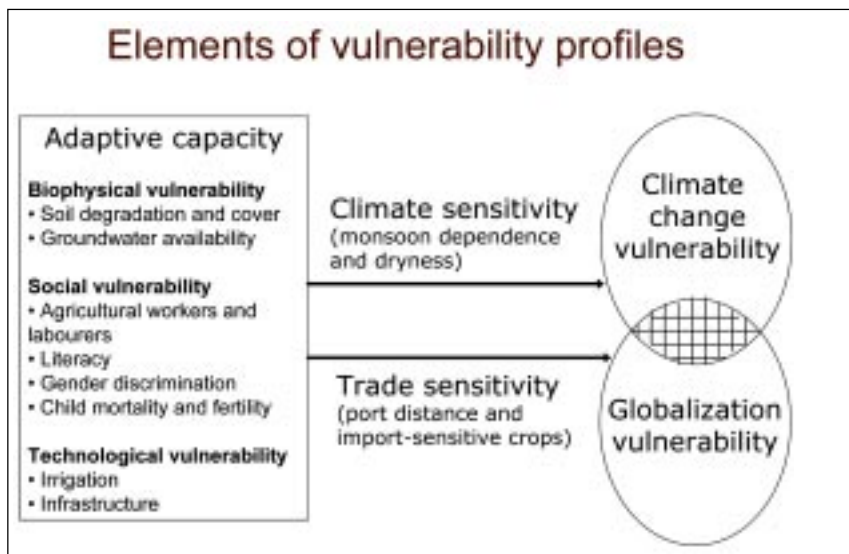
The relevance of weather-indexed insurance to protect the overall income of farmers, improve their risk profile and enhance access to credit, are issues that are currently being examined in the context of vulnerability to climate variability and climate change

**A**daptation research must be impact-driven and use a multidisciplinary approach. Like many research agencies in the world, The Energy and Resources Institute (TERI) has done some adaptation research; two studies are complete.

The first generation of adaptation research was linear in nature and impact-driven. It focused on impacts, beginning with emissions and climate change scenarios, leading to a determination of the physical impacts and identification of adaptation options. It resulted in a macro-level assessment for regions, resources and sectors affected and a broad analysis of the policy options. The response to these impacts is technology-based, market-driven, legislative and institutional.

This has evolved into the second generation of adaptation research where vulnerability is central and adaptation is considered in response to economic, social, political and environmental circumstances, requiring a multidisciplinary analysis and a finer resolution of assessments. Adaptation requires a close look at the complex balance between human and environmental influences, across multiple spatial, functional and temporal scales.

TERI, the Centre for International Climate and Environmental Research (CICERO) and the International Institute for Sustainable Development (IISD) undertook a study based on the concept of double exposure,



mapping the dual impacts of climate change and economic globalization on different regions in India at the macro level, and different social groups at the micro level. After developing the vulnerability profile of the agriculture sector in the country, with the district as the spatial dimension, five case studies were conducted in “doubly exposed” regions to assess coping capacities and the determinants thereof. The micro-scale case studies highlight those who are more vulnerable, the extent of vulnerability, and what makes them more vulnerable.

The elements of vulnerability profiles are adaptive capacity, climate and trade sensitivity that determine vulnerability to climate change and globalization.

Sen’s entitlements and capabilities approach introduces a household perspective on vulnerability where the main contribution focuses on vulnerability of individuals and social groups, where vulnerability

Adaptation requires a close look at the complex balance between human and environmental influences, across multiple spatial, functional and temporal scales



arises largely from differential access or “entitlement” to resources and does not solely stem from an individual’s cash income but is based on other factors such as development.

Studies at Anghora show that access to irrigation and better availability of electricity, health facilities, access to markets (Kota) and transport infrastructure enhance coping options. At Lakhakheri Umat, which is dependent on rainfed agriculture, it was observed that semi and medium farmers were forced to sell livestock – in these areas, livestock is wealth, landless laborers migrated every season, and small and marginal farmers resorted to coping measures that were temporary. There was no long-term adaptive solution.

Adaptive capacity of communities is determined by access to resources – economic and technology, information and skills, infrastructure and institutional support. Financial resources increase adaptive capacities while the lack of resources limits adaptation options. Lack of technology also limits the range of potential adaptation options, and less advanced regions are less likely to develop and implement technological adaptation. Access to information increases the likelihood of timely and appropriate adaptations while the lack of informed, skilled and trained personnel reduces adaptive capacity. A variety of infrastructure can enhance adaptive capacity through a larger number of options; however, the character and location

of infrastructure can also affect adaptive capacity.

Well-developed social institutions help reduce the impacts of climate related risks and advocate policy and regulations that enhance adaptive capacity. An important factor in building adaptive and resilient communities is for the public policies, which influence the behavior of communities, to themselves be adaptive and resilient to uncertainty, change and surprise. Adaptive policies must have the ability to be effective under a range of anticipated conditions and respond well to unanticipated circumstances and longer-term change. While policies and strategies are important, the implementation and how the various actors deal with complexity is also very important.

The insights from an Indian case study research show the evolution of crop insurance from experimental individual scheme in 1972, to pilot crop, comprehensive crop, experimental crop, and a National Agriculture Insurance Scheme to farm income insurance schemes and weather-indexed insurance. Insurance was first linked to short-term credit at a 2 percent premium with a subsidy for small farmers and covered basic rainfed food grains. There was very poor coverage of farmers and a very low premium to claim ratio. After economic reforms in 1998, the National Agriculture Insurance Scheme had higher premiums with the subsidy for small farmers being phased out and an option of covering higher risk at

Adaptive capacity of communities is determined by access to resources – economic and technology, information and skills, infrastructure and institutional support. Financial resources increase adaptive capacities while the lack of resources limits adaptation options

higher premiums. This was extended to non-loanee farmers and included commercial crops.

However, coverage and financial viability still remain as issues. The farm income insurance scheme for wheat and paddy will replace the National Agriculture Insurance Scheme. Weather-indexed insurance involving microfinance institutions and SHGs through village Internet kiosks are being planned.

Traditional crop insurance helps deal with a range of weather conditions though the coverage. Financial viability, adverse selection and delays in payment of claims are difficulties, and small and marginal farmers are unable to access it.

Weather-indexed insurance, which is available in some countries, minimizes adverse selection, eliminates the need to draw up and monitor individual contracts, protects overall income rather than yield of specific crop, improves farmers' risk profile and access to bank credit, and settlement of claims is fast. The role of micro finance institutions is important in weather-indexed insurance.

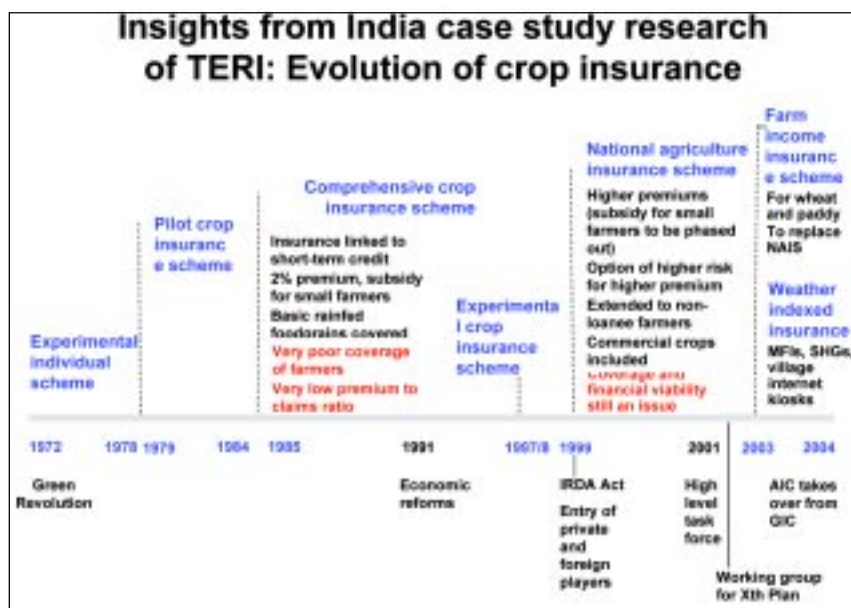
From a development perspective, addressing future risks involves addressing today's vulnerability to climate variability and planning for impacts to enhance the resilience of people, communities, countries and regions.

The development agenda for climate change must establish research and development priorities, fortify current coping capacity, use insights gained from case study

approaches, understanding impacts at individual and community levels rather than at sectoral or regional levels, and designing appropriate policies that enhance the adaptive capacity at the individual and community level and the relevant roles played by voluntary agencies, corporations and the government.

This work and methodology is now being honed further to assess vulnerability and adaptation options in two drought-prone and one flood-prone region of the country. At another level, TERI has also initiated research on the role of a specific instrument – crop insurance. The relevance of weather-indexed insurance to protect the overall income of farmers, improve their risk profile and enhance access to credit are issues that are currently being examined in the context of vulnerability to climate variability and climate change. These studies highlight the multi-pronged approach that is required to further adaptation research.

Insurance and related financial mechanisms are essential tools to assist communities in adapting to climatic variability and change



# Key points raised in the discussions

## Session–2

**1. Migration as adaptation strategy.** Migration is a core strategy communities and households use for adapting to problems within local livelihood systems and responding to emerging opportunities in other areas. There are different types of migration on different scales and resulting from differing causes. The factors underlying migration are often complex. In some communities, migration is a tradition. In other regions, people migrate either for better lives or for livelihood sustenance. Major distinctions exist between migration that comes about as a response to new economic or other opportunities and forced migration. In Rajasthan, there are areas where agriculture is no longer viable and so people migrate. Migration also expands the scope of adaptation through livelihood diversification. It is therefore important to study the causes of migration. Migration occurs from rural to rural as well as rural to urban areas and migrants tend to disregard national borders, some of which are only 50 years old, in the South Asian region. Therefore, strategies to cope with migration will have to cut across borders.

**2. Policy and planning on migration.** Planning to address the issue of migration needs to take into account all the factors leading to migration. Official estimates of migration are significantly lower than actual numbers. Urbanization policies also need to be examined – the government should consider establishing suburban towns to accommodate migrants.

**3. Adaptation as evolutionary process.** At the local level, the macro implications of climate change are not well understood. Therefore, strategies for supporting adaptation need to evolve according to needs as they emerge at local levels.

**4. Stages of adaptation research.** The first generation of adaptation research has generally taken a top-down approach and focus has been on identifying the impacts of climate change on regions. This generation focused primarily on macro- or regional level issues. As a result, understanding of adaptation issues across communities has been relatively weak. Important aspects at the local levels include changes in the natural system impacting communities, location of human settlements and livelihood issues. Differential vulnerability and adaptation strategies across socioeconomic, gender and community groups are also important. A second-generation approach to adaptation using bottom-up research methods and perspectives is now beginning to emerge. Ideally, the two approaches need to be integrated.

**5. Developing effective adaptation strategies.** Both new and traditional knowledge drawn from diverse situations need to be tapped for the development of effective adaptation strategies. Criteria for evaluating the effectiveness of adaptation strategies also need to be developed, particularly in relation to longer-term aspects that are designed to reduce risk. Most current development and disaster relief programs focus only on immediate “tangible” indicators that may have little to do with longer-term adaptation objectives. For example, after the tsunami, the only concern was “how many lives did you save?” Nobody asked whether or not the risks facing survivors had been reduced in the process of rebuilding livelihoods. Unless adaptive responses are supported and criteria necessary to evaluate them are prepared, focus will remain on short-term indicators that only measure immediate relief. Sustained pressure from the international community and professionals is needed to address such issues when dealing with water resources.

# DAY-1

## Session 3

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# Flood control where technology gets stuck: a case study of the Ganga-Brahmaputra Basin of India

Dinesh K. Mishra, *Barh Mukti Abhiyan*

**F**loods of different magnitudes have occurred in different locations in India.

In Tamil Nadu, Gujarat and Mumbai, they are considered extreme events. In Bihar, however, floods occur every year and people have learned to cope. Structural interventions (there are 8 measures) used for flood control include:

- embanking of rivers;
- construction of ring bunds along settlements;
- raising the ground level of settlements;
- re-sectioning and increasing discharge carrying capacities of rivers;
- construction of large dams;
- straightening of meandering rivers and increasing flow velocity;
- inter-basin transfer; and
- development of detention basins.

Unfortunately, all these interventions have a hidden environmental cost. Politicians create the impression that once these interventions are made, the area will be freed of problems.

The adverse impacts of flood control become visible much later and the mistakes are often repeated elsewhere. Sometimes when the technology fails to meet the

aspirations of the people, regulatory methods to limit habitations and development of infrastructure are suggested. Enforcing regulations are not taken up seriously and the flood problem persists. It also defines the regulatory methods of minimizing the impact of floods.

People have developed their own coping mechanisms to deal with floods, over generations, as natural floods have been an annual event. Using technology alone to deal with floods will not help. The solution is to incorporate local knowledge and experiences into scientific techniques and methods.

Contrary to common belief, farming started on hill slopes where rainfall met requirements for crops. As perennial sources of water were felt necessary for farming, people moved closer to rivers. Fishing was an additional benefit. As farming along rivers gained momentum, the land became vulnerable to floods. While normal floods helped the crops, the abnormal ones harmed them. This led to the search for non-monsoon crops. These crops yielded a good harvest as the river would revitalize the land by spreading fresh silt every year during the rainy season and the

moisture content of the soil would be enough to meet the water requirements of the crops throughout the year. Thus, in the years of abnormal flooding, any damage to the monsoon crops would be suitably compensated by a rich harvest of winter crops.

Reckless denudation of forests cleared the flow path of rainwater and it took less time to reach the streams. The grip of trees and plants on the adjoining soil weakened, making its erosion easier. The subsequent deposition of the eroded soil in the riverbeds made them shallower, and this reduced the discharge carrying capacity of the rivers. They started spilling over their banks more frequently and floods became a common feature.

Preventive measures are dependant on the political will of the time. If politicians do not want to adopt a certain measure in a certain area at any given time, engineers devise valid reasons for the decision. The solution probably lies in combining the experience of people living in the plains who have developed coping mechanisms to the floods with technology, and it is hoped that someday this combined strategy will be taken.

# Responding to water scarcity and floods

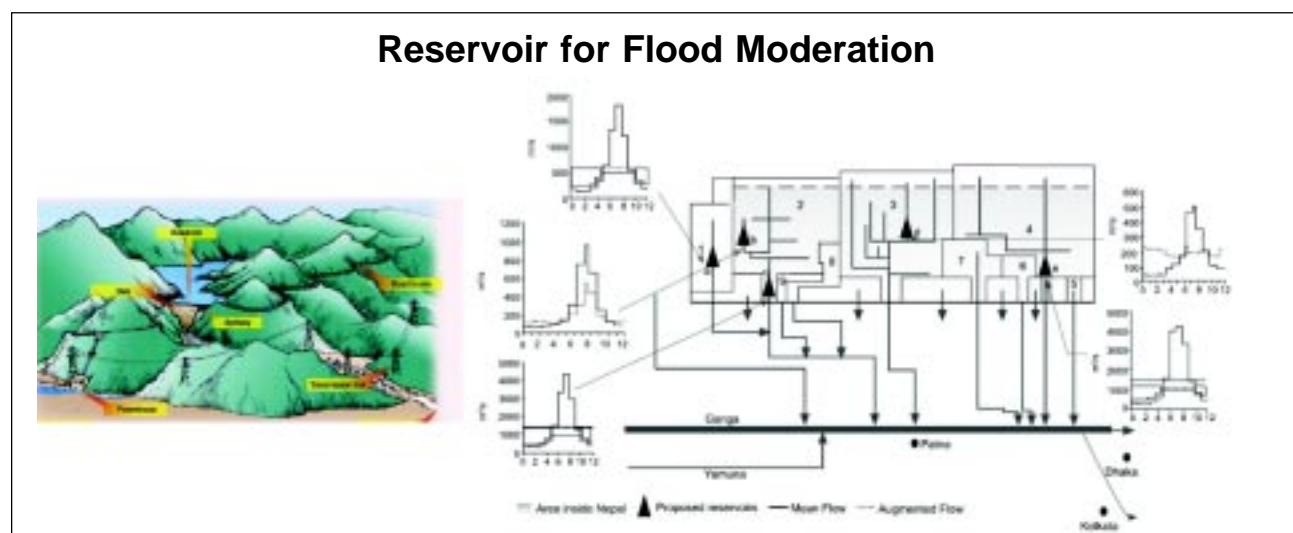
Ajaya Dixit, Nepal Water Conservation Foundation (NWCF)

Disasters caused by too little and too much water are unresolved problems of development. There is a link between disasters and conditions in society during “normal times.” Understanding this link is essential for identifying the causes and effects of disaster – and how to deal with the situation created by water scarcity as well as that by its excess. If we understand and give emphasis to the link between disasters and conditions in society during “normal times,” there is greater room for the strategy of intervention to be appropriate to the situations of both floods and scarcity. All water related activities, at the regional and community level should heed to mitigating and

preventing stress caused by water. Such an approach should have a bearing on identifying priorities for securing development and determining how these are to be carried out. We need to know more about people who are victims of such disasters. Their position in social, political and economic conditions in normal times is important to understand how scarcity of water and floods affect them.

In order to control floods, the Himalayan Ganga water has to be stored in mountain dams and reservoirs built for flood moderation. Most reservoirs are in the hills; in the south, reservoirs are not possible and embankments can

If we understand and give emphasis to the link between disasters and conditions in society during “normal times”, there is greater room for the strategy of intervention to be appropriate to the situations of both floods and scarcity



be and are constructed. However, this does mean that floods are eliminated, and yet, flood water has to somehow flow to the sea. In 1993, the Bagmati Barrage was built, designed for 8,000 cubic meters of water per second. At that time, various figures were studied. A barrage design, which had been prepared for 11,000 cubic meters per second was not used as the figure was considered an outlier. There followed a flood with a flow of 15,000 cubic meters per second which the barrage could not withstand.



Social realities determine why certain groups are more vulnerable to scarcity and excesses of water while others are less vulnerable. Who has access to power and resources of various types, and thereby who has more access to material benefits, and who has more control over their own lives, is a major determinant in deciding the extent of vulnerability. These relationships are defined by social institutions. These can be formally stated between individuals, within households and families, between classes and groups, and between other social organizations. They could be informal, based on traditional practices. Inequalities between classes, ethnic groups and gender categories are often a result of, and reinforced by, these social institutions; they do not easily go away.

It is important to analyze these relationships in society in normal conditions to understand the degree of vulnerability of different sections of the population to disasters. For

effective long-term management of risks, we must develop strategies to first understand how these institutional functions interrelate with each other. This can help us to bring about gradual changes to understand why people become vulnerable, and how it could be reduced. Institutional issues lie at the root of strengthening the community's capacity to cope with the situation of water scarcity and floods. Such understanding should be part of any intervention to ensure security from scarcity of water as well as flood.

Due to their disruptive effects on societies, the situations of water scarcity and floods provide opportunities for changing existing relationships and to make basic changes in the way we tackle such problems. Such situations also offer opportunities to develop new institutional structures through which disadvantaged groups can be better prepared to the extreme water situations.

Institutional issues lie at the root of strengthening the community's capacity to cope with the situation of water scarcity and floods

# Existing coping strategies to climate change and variability: findings from the NAPA stakeholder consultation workshops

Mozaharul Alam, *Bangladesh Centre for Advanced Studies (BCAS)*

The Least Developed Countries (LDCs) are preparing a National Adaptation Programme of Action (NAPA) as a response to the decision of the Seventh Session of the Conference of the Parties of the United Nations Framework Convention on Climate Change (UNFCCC). The annotated guideline prepared by the LDC's Expert Group is being used for preparing the NAPAs, where involvement of different stakeholders, including a multidisciplinary team of experts, government and non-government agencies and local level people has been suggested as an integral part of the preparation process. The Bangladesh NAPA preparation process has organized four sub-national stakeholder consultation workshops as well as a national stakeholder consultation workshop for prioritizing suggested projects to address adverse effects of climate change. In addition, sectoral working groups have organized meetings with various agencies on how to integrate adaptation measures into sectoral policies and plans.

The primary aims of the sub-national stakeholder consultation

workshops were to:

- identify problems related to weather, climate and variability;
- identify existing coping strategies/measures to reduce these risks and impacts;
- see how existing coping strategies/measures can be improved in the future; and
- identify new strategies/measures that can be undertaken in future if existing problems are aggravated.

The key findings gathered from these workshops, meetings and the national consultation include an understanding and knowledge of different stakeholders on climate change and barriers for integration into sectoral policies and plans. Future research questions on the effectiveness of existing coping strategies and measures under a changed condition were also highlighted.

## Constraints

At the sub-national stakeholder consultation, problems were enumerated referring to the erratic nature of rainfall (excessive and untimely) and temperature fluctuations, irregularity in seasonal change, the duration of changes, water logging, early or otherwise untimely floods, reduction in

The Bangladesh NAPA preparation process has organized four sub-national stakeholder consultation workshops as well as a national stakeholder consultation workshop for prioritizing suggested projects to address adverse effects of climate change



## Lessons learned

- Locals are able to identify problems related to climate variability and extremes.
- Communities know the benefits and limitations of existing coping strategies and measures.
- Suggestions for improving existing coping strategies and measures are also valuable, but making concrete suggestions is difficult.
- Communities have limited knowledge of how to cope when problems are aggravated.
- Sub-national stakeholder engagement and consultation was found a very good approach to address context-specific problems.
- Engagement of different categories of stakeholders (men, women, farmers, non-governmental and government agencies) is necessary.
- Differentiation of other environmental and development problems from climate related problems were key difficulties during the sub-national stakeholder consultations.
- The role of a facilitator is crucial for stimulating group discussions and to keep it on track.

freshwater flows, salinity intrusion, and fluctuation/variation in soil and water salinity. Other problems identified were: cyclones, storm surges, tidal floods, lack of access to safe drinking water due to salinity, drought, increased acidity of soil and water, sedimentation in riverbeds, flash floods, localized inundation/floods (due to a collapsing embankment or dam or to sedimentation in the riverbed), intense fog in winter.

### Coping strategies

Existing coping strategies include: shrimp farming (saline and brackish), poly-culture (shrimp and rice farming), salt panning, collecting drinking water over long

distances, rainwater harvesting, keeping land fallow, migration, construction of polders or embankments, afforestation, taking shelter just before a cyclone following the signals, practicing floating agriculture during flooding or the monsoon season, developing of saline tolerant species, establishing shallow tubewells for irrigation to reduce the impact of salinity, planting a variety of crops based on the situation, supplementary irrigation and drainage depending on season and temperature, artificial temperature management such as the use of wet jute bags over a shade, and exhaust fans (to simulate hot weather) or electric bulbs (to create heat during the winter).

Communities know the benefits and limitations of existing coping strategies and measures

## Lessons to be learned

- Improving the effectiveness of existing coping measures and strategies to address both present and future problems.
- Integrating local level needs in planning and project development.
- Since impacts are cross-sectoral, measures also have to be cross-sectoral for which coordination and collaboration with government and non-government entities has to be improved.

# Where is Bangladesh in terms of climate change?

Johny M. Sarker, *Department for International Development (DFID), Bangladesh*

**T**he South Asian region – Bangladesh in particular – is most vulnerable to climate change. Bangladesh has a population of 140 million people living on 147,570 sq km of land, most of which consists of low and flat lands. With a growth rate of 5 percent over the past 10 years, poverty is widespread. The low economic strength, lack of institutional capacity and a high dependence on the natural resource base makes Bangladesh especially vulnerable to climate change.

The most damaging impacts of climate change relate to floods, salinity intrusion and drought. If there is a 1.5 meter rise in the sea level, 17 million people will be affected. The people who live along coastal areas and on islands are among the poorest, and the livelihoods of the majority are dependent on water. The Brahmaputra River rises after rainfall and sedimentation occurs.

Climate change related vulnerabilities in Bangladesh include water resources, sedimentation and riverbed rise, the coastal

zone, crops, agriculture and food security, forestry and biodiversity.

There is a lack of awareness of climate change issues. Climate change impacts are not incorporated into the planning or response process, and there is a lack of adequate knowledge, tools and methodologies. Priority actions at the country level are to increase national level awareness on climate change and build the government's capacity to coordinate climate change issues, integrate adaptation, and implement projects with international responses. Bangladesh has signed the UNFCCC. The Department of Environment has initiated a climate change cell that acts as the secretariat and mainstreams policy in various departments. A National Environment Committee has also been set up. Risks due to climate change and sedimentation are highlighted within the context of how these impact the local level. The National Adaptation Programme of Action (NAPA) is an essential document that encapsulates issues and challenges.

Climate change related vulnerabilities in Bangladesh include water resources, sedimentation and riverbed rise, the coastal zone, crops, agriculture and food security, forestry, and biodiversity

# Key points raised in the discussions

## Session–3

**1. How are stakeholders involved in the National Adaptation Plans of Action in Bangladesh?** In Bangladesh, stakeholders in the NAPA process include government agencies, community-level organizations, farmers' groups and women's groups. In the northeast and southeast of Bangladesh, tribal groups are also involved. Overall, specific efforts have been made to ensure broad-based stakeholder involvement and this has been central to the success of the NAPA process.

**2. What are some of the key adaptive response to climate change in coastal areas of Bangladesh?** The development of floating agricultural systems is one. This first began 40 or 50 years ago when people started working nearer coastal areas. In the southern part of Bangladesh, different agricultural activities are promoted near the coast to reduce climate related risks. Water logging is, however, a problem that will be exacerbated by climate change, particularly the impacts of sea level rise. The coastal policy has sections that deal with climate change.

**3. Substantial experience exists within communities in Nepal for coping with environmental contexts. This experience is relevant for responses to climate change.** In Nepal there is a vast difference between conditions in the hills and the plains. As a result, the strategies local communities follow to adapt their livelihood systems to local conditions is very different. Challenges include steep slopes (which contribute to erosion and sedimentation), extreme events (many of which cross national boundaries), and highly variable patterns of rainfall. Points of particular success in developing strategies for "coping with" or "adapting to" this variability include traditional "variability adapted" water and irrigation systems, cultivation of fruits, and use of renewable energy sources (particularly micro-hydropower).

**4. Collaboration is essential to address the diverse requirements between communities in adaptation.** The definition of disaster is relative. Floods in Bihar and

drought in Rajasthan are regular events. Livelihood systems have been developed that respond to these recurrent events while in other areas similar events would represent true "disasters." As a result, collaboration between communities and external actors is required to identify adaptation needs even where the physical nature of disruption is the same. In addition, at the local level strategies that support adaptation within different communities generally require cooperation and collaboration. Fishermen and paddy growers, for example, have different water needs, and the needs of one are often detrimental to the other. Cooperation and collaboration is the only way toward local solutions. These local solutions can be supported through scientific work that helps identify practical alternatives when strategies conflict.

**5. Local systems.** Communities often remain in disaster-prone areas for a variety of basic reasons including lack of access to alternative land and the presence of livelihood activities that can only occur in such areas. In many situations these communities have developed effective strategies for adapting their livelihoods to local conditions. Such systems of coping or adaptation must be studied and, where appropriate, replicated. Experiences throughout the country and across the region must be studied, documented and shared.

**6. Regional policies are required that support adaptation.** Climate change is likely to increase the occurrence of extreme events such as floods. Responding to this requires changes in policies for early warning and land use. Many issues, such as flooding in the Ganga Basin, cross one or more national boundaries. Policies that enable early warning systems to function at a basin level are essential. Such policy reforms would address immediate problems as well as those associated with climate change. Floods, for example, occur due to a rise in water levels, glacial lake outbursts and snow melting. Communication is vital and governments must realize the value of early warning systems.

# DAY-2

## Opening Session

### Page No

#### Keynote Address

#### ADAPTATION RELATED ACTIVITIES IN INDIA

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Dr. Prodipto Ghosh, *Secretary, Ministry of Environment and Forests (MoEF)*

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#### FROM IMPACTS TO DECISION SUPPORT: THE EVOLUTION OF THE EPA GLOBAL CHANGE RESEARCH PROGRAM

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Mr. John Furlow, *US Environment Protection Agency (USEPA)*

# Adaptation related activities in India

Dr. Prodipto Ghosh, *Secretary, Ministry of Environment and Forests (MOEF)*

Vulnerability and adaptation is a challenge for sustainable development that is often neglected in global debates over climate change. The focus is mainly on mitigation – that is reductions in greenhouse gas emissions. The political level should look at devising means and broadening the scope of vulnerability and adaptation (V&A). To do this meaningfully requires technology, resources and political capital. V&A cannot be separated from sustainable development and this is part of the global challenge.

Occupations of the poor are dependent on climate and, therefore, they are the most vulnerable to climate change. Marginal farmers, the vast majority of the population in India, are dependent on land, precipitation and forest resources that are affected by climate change. Coastal areas are even more vulnerable. The capacity to adapt to climate change therefore must be strengthened.

During the development process there is typically a progressive change. For better livelihoods, the poor move out of primary occupations such as extraction of

natural resources, and into industry, transport and advanced methods of farming among others. As this movement gains ground, vulnerability is reduced.

Direct measures for supporting adaptation and reducing vulnerability include actions such as the protection of water resources, building of cyclone shelters, and preventing spread of vector-borne diseases. Support for such courses of action are already in place. However, there is a huge gap in the amount of resources spent on mitigation and the amount used for adaptation, and the challenge is to increase development resources to address adaptation. Strategies for supporting adaptation need to strengthen and build on existing activities.

Globally, the Clean Development Mechanism (CDM) has become operational. Mechanisms such as carbon markets have been developed that enable technology and financial resources from the private sector to be harnessed for mitigation. It is much more difficult to harness non-governmental resources for financing direct measures to support adaptation. Building support for investments in

During the development process there is typically a progressive change. For better livelihoods, the poor move out of primary occupations such as extraction of natural resources, and into industry, transport and advanced methods of farming among others. As this movement gains ground, vulnerability is reduced

adaptation is also complicated because climate models are unable to reliably quantify specific change in climate parameters, especially on a disaggregated scale. This also makes it difficult to estimate the incremental costs of adaptation.

What has India been doing to support adaptation? India, and South Asia, have a high degree of natural variability of climate, and climate sensitive occupations are dependent on the annual monsoons. These often differ in quantity of precipitation, its timing, and spatial distribution. There are various existing programs which seek to reduce dependency on the monsoon, address drought (there are large drought proofing programs) and its impacts on agriculture, control vector-borne diseases and provide cyclone early warning and protection. Adaptation to climate change can be incorporated into these programs at a marginal cost. New programs that focus on climate variability and change will require time and substantial financial resources.

COP-11 identified areas of dialogue to address scientific, economic,

social and political challenges. Developing countries should continue to focus on vulnerability and adaptation within the broad concept of sustainable development. Ultimately, legal and financial commitments supporting adaptation will be required.

### Constraints and issues

**Traditional coping strategies:** In response to a question on the role of traditional coping mechanisms, Dr. Ghosh responded that people have various adaptive strategies developed over time. Traditional strategies for coping with natural variabilities are not, however, enough to address climate change. Traditional strategies relate to traditional occupations. As people move out of traditional occupations (for better lives) these strategies lose relevance.

**Policy perspective on adaptation:** India has a draft environment policy. There is a chapter on adaptation. It has broad approaches to climate change. Adapting new strategies does not mean additional programs – it is more viable to increase the scope of existing programs.

Traditional strategies for coping with natural variabilities are not enough to address climate change. Traditional strategies relate to traditional occupations. As people move out of traditional occupations (for better lives) these strategies lose relevance

# From impacts to decision support: the evolution of the EPA Global Change Research Program

Mr. John Furlow, *US Environment Protection Agency (USEPA)*

## Introduction

The US Environmental Protection Agency (EPA) is dedicated to evaluating the potential consequences of global change on air quality, water quality, ecosystems, and human health in the United States. The program works to improve the scientific basis for evaluating effects, risks and opportunities presented by global change in the context of critical stressors. The EPA-Global Change Research Program (EPA-GCRP) conducts research and assessments in each focus area, and it also supports three regional, stakeholder-driven assessments. These studies provide adaptation options that can improve societies' ability to effectively respond to risks and opportunities associated with global change and, ultimately, increase the resilience of social and ecological systems.


This presentation highlights an evolution in the EPA-GCRP's approach to providing information and tools for enabling stakeholders to better incorporate considerations of climate change into their decision-making processes. Our experience with a regional

assessment in the Great Lakes provides an example of the evolution taking place within the program.

## Great Lakes Regional Assessment

The EPA-GCRP is a member of the US Global Change Research Program (USGCRP). The US Global Change Research Act of 1990 established the USGCRP\* and requires periodic assessments of the state of climate change research and of the possible consequences of climate change in the United States.

### The Great Lakes Regional Assessment: Potential Impacts of Climate Change



**Organized by Issue**

- **Water Resources**
  - water levels and recreational boating
- **Aquatic Ecology**
  - streamflow, fish population, primary productivity
- **Terrestrial Ecology**
  - vegetation, forest distributions, bird migration
- **Agriculture**
  - alfalfa, maize, soybean production
- **Quality of Life**
  - respiratory health, winter recreation, tourism, rural landscapes

\* The USGCRP was incorporated into the US Climate Change Science Program in 2002.

The USGCRP conducted the first round of assessments from 1997-2000, focusing on 19 regions and five sectors (agriculture, coastal and marine resources, forests, human health and water resources). Each of the federal agencies comprising the USGCRP partnered with an academic institution to conduct one or more of the assessments.

EPA took the lead on the Great Lakes, Mid-Atlantic, and Gulf Coast Regional Assessments as well as the Human Health Sector Assessment. Some of this work continues today, such as the EPA's ongoing Great Lakes Regional Assessment.

In the Great Lakes, EPA worked with a multi-institution team led by Michigan State University. The first round of the assessment considered the potential effects of climate change and variability in the context of non-climate stressors. The Michigan State team addressed four questions:

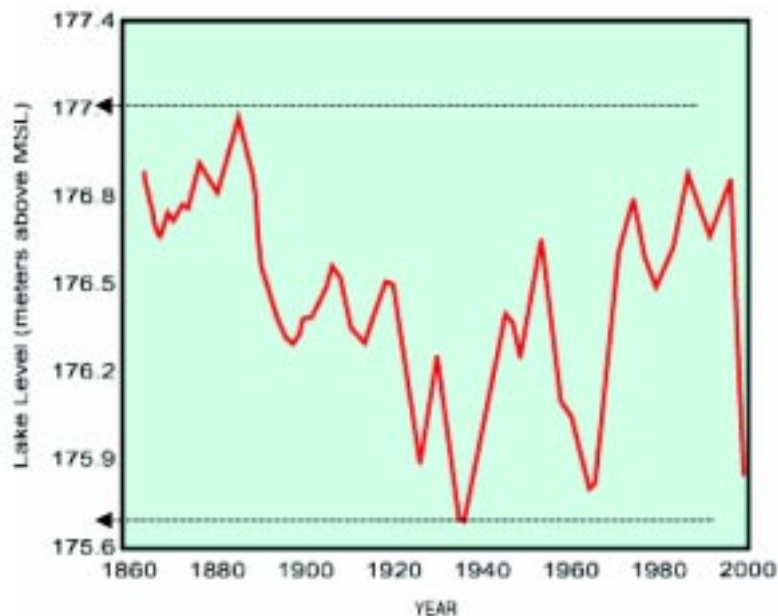
- a) What are the current environmental stresses and issues of concern in the region?
- b) How might climate variability and change exacerbate or ameliorate existing problems, and what new problems might arise?
- c) What are the key research and information needs of the public and decision makers?
- d) What adaptation options are there to take advantage of opportunities and lessen the negative impacts of climate change and variability?

The assessment team relied on stakeholder involvement to ensure

that research addressed high priority issues. A workshop was held at the beginning of the assessment to share information on climate change with stakeholders and elicit their ideas on issues to be investigated. The issues identified by the stakeholders in the Great Lakes Region were: water resources, particularly water levels in the Lakes; aquatic ecology; terrestrial ecology; agriculture; and quality of life, with an emphasis on human health, recreation, and tourism. The assessment team addressed these issues in their study and returned relevant information to stakeholders through a series of follow-up workshops.

The assessment team found that the Lake water levels may be particularly sensitive to climate change. Water levels in Lake

**Historic Lake Michigan-Huron Water Levels**





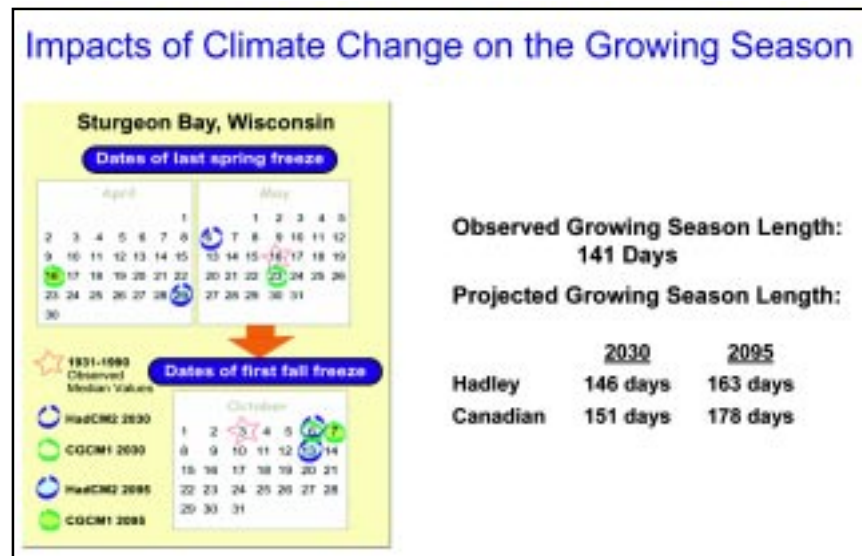
Michigan-Huron fell to near-record lows in 1999-2000. Drinking water facilities and power plants rely on the Lakes for water supplies. The plants are designed to withstand “100-year” extremes, which have occurred several times in the past few decades. The low water levels also affected the shipping industry: for each inch of draft lost, 1,000 foot ships must offload 270 tons of freight. This resulted in lower revenues and higher costs, and shippers worried that a shift to land transport would mean job losses in the shipping industry. In the agriculture sector, the growing season is projected to increase by between 3 and 7 percent in 2030 and 15 and 26 percent in 2090. Details on these findings are available at: [www.geo.msu.edu/glra/](http://www.geo.msu.edu/glra/)

Preliminary information on the potential impacts of climate change enabled stakeholders to describe more specific information needs. For example, the shipping industry recognized the importance of Lake levels, and stakeholders identified a need for real-time information on water levels and shipping channels. They identified adaptation options such as lengthening the shipping season to take advantage of longer ice-free periods, dredging, buying shallower-draft ships, and shifting to land transport. The agriculture sector identified needs for long-term planning decision support, derivatives and other risk-sharing instruments, and other non-crop opportunities, such as wind farms. The timber industry cited a need for operational decision support.

The first phase of the regional assessment provided information on potential impacts, but there was no time to pursue the specific support needs of stakeholders. This provided the foundation for the development of specific decision support tools. These resources begin to link impacts information with appropriate aspects of adaptive decision-making. These new resources help decision makers to make better-informed decisions and to improve social and environmental outcomes.

The second phase of the Great Lakes Regional Assessment reflects the growing emphasis on decision support. At the beginning of the second round of regional assessments, EPA required that its academic partners identify stakeholders and opportunities to develop decision support tools. The Michigan State team is now working closely with stakeholders from the agriculture and tourism sectors to develop tools that enable

Preliminary information on the potential impacts of climate change enabled stakeholders to describe more specific information needs

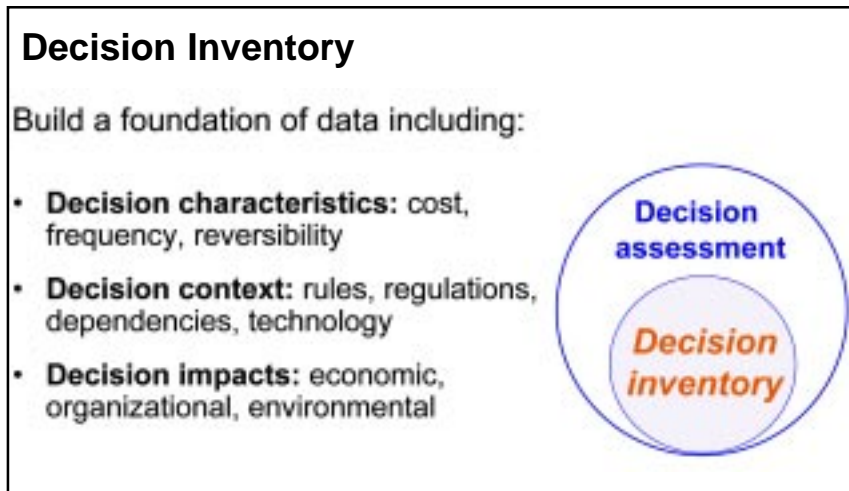


decision makers to better consider climate change. Their approach is to analyze tool design to assist decision makers and will incorporate climate and socioeconomic factors.

EPA has found that simply identifying potential impacts of climate change may not be enough to enable stakeholders to consider climate change among the many factors that drive decisions. And yet, the effectiveness of many decisions may be compromised by climate change. In order to provide better decision support, EPA is taking a systematic approach to understanding decisions that may be climate sensitive, and to understanding the needs of decision-makers.

### Evolution toward effective decision support

In the early years of the program, the GCRP focused primarily on understanding the potential impacts of climate change on endpoints of concern (e.g., aspects of water quality or biodiversity). The program engaged stakeholders to identify important endpoints and implicitly assumed that stakeholders would use the results to improve their future decision-making. Information on climate change would become one of many factors affecting a decision. In some cases, the information was utilized by decision makers. In others, stakeholders expressed an interest in considering information on the effects of climate change, but faced obstacles to incorporating the information into their decision processes. In many cases, decision makers were constrained by regulatory requirements, costs, and



other issues that were not fully understood.

EPA recognizes the need for a more systematic approach to the development of new decision support resources. This involves identifying decisions where targeted research and development are most likely to contribute to adaptive environmental outcomes. The best candidates for effective decision support are sensitive to climate or important to determining the effect of climate change. Identifying these opportunities requires new types of data, particularly information on the context and characteristics of decisions and decision makers. EPA is building such a database through a process called decision assessment and decision inventory. The approach is currently being applied to the EPA's Chesapeake Bay Program (an interagency effort to protect and restore North America's largest estuary). The decision inventory database contains information about potential adaptive decisions such as the design of flood control structures;

Information on climate change would become one of many factors affecting a decision. In some cases, the information was utilized by decision-makers. In others, stakeholders expressed an interest in considering information on the effects of climate change, but faced obstacles to incorporating the information into their decision processes

capacity of water treatment facilities; management of water supply systems; strategies for ecosystem restoration; and approaches to the detection and eradication of invasive species. The inventory will also include information on decision characteristics, including the cost, frequency, reversibility of that type of decision; the decision context, including any dependencies, regulations or technology requirements; and decision impacts, such as the economic, organizational and environmental impact of a decision.

This information can be used to help identify opportunities for the development of new decision support tools, improve linkages between decision theory and decision support practice, and provide more effective and relevant decision support. Early decision support accomplishments include the water evaluation and planning model, a modified index for evaluating the vulnerability of groundwater supplies to salt water intrusion, and a tart cherry crop model, each of which will be presented in a later session.



*Long term climate information could help vineyard owners and other farmers make better long-term planting decisions.*



Early decision support accomplishments include the water evaluation and planning model, a modified index for evaluating the vulnerability of groundwater supplies to salt water intrusion, and a tart cherry crop model, each of which will be presented in a later session

# DAY-2

## Session-1

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66	THE PILEUS PROJECT: DEVELOPMENT OF TECHNIQUES AND TOOLS TO HELP ASSESS THE IMPACT OF CLIMATE VARIABILITY AND CHANGE ON AN INTENSIVELY-MANAGED AGRICULTURAL CROP J.A. Andresen, <i>Michigan State University (MSU)</i>
68	KEY POINTS RAISED IN THE DISCUSSIONS

# Sea level rise and groundwater-sourced community water supplies in Florida

John Furlow, *US Environment Protection Agency (USEPA)*

## ABSTRACT

The average global sea level is rising more rapidly as a result of climate change, posing risks to estuaries, aquifers, wetlands, lowlands, beaches, and infrastructure. A study was conducted to provide a better understanding of whether the state’s groundwater-sourced water supplies might be vulnerable to rising sea levels and saltwater intrusion. The objectives of the study were to: develop a screening tool to characterize vulnerability of groundwater-supplied community water supplies (CWS) to saltwater intrusion due to sea level rise; develop a priority-setting framework based on vulnerability and aquifer reliance; and demonstrate the framework with CWS in Florida. The limitation was the applicability to confined aquifer systems and the utility when data availability was limited.

Salt water intrusion associated with sea level rise resulting from climate change may pose a risk to water treatment infrastructure in many coastal and low-lying areas

**S**alt water intrusion associated with sea level rise resulting from climate change may pose a risk to water treatment infrastructure in many coastal and low-lying areas. The US Environmental Protection Agency’s Global Change Research Program (EPA-GCRP) recently completed a study assessing the vulnerability of groundwater drinking water supplies to sea level rise in Florida, USA. About 17 million people live in Florida, and over 90 percent of them are served by community water supplies (CWS) that rely on groundwater supplies. The objectives of the study were to:

develop a screening tool to characterize vulnerability of groundwater-supplied CWS to saltwater intrusion due to sea level rise; develop a priority-setting framework based on vulnerability and aquifer reliance; and demonstrate the framework with CWS in Florida. The study was conducted to provide a better understanding of whether the state’s groundwater-based water supplies might be vulnerable to rising sea levels and saltwater intrusion.

The most widely used groundwater vulnerability index in the US is the DRASTIC index, named for the

seven hydrogeologic factors that are considered in the method.

Developed by the EPA and the National Water Well Association, the DRASTIC index is used to measure the vulnerability of groundwater to contamination from the ground surface. The DRASTIC guidance manual provides information about two major elements of the system: 1) the mappable units or hydrogeologic settings; and 2) the relative rating system, which uses seven factors to produce the DRASTIC Index score.

A basic assumption in the standard DRASTIC Index is that contamination is introduced at the ground surface and transported into groundwater by precipitation. The DRASTIC score is the sum of the following factors:

D – Depth to Water

R – Net Recharge

A – Aquifer Media

S – Soil Media

T – Topography

I – Impact of Vadose Zone

C – Conductivity

To assess the vulnerability of groundwater to salt water intrusion associated with sea level rise, we modified the DRASTIC Index to account for the fact that salt water intrusion occurs as lateral or upward flow into aquifers. Two additional criteria were also added – distance from the coast and the elevation of the potentiometric surface. In the modified DRASTIC Index, the pollution potential from sea level rise, expressed as a “vulnerability score,” is the sum of the products of each rating factor

and the weight assigned to it:

$$\text{SLR Vulnerability Score} = D + R + 3A + 2T + I + 3C + 5M + 5P,$$

where

D (Depth to Water) ranges from 1 (0-5 ft) to 10 (100+ ft)

R (Net Recharge) ranges from 10 (0-2 in./yr) to 2 (10+ in./yr)

A (Aquifer Media) ranges from 2 (massive shale) to 10 (karst limestone)

T (Topography) ranges from 1 (18% slope) to 10 (0-2% slope)

I (Impact of Vadose Zone) ranges from 10 (confining layer) to 1 (karst limestone)

C (Conductivity) ranges from 1 (1-100 gpd/sq ft) to 10 (2000+ gpd/sq ft)

M (Miles to Coastline) ranges from 10 (less than 0.31 miles) to 1 (more than 4.35 miles)

P (Potentiometric Surface or Water-Table Level from Sea Level) ranges from 10 (less than 0.5 ft) to 1 (greater than 3 ft)

The Florida Drinking Water Administration provided data on the location of drinking water systems. The data provided included the latitude and longitude of each CWS in the state and the standard DRASTIC scoring of aquifers.

In addition to the modified DRASTIC Index, we also developed a “reliance score” for each system. The reliance score is based on the number of people served and the availability of alternative sources of water. For example, a system serving a large population with only one source of water would have a high reliance

A basic assumption in the standard DRASTIC Index is that contamination is introduced at the ground surface and transported into groundwater by precipitation

score, and a system serving a small community with alternative supplies would have a low reliance score.

Reliance was calculated as follows:  
 $Reliance = 2 * \log(Pop\ served) + AWS$

where:

Pop served = number of persons served by the system (Min = 25 (for a mobile home park)  
 Max = 475,000 (for Tampa)

AWS = measure of availability of alternative water supplies; for example Biscayne Aquifer (designated by the Safe Drinking Water Act as sole-source aquifer) = 10; Water resource caution areas (designated by regional water management districts) = 5; All others = 1)

The relative vulnerability of each CWS was then based on the

modified DRASTIC Index score and the reliance score.

Key findings were that high vulnerability/high reliance CWS were concentrated in the Pensacola on the Gulf Coast and the Miami-Palm Beach areas of the Atlantic Coast. These results are consistent with known occurrences of salt water intrusion in Florida. These areas are also areas of high population living very near the coasts of Florida. Results also suggest that the modified DRASTIC Index could be simplified (to drop some DRASTIC factors) and still provide valid results. The “M” and “P” factors appear to be most important.

**Peer review**

The DRASTIC Index has been thoroughly reviewed and is used widely. Our modified index has only been internally reviewed.

...a system serving a large population with only one source of water would have a high reliance score, and a system serving a small community with alternative supplies would have a low reliance score

# Evaluating impact of future climate scenarios on agricultural water management: an application of the water evaluation and planning (WEAP) system

David Purkey, *Natural Heritage Institute (NHI)*

## ABSTRACT

Global climate change has the potential to alter hydrologic conditions in California by changing the spatial and temporal patterns of snow accumulation and snowmelt. The water management infrastructure in California had been designed, and is operated in accordance with historic hydrologic patterns. A study was conducted to understand the potential impacts and adaptation to global climate change and to evaluate the utility of various tools in refining this understanding in the future.

An application of the Water Evaluation and Planning (WEAP) system, developed by the Stockholm Environment Institute for California's Sacramento River Basin was used to evaluate the impact of future climate scenarios on agricultural water management in the region, and to investigate whether water management adaptation could reduce potential impacts.

**G**lobal climate change has the potential to alter dramatically hydrologic conditions in California by changing the spatial and temporal patterns of snow accumulation and snow melt. The water management infrastructure in California has been designed and is operated in accordance with historic hydrologic patterns. Understanding if and how this infrastructure can be managed in the face of global climate change in order to meet the array of vital

water management objectives for the system is a critical research question to which an investigation was conducted. The goal was to begin to understand the potential impacts of and adaptation to global climate change and to evaluate the utility of various tools in refining this understanding in the future.

The Environment Protection Agency's Global Change Research Program (EPA-GCRP) financed

The water management infrastructure in California has been designed and is operated in accordance with historic hydrologic patterns. Understanding if and how this infrastructure can be managed in the face of global climate change in order to meet the array of vital water management objectives for the system is a critical research question



three research teams to attempt to develop a climate change impact and adaptation framework for water resources and aquatic ecosystems. One research team comprising of the Stockholm Environment Institute (SEI), the National Center for Atmospheric Research (NCAR) and the Natural Heritage Institute (NHI), used the Sacramento River system in California as a case study. An application of the Water Evaluation and Planning (WEAP) system, developed by the SEI, was the starting point for this pilot

project. It was used to evaluate the impact of four future climate scenarios on agricultural water management in the region, and to investigate whether water management adaptation could reduce potential impacts.

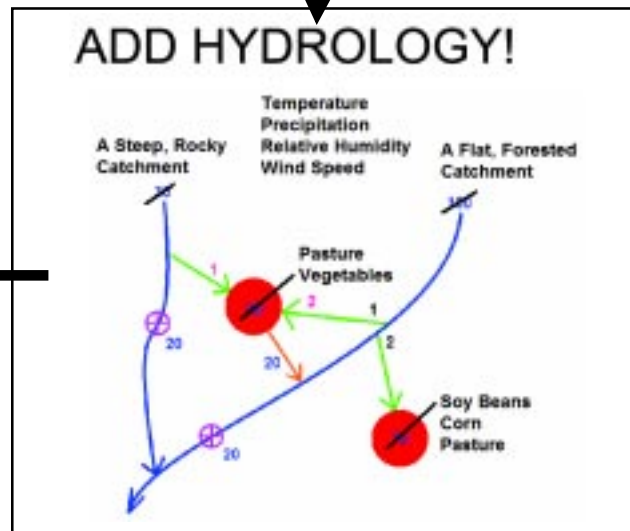
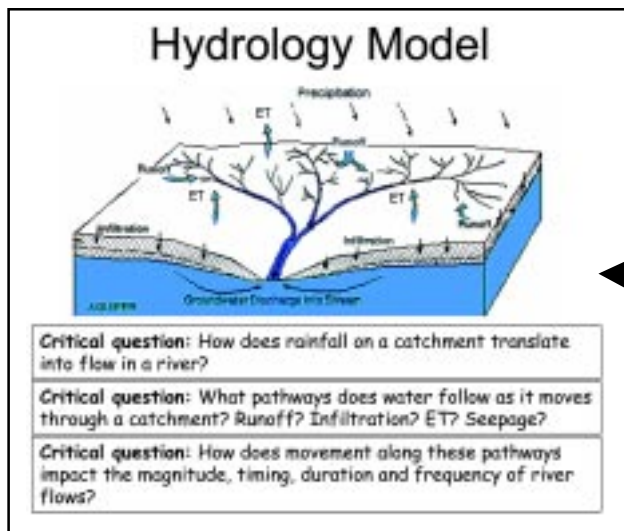
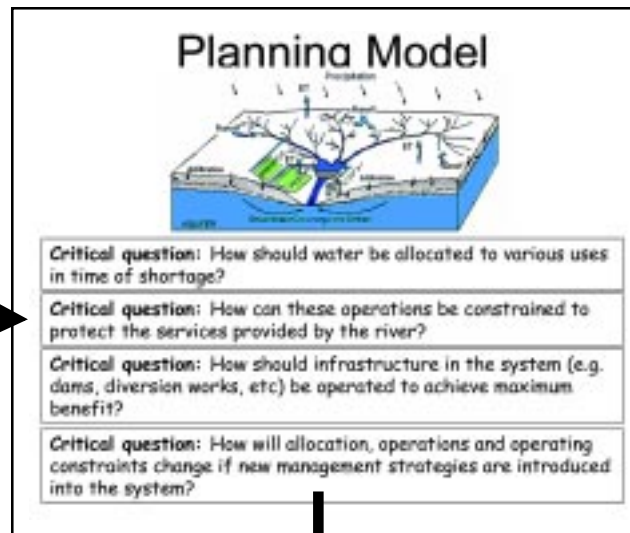
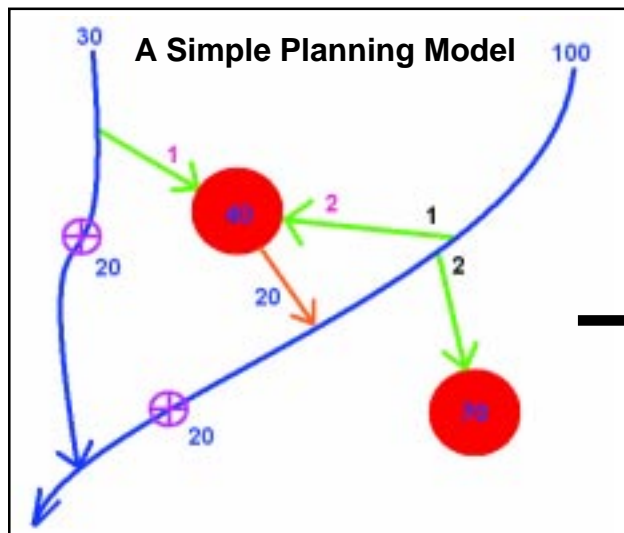
The original version of WEAP, and most other water resource planning models, are simple planning models where four critical areas are addressed:

- allocation of water to various users in periods of scarcity;

- operations to be constrained to protect the services provided by the river;
- Operation of infrastructure in the system (e.g dams, diversion works, etc.) to achieve maximum benefits; and
- allocation, operations and operating constraints changing with new management strategies introduced into the system.

Such models are based on the assumption that the

- quantity of water flowing at the



top of each river;

- quantity of water flowing into or out of the river as it moves downstream; and
- water demands are known with certainty.

However, this system has been removed from the hydrologic context and a hydrology module was incorporated into WEAP that provides a framework to also answer the following:

- How does rainfall on a catchment translate into the flow in a river?
- What pathways does water follow as it moves through a catchment – runoff? infiltration? ET? seepage?
- How does movement along these pathways impact the magnitude, timing, duration and frequency of river flows?

The study, the results of which were also included in a report requested by California Governor Arnold Schwarzenegger (see box), followed an approach that would:

- use output from two General Circulation Model (PCL and GFDL) run under two emission scenarios (A2 and B1);
- downscale to produce four climate time series scenarios for California; and
- run the model for the entire 21st century without adaptation and with adaptation.

The system can be adapted to assume a trend of improving

irrigation efficiency for the first half of the 21st century and assume that on an annual basis cropping decisions are made dynamically to favor higher valued, less-water-intensive crops in times of scarcity. The results of the study showed that adaptation dramatically reduced the amount of groundwater pumping that took place during future dry periods and allowed for greater flexibility in meeting drinking water and ecosystem water needs in the future.

Potential improvements to the model include the ability of the tool to:

- Develop ensembles of climate scenarios so that we can begin to get toward the notions of uncertainty and risk
- Describe a more robust set of potential adaptations, including some that are not of a pure water management character
- Tie the description of adaptation dynamics much more closely to local knowledge.

As part of a second pilot project, in Brazil, WEAP was used at the community level, then scaled up to a river basin level of analysis. The challenge is to conduct community level analysis everywhere. Some approaches to generalize diverse local knowledge, goals and actions at the river basin level are necessary. These will involve agent-based modeling and community indicators among others.

## Executive Order S-3-05

Issued by California Governor  
Arnold Schwarzenegger

"The Secretary of the California Environmental Protection Agency shall report to the Governor and the State Legislature by January 2006 and biannually thereafter on the impacts to California of global warming, including impacts to water supply, public health, agriculture, the coastline, and forestry, and shall prepare and report on mitigation and adaptation plans to combat these impacts."

# The Pileus Project: developing techniques and tools to help assess the impact of climate variability and change on an intensively-managed agricultural crop

J.A. Andresen, J.A. Winkler, J.R. Black, C. Zavalloni, and J.M. Bisanz, *Michigan State University (MSU)*\*

## ABSTRACT

The Pileus Project was undertaken by a large, multi-disciplinary team to investigate the potential impacts of climate variability and change on two economically important climate-sensitive industries located in the Great Lakes Region of the USA: agriculture and tourism. Production of sour or tart cherries (*Prunus cerasus*) was chosen as a primary research topic. A variety of tools are being developed to assist growers and others in making decisions related to tart cherry production and climate.

Despite continuing improvements in technology, weather and its longer-term variant, climate, remain among the most uncontrollable factors in agricultural production systems. The Pileus Project was undertaken by a large, multi-disciplinary team to investigate the potential impacts of climate variability and change on two economically important climate-sensitive industries located in the Great Lakes Region of the USA: agriculture and tourism.

Production of sour or tart cherries was chosen as a primary research topic. It is a deciduous perennial tree fruit (*Prunus cerasus*) with an approximate production cycle of 25-30 years. The major rationale for this selection was geographical, as the majority of the US production is concentrated in the Great Lakes Region, downwind of the Lakes in Michigan. The level of management sophistication required is high in comparison with other crops, and fruit commodity quality standards necessitate frequent control

## Components of the Pileus Project



*Project funded by the U.S. Environmental Protection Agency*

\*Paper presented by J.A. Andresen; J.R. Black is from Department of Agricultural Economics; All others from the Department of Geography.

measures for pests and diseases. Tart cherries are characterized by extremely high interannual yield (and commodity price) variability. All major aspects of the industry and value chain – production areas, processing facilities, sales, and storage – are located within a relatively small area in the Great Lakes Region.

This allowed a unique opportunity to link expertise in tart cherry production, economics, and climate science. There was also scientific rationale, as very little research has been conducted on climate and specialty crop production or on climate and intensively-managed crops in general.

The major objectives in this portion of the Pileus Project were to:

- cultivate stronger research partnerships with tart cherry growers, processors, and marketers, to establish assessment goals, identify specific needs, and provide expertise;
- create quantitative models to simulate relationships between climate variability and several aspects of the tart cherry industry; and
- integrate model simulation output and stakeholder input to develop decision support tools to be utilized by the tart cherry industry for risk management.

A series of meetings were held in the early stages of the project with growers and other industry representatives to identify key production-related issues and problems and needs. Among the

major difficulties identified were high year to year yield variability and production, low commodity prices, increasing land prices, and no federal crop insurance options. [Key climate-related issues included late spring freeze events, cool, wet weather during crop pollination. Growers have few options to hedge climate-related production risks], other than choice of orchard location (hilltops with cold air drainage away from orchard sites are strongly preferred), frost protection technology, and irrigation.

A sequential or linked approach is being used in the assessment, whereby multiple models are linked together to represent various aspects of the production system. In the initial step, a tart cherry simulation model was developed to predict crop phenology, water use, and yield potential. The model utilizes daily input weather series of maximum and minimum temperature, solar radiation, and precipitation and was found to satisfactorily simulate yield, with a mean absolute error on the order of

10-15 percent of observed yields. Weather and climate-related relationships and impacts identified in the historical time frame were assumed to continue in future time frames. Analyses will be performed on 15 separate locations across the region for both historical (1961-2004) and projected future (1990-2100) time frames. The future time scenarios were developed with an empirical downscaling technique utilizing free atmospheric variables from four separate GCM, eight separate downscaling methodologies, and two different future greenhouse gas emission scenarios for a total of 64 scenarios per site.

A variety of tools are being developed based on the output of the project, which are intended to assist growers and others in making decisions related to tart cherry production and include short- and long-term management time frames. The tools will be deployed on a dedicated project web site and are scheduled to be released to the public in 2006.



# Key points raised in the discussions

## Parallel Session–1

**1. Gradual versus pulsed change.** As opposed to much of the discussion in this conference, most of the EPA's work has focused on long-term trends such as sea level rise or gradual changes in temperature rather than the impact of sudden changes or extreme events that might be associated with climate change.

**2. Top-down versus bottom-up approaches.** Most of the studies that have been conducted in California used top-down approaches and most first generation tools looked primarily at water resources. Second generation tools consider local knowledge and it is hoped that such tools can be used for a bottom-up approach. The second approach is being used in Brazil where three communities are involved, and it is hoped that they will be able to manage their own water resources.

**3. Data issues.** Data issues represent a major problem in evaluating the impacts of climate change. In California, initial evaluations were done using the WEAP model. Now the California University model is being used. However, the requirement for huge data essential for effective application of the California University model cannot be met using data generators and, if variables are assumed, the model does not work. WEAP is designed to be scalable and requires less data than conventional

large hydrological models. Data are, however, essential. This said, it is important to recognize that models can give some results even if few data are available. While hydrology data is difficult to obtain, climate data is more easily available. WEAP is now being improved so that water availability can be projected based on precipitation and other data that tend to be more readily available than the data on stream flows that have traditionally served as a foundation for hydrologic modeling. GIS tools also make data access simpler and easier to use.

**4. Involving vulnerable communities to address climate impact evaluations in California.** The project to evaluate climate impacts in California commenced before deciding who was going to use it. It was, therefore, not specifically targeted at vulnerable communities. In the case of the surface water study, vulnerable groups were contacted.

**5. Local knowledge.** A study covering three tribes in Brazil provides some insights at the local level. Data relating to the community's water use will be used to develop some characteristic variables that will feed into river basin models. This effort is underway and some very detailed information on local knowledge is being developed.

# DAY-2

## Session-1

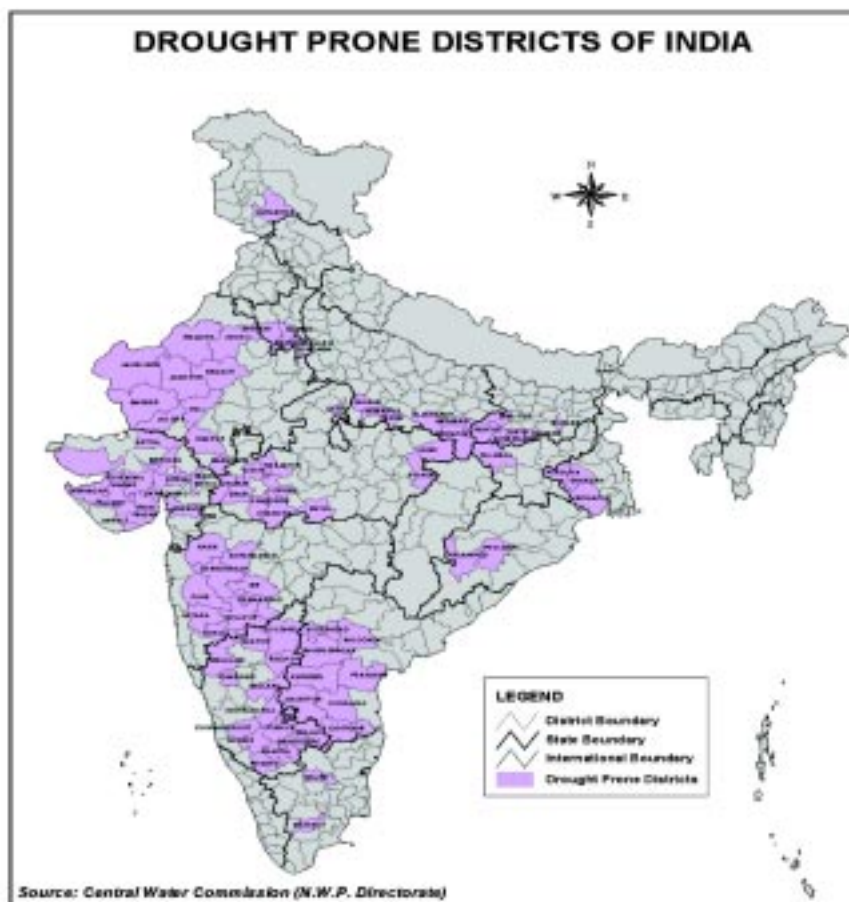
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70	WATERSHED DEVELOPMENT THROUGH THE ADAPTATION LENS Shashikant Chopde, <i>Winrock International India (WII)</i>
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# Watershed development through the adaptation lens

Shashikant Chopde, *Winrock International India (WII)*

**M**ore than two-thirds of the area of India is drought-prone. Droughts are increasing both in intensity and duration. As a result, increasing the ability of communities to adapt to droughts through the development of resilient livelihood systems is crucial. Over the longer-term this will also help governments, communities and support agencies respond to the anticipated effects of climate change. The adaptive capacity of a system is its ability to adjust in response to, or anticipation of, changed conditions. It reflects the capacity to cope with the consequences or take advantage of opportunities that change brings about. Watershed development (our focus here) contributes to adaptive capacity, although only to some extent, by reducing the vulnerability of poor and marginalized rural communities in drought-prone areas. It increases the coping capacity of the population, improves livelihoods and conserves biodiversity. But there are inherent issues of access, equity and sustainability in relation to the natural resources augmented through watershed development.

To evaluate the impact of watershed development on livelihood resilience, Winrock International India (WII) conducted a review of four case study areas from two drought-prone states of western India: Gujarat and Rajasthan. Watershed development and water harvesting activities were undertaken in these areas prior to



the drought of 2000-2002 and the review found that the activities significantly contributed to the differential adaptive capacities in these areas.

The review was conducted in areas where non-governmental organizations (NGOs) had been involved in the implementation of watershed projects. Case examples were as follows:

**1. Sri Kundla Taluka Gram Sewa Mandal (SKTGSM)** works in

Amreli district, Savarkundla taluka, Gujarat. Average annual rainfall at this site is 540 mm with topography slope between 10 and 15 percent. The site has basaltic groundwater formations and there are open wells and tubewells. The community is heterogeneous, stratified on basis of caste including Patels, Kolis, Muslims, Kumbhars and Harijans.

**2. Self-Employed Women's Association (SEWA)** works in Patan district, Santalpur and Radhanpur taluka, Gujarat, where the annual average rainfall is 175 mm. The area has flat topography with very mild slope of 0-5 percent. Groundwater in the area is saline and is contained in the recent alluvium. Here also the community is heterogeneous, comprising of Ahirs, Rabaris and Thakores.

**3. Seva Mandir** works in Udaipur district, Jhadol, Badgaon block, Rajasthan, where the annual average rainfall is 640 mm. The topography is undulating with slope between 25 and 40 percent. The ground system comprises hard rock and therefore water storage is poor. The area has

open wells and the community is relatively homogeneous tribals.

**4. PRADAN** works in Alwar district, Kishangad Bas block, Rajasthan. The annual average rainfall there is 650 mm and the terrain slope ranges between 10 and 20 percent. The groundwater is found in highly prolific hard rock aquifers overlain by thin alluvium. There are open wells and tubewells. The community consists of Sardars, Meus and Jatwas.

Research was undertaken to assess the extent to which watershed development and water harvesting helps augment natural capital (water, land and forest resources) and social capital (including institutional and human capital). Under definitions used in the study, institutional capital consists of local institutions involved in managing local resources, promoting broader livelihood options, better drought coping strategies; and development of water, food and fodder security. Human capital consists of the skills and knowledge available. The contribution of each in combating droughts and enhancing livelihoods was studied in the context of migration, social and gender equity, sustainable and efficient use of natural resources and water, food and fodder security.

The field study included group discussions with the watershed committee, village development committee and other institutions, including credit groups, dairy groups and women's groups. Leaders, the village sarpanch (mayor) and farmers were interviewed,

Research was undertaken to assess the extent to which watershed development and water harvesting helps augment natural capital (water, land and forest resources) and social capital (including institutional and human capital)



followed by visits to farmers’ fields and watershed structures. Finally, a debriefing with implementing organizations was conducted.

The four cases offer valuable insights. There is close linkage between social capital, social benefits and institutional sustainability.

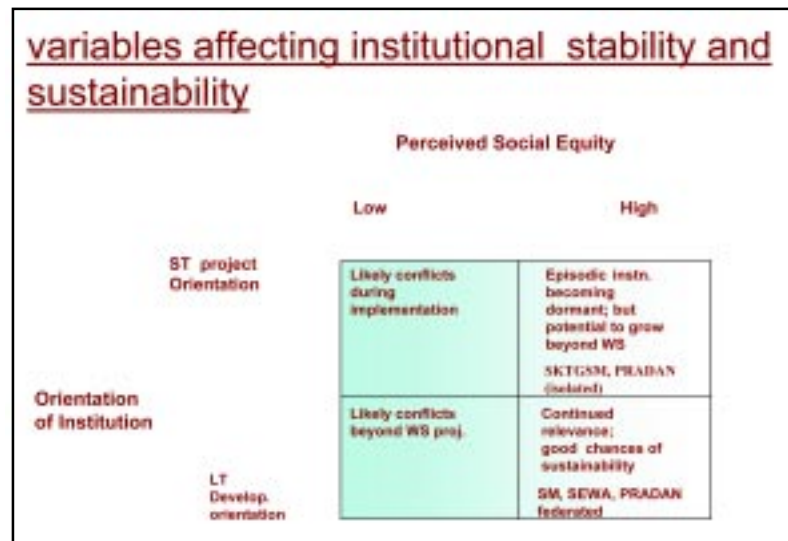
Institutions need to be stable and sustainable to ensure equitable participation of different stakeholder groups and to maintain water-harvesting structures in the long run. Institutional sustainability in itself is dependent on the perception of equity among stakeholders. This perception is shaped by a number of variables, including the representation of stakeholder groups in the local institution, the broad-based nature of leadership, redundancy in skills developed, and special focus on the weaker sections of society as well as gender. In addition, the orientation of the support institution should be long-term as opposed to short-term (project oriented).

As the accompanying figure indicates, when perceptions regarding social equity and the sustainability of interventions are low (i.e. interventions have a short-term project orientation) it is difficult to create sustainable institutions. When the perception of equity is high (cell 2) but interventions are seen as stemming from a short-term project orientation, institutions tend to become dormant or disintegrate after the project is over unless they

develop a leadership and vision that takes them on to new objectives beyond watershed development. This situation is characterized by what we term “episodic” institutions. The best chances for sustainability occur when all stakeholder groups are satisfied about their roles and responsibilities and when both the facilitating agency as well as the concerned CBO begin to develop a long-term developmental orientation (cell 4).

In the sample cases, the committees in Savarkundla and the isolated watershed committees of Alwar could be classified as episodic institutions. They performed well during the project period but began to lose direction once the project was over. In contrast, the committees promoted by SEWA in Santalpur, those promoted by Seva Mandir in Udaipur, and the 10 committees in Alwar that got federated, were active and purposeful beyond the watershed project. In fact, with the wider

Institutions need to be stable and sustainable to ensure equitable participation of different stakeholder groups and to maintain water-harvesting structures in the long run



responsibilities, the committees in both Santalpur and Udaipur were gradually converted into *gram vikas* (village development committees) with a larger developmental mandate.

Increase in livelihood options would also result in better drought coping, especially if these are not based on land-based activities and can be practiced even during the drought years.

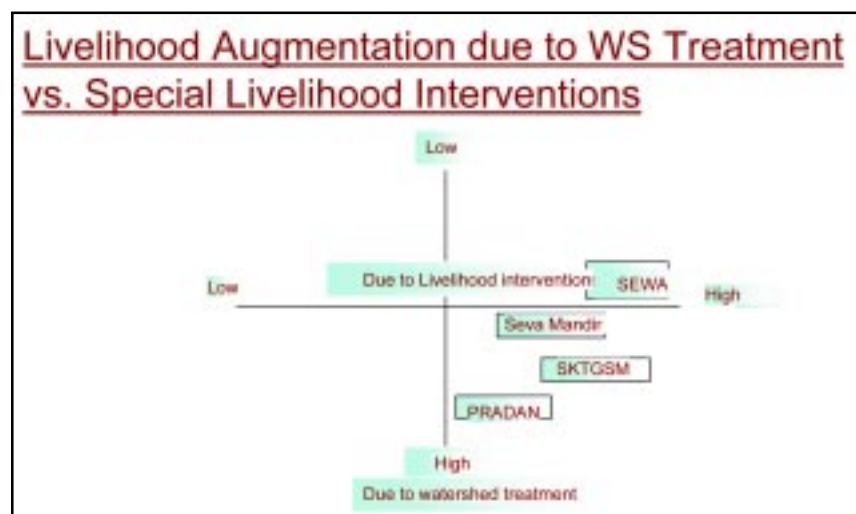
In the four interventions, the study team found that apart from watershed development, agencies were involved in other interventions geared to augment livelihood options of the local communities, particularly the poor. Hence, a need was felt to separate the impacts of the two types of interventions but also to look at them together to see the total impact in a given region.

The source of drought proofing, whether due to watershed treatment or due to generation of alternative livelihood options could be mapped

on the basis of data available as shown in the figure below. It is closely linked to the extent to which social capital was augmented. In cases from Gujarat, government funding for a software set of capacity building and awareness activities was low. In the Rajasthan cases studies, funding was augmented through donors for software activities.

In the case of PRADAN, the major contribution to drought proofing has been from watershed treatment while in the case of SEWA it has been through its livelihood interventions. PRADAN has also started promoting dairy cooperatives of women in a big way. Seva Mandir and SKTGSM have made some efforts at developing alternative livelihood options but these are in the nascent stage (e.g., soap making from *ratanjyote* and cultivation of *safed musli* in the case of Seva Mandir; and manufacture of bio-pesticide in the case of SKTGSM).

The best chances for sustainability occur when all stakeholder groups are satisfied about their roles and responsibilities and potential share in the benefits and when both the facilitating agency as well as the concerned CBO begin to develop a long-term developmental orientation



# Enhancing resilience of the poorest community groups to droughts through rural livelihood approaches in the Western Orissa Livelihoods Project (WORLP)

Subodh Kumar Mahapatra, *Orissa Watershed Development Mission (OWDM)*

**W**estern Orissa has a population of four million of which about 60 percent lives below the poverty line. The area experiences extreme climatic conditions and droughts occur every 3 or 4 years.

Malnutrition, infant mortality and maternal mortality rates are some of the highest in India. Between 5 and 10 percent of the area is urban and literacy rates are between 10 and 16 percent. Only 16 percent of the villages are connected to all-weather roads. Distress migration is around 40 percent.

The Orissa Watershed Development Mission (OWDM) was established in 2000 by the state government to manage watershed projects and schemes for the state of Orissa. The Western Orissa Rural Livelihoods Project (WORLP) was funded by Department for International Development (DFID) and implemented by OWDM. The project is working in four districts of Western Orissa.

The annual rainfall of the area is around 1300 mm. Most of the

rainfall happens to be during the monsoon months (July-September). The mission is currently working in about 2,600 watersheds – 290 watersheds under WORLP are spread over four districts.

The project involves capacity building, enhancing the livelihood asset base, and creating an enabling environment. The project has also initiated a community-driven micro-planning process. The process involves prioritization of issues, problems and solutions and negotiation for equity and contribution as per need. Village institutions have been strengthened.

The Common Interest Group (CIG) and Self-help Group (SHG) cooperative concept was adopted. There are now over 2,200 SHGs with savings of more than Rs. 10 million. There are over 1,400 user groups and Watershed Development Fund is more than Rs 6.5 million. About 400 village experts have been trained in areas such as micro-enterprise and marketing, livestock, aquaculture, and soil and water conservation. Exposure visits, training and sensitization activities for the

About 400 village experts have been trained in areas such as micro-enterprise and marketing, livestock, aquaculture, soil and water conservation

community and SHG members were conducted. Participatory research was undertaken to develop other activities such as micro-irrigation, and medicinal plants and tuber crop production.

The outcomes of enhancing and broadening the livelihoods asset base included land treatment of over 18,000 hectares, creation of over 3,000 small and big water harvesting structures, enabling access to over 200 metric tons of quality seeds, diversification to tuber crops, pulses and oil seeds, and installation and operation of more than 1,100 (Krishak Bandhu) pumps. Over 125 grain banks are managed by the villagers. Increases in primary crop productivity have reached over 30 percent and second crop productivity over 20 percent. Water conservation measures have helped to increase the water table in identified dug-wells by one meter.

The project has identified aquaculture as one of the most attractive livelihoods option for the poor and mobilized around 300 women's groups. The project established liaison with the Fisheries Department for supply of fingerlings and capacity building of such women's groups. A low-cost fiberglass reinforced plastic (FRP) hatchery was established in one of the remotest districts of the state. The FRP hatchery is a new technology developed by the Central Institute of Freshwater Aquaculture based in Bhubaneswar and has only been tested within the institute campus. There are 55 SHGs in nursery pond management

### Block Printing by SHGs in Kotasingha village



who have networked with this newly established FRP hatchery. These are spread over four districts of the project area. To provide information, technology, better practices and input services to the fishing community through a single window, six One-stop Aqua Shops (OAS) have been established in the project area. Four of these OAS are managed by the fisheries department and the other two by NGOs and the community together. To build the capacity of the fishing community, 19 Better Practice Guidelines (BPG) have been developed in the local language.

Strengthening market support has included organizing meetings between buyers and sellers, exposure to town and terminal markets, promotion of local *haats* (markets), and training in quality, volume and price ratios. The collective marketing effort of over 30 SHGs for selected items has resulted in a turnover of Rs. 2.5 million.

### Preventive health measures

The use of herbs as alternative medicine has reduced the health

Strengthening market support has included organizing meetings between buyers and sellers, exposure to town and terminal markets, promotion of local *haats* (markets), and training in quality, volume and price ratios

budget in six villages. Awareness has been created on Reproductive Tract Infection (RTI) among migrant women in 5 villages; impregnated mosquito nets are being used in 15 villages; and full sanitation facilities in 25 villages.

### Alternate livelihoods – income generation activities (IGAs)

Small income generating activities have been initiated by around 15,000 SHG members with a total turnover of Rs, 25 million. The group members selected diversified income generating activities matching their skills and experience, 64 such small IGAs so far have been adopted by project participants (beneficiaries).

### Alternate livelihoods – livestock

Goats are gold for poor people in this area – during an eventuality a goat can be sold off at midnight. Small ruminants like goats and poultry birds are the alternate sources of livelihood after agriculture. The project identified that prevention of diseases for goats and poultry birds of local breeds can help to improve the productivity of livestock for the poor. The strength of the livestock department is poor in this part of the state; hence a module of community link workers on livestock was adopted under the project, and 134 paraworkers/ community link workers trained and linked to local veterinary doctors for hand holding support. Such community link workers provide services to poor livestock keepers at their doorstep and

### Manual operated Pressure Pump to irrigate areas in the upper catchments



establish a liaison with the local livestock officer for additional support. More than 3,000 people are involved in rearing goats and poultry birds. A milk cooperative has also been established in line with the government's programs.

### Enabling environment

The project facilitated in setting up a fully staffed office in four districts, and mobilized the government to provide opportunities to NGOs in the development process. As a result, around half the project implementing agencies are NGOs. Project implementing agencies operating at the watershed level had to manage large numbers of watersheds, which was difficult for supervision. The project facilitated policies for limiting 15 watersheds per implementing agency. The project adopted a participatory approach to find solutions and fight against frequent droughts and hunger. Adoption of local knowledge and priority to the voice of the poor has helped to achieve exciting results.

Goats are gold for poor people in this area – during an eventuality a goat can be sold off at midnight. Small ruminants like goats and poultry birds are the alternate sources of livelihood after agriculture

# Adaptive potential of innovative water management practices in coping with climate uncertainties: a case study of Purulia, West Bengal, India

Shrinivas Badiger, *Institute for Social and Economic Change (ISEC)*

## ABSTRACT

Access to sustainable water supplies remains a major obstacle to efforts in rural poverty alleviation in Indian agrarian communities. The agricultural sector, especially rainfed farming in large tracts of arid and semi-arid belts, is highly vulnerable to uncertainties in climate. These regions are particularly vulnerable to erratic rainfall, mostly short spells of high rainfall and degraded soils that cover large areas that have made much of the land less fertile. Although the rainfed agricultural sector is sensitive to global changes in rainfall and temperature, communities in these resource scarce regions have been taking into account variability in local climates. Their ability to adopt low-cost, small-scale water management technologies along with best crop management practices has proven to augment water availability during critical periods of crop growth, securing household food production even during low rainfall years. One such example is the “five-percent-technology,” a technique for harvesting rainwater and excess runoff. Initiated by PRADAN in the late 1990s in the Purulia district of West Bengal, this on-farm water harvesting technique has provided farmers a system of adaptation to risks in climatic variability not historically practiced in these typically non-agrarian tribal belts.

Five-percent-technology is a simple technique of allocating a small portion of cultivated land, roughly five percent, usually at the most upstream portion of the farmer’s plot, to water storage. It is a risk reduction technique primarily implemented to mitigate the weather related uncertainties that affect the rainfed paddy crop on which the small holding farmers of this poor region depend for their subsistence. Although the average annual rainfall in this region is about 1,200 mm, considered semi-humid in technical terms, most of it is received during early monsoon. Even during this period, the distribution of precipitation is often erratic, and drought-like conditions occur during critical crop

The agricultural sector, especially rainfed farming in large tracts of arid and semi-arid belts, is highly vulnerable to uncertainties in climate

growth stages. According to PRADAN, the implementing NGO, the five-percent area meant for on-farm water storage is the minimum and not a sacrosanct figure, and mostly depends on the topography, soil conditions and land available.

Field investigations in three hamlets of Purulia indicated that the best results could be obtained over large contiguous areas that consist of a farm pit, field bund management and bund-plantation of selected tree species, which add to the overall revenue of poor tribal communities. Increase in paddy yields of up to 30 percent was recorded among farmers who were progressive and willing to maintain the pit system properly. However, the variability of its success was very high, attributed to a reluctance in collective uptake of the practice by farmers. It was also observed that many of the farm pits in the mid-slopes and downstream of contiguously treated lands had enough water to provide deficit irrigation for paddy and an additional vegetable crop beyond the monsoon. The study indicated that less than 20 percent of implementers had to depend on migration, wage labors, or other sources of income to support their livelihoods.

**P**urulia district is very drought-prone and is one of the three districts in West Bengal most frequently affected by drought. Agriculture in this area began only 40 years ago. Rain falls mainly in September, the monsoon period, and a seven-day dry period during this month results in crop failure.

The communities inhabiting this area are mainly tribals, consisting of Mahatos (65%), Singh Sardars (20%) and Santhal Parganas (5%). Chitrakar, Karmakar, Malakar and Kalindi are the other communities living in the area. They relocated from forests in the Chhotanagpur Plateau to new settlements and are traditionally non-agrarian communities.

## Drought Pattern

Period	Year of Drought	Frequency
1801-1825	1801,4,6,12,19,25	6
1826-1850	1832,33,37	3
1851-1875	1853,60,62,66,68,73	6
1876-1900	1877,83,91,97,99	5
1901-1925	1901,4,5,7,11,18,20	7
1926-1950	1939,41	2
1951-1975	1951,65,66,71,72,74	6
1975-2000	1977,78,79,82,83,85,87,88,92	9

IMD; official drought years recorded

Traditional drought coping mechanisms include intercropping, partial cropping and distributed cropping. Streams are the source of water. Where the land is fallow, migration takes place

The frequency of droughts in the last 50 years has increased and agricultural lands are highly degraded. Annual rainfall is erratic, between 50-450 mm with an average rainfall during September of 200 mm. The probability of two successive wet weeks during the monsoon is 0.73, that of one wet week followed by one dry week is 0.29, and of four successive weeks with 25 mm of rain per week is 0.20. Traditional drought coping mechanisms include intercropping, partial cropping and distributed cropping. Streams are the source of water. Where the land is fallow, migration takes place. Less than 75 percent of the area is under rainfed paddy, and this production meets about 30 percent of a household's food requirements.

In the late 1990s, PRADAN began implementing the five-percent system. The scheme primarily aimed at serving as a reserve for critical irrigation (paddy) in September and proved to be a mix of successes and failures. The scheme was, however, later supported by local governing bodies.

The main component of the five-percent system is a farm pit, which occupies five percent of the land area, and which was used for supplementary irrigation during September and October, the critical growth periods for grain formation and filling. Tree species were selected for fruit, fuel and fodder. Grass was grown on bunds for fodder and making rope. Fish was cultivated for a short duration in the pit.

The system provided food security for 16 percent of the population, mainly large landowners, throughout the year. About 22 percent of the population had food security for eight months of the year, 38 percent for six months and 24 percent for less than six months of the year. Over 80 percent of the population still had to support their livelihoods through other means, mainly wage labor.

From the study it can be concluded that although the five-percent system reduces the chances of total crop failure, it does not secure the food needs for the entire population for the whole year. Large land owners located downstream and socially better off benefit more from this scheme than small and marginal farmers located further upstream. The five-percent system is more effective when used in combination with other upland treatments and bunding to ensure water is captured in upstream pits. It did, however, reduce migration during the monsoon months.

The main component of the five-percent system is a farm pit, which occupies five percent of the land area, and which was used for supplementary irrigation during September and October, the critical growth periods for grain formation and filling

### Water harvesting intervention of 5 percent pits





# Women in livelihoods – self-help groups as a medium of empowerment

Srinivas Mudrakartha, *Vikram Sarabhai Centre for Development Interaction (VIKSAT)*

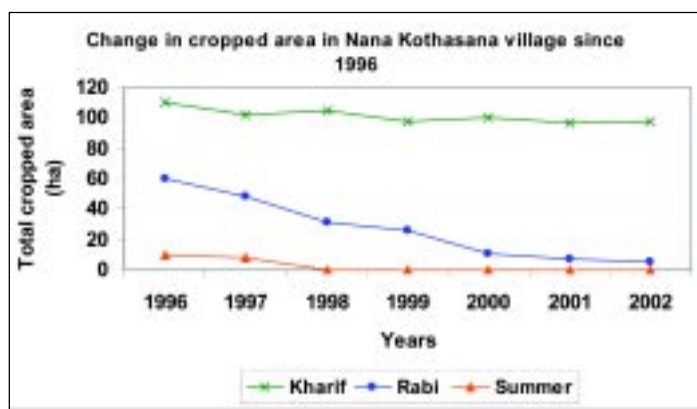
## ABSTRACT

Sustaining land-based livelihoods is facing a challenge due to the increasing complexity of meteorological, physical and socioeconomic conditions resulting from increasing water scarcity. Women's groups have taken on the role of contributing to coping and adaptive strategies in a semi-arid district in Gujarat. Beginning as small savings and credit programs, the groups have evolved into a federation, taking loans to release mortgaged lands, construct check dams, and ensure food and fodder security. These self-help groups (SHGs) have empowered women to develop strategies to adapt to drought periods through non-farm income generating activities. The groups are now focusing on expanding non-land based income through micro-enterprise.

Sustaining land-based livelihood, such as agriculture and animal husbandry, is facing a great challenge today due to the increasing complexity of meteorological, physical and socioeconomic conditions resulting from increasing water scarcity. People's responses to events such as droughts is a combination of many factors. Common coping and adaptive mechanisms include loans or borrowing, reduction of food expenses, mortgage or sale of land, and migration. However, prolonged and frequent drought conditions, especially in arid and semi-arid regions, tend to sap the physical, economical and psychological strengths of communities.

In Nana Kothasana village, since 1996, the area under *kharif* (monsoon) crop has fallen marginally while the area under *rabi* (winter) crop has dropped significantly. Summer crops are no longer being cultivated. The trend is the same in Bhanavas village. In Bhanavas, monsoon crops,

Common coping and adaptive mechanisms include loans or borrowing, reduction of food expenses, mortgage or sale of land, and migration



including groundnut, cluster beans, maize and minor millet (*bajra*), failed in 2002, while of the three winter crops – wheat, mustard and tobacco – only wheat was cultivated.

Crop production fell drastically due to low rainfall, though there was an increase in income from animal and non-farm activities. As a strategy, farmers tend to save groundwater in wells for the *rabi* crop, since residue from the *rabi* crop provides fodder for their livestock. Milk production led to an increase in cash flow that was invested in animal husbandry and the quality of lives improved. Income during drought periods increased from 16 to 69 percent after interventions from non-governmental organizations (NGOs).

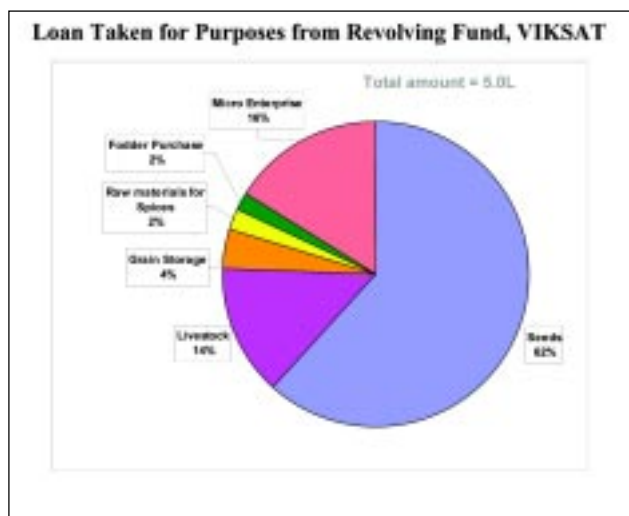
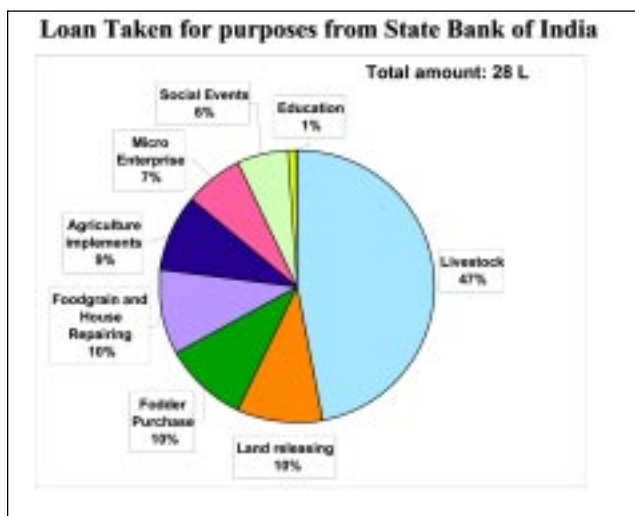
In the semi-arid Satlasana taluka of Mehsana district, women’s groups took on the enviable role of contributing to the family’s coping and adaptive strategy with support from the Vikram Sarabhai Centre for Development Interaction

(VIKSAT). The National Bank for Agriculture and Rural Development (NABARD) supported a one-year project and established linkages with the State Bank of India. After visiting VIKSAT field areas, the bank offered a line of credit and established direct contact with the SHGs. These now could access both revolving funds from VIKSAT as well as loans from the bank.

A revolving fund management committee was set up and norms laid down for access to the financing. The revolving funds were loaned at different interest rates and involved income sharing and reinvestment. Through the involvement of federations, Tree Growers Cooperative Society (TGCS), a mutual stake was created.

The bank provided loans to 72 SHGs from 12 villages, amounting to Rs. 2,777,500 and VIKSAT’s revolving fund provided Rs. 500,000. Most of the funds were used for seeds, livestock and fodder. Other uses included collection of food grain, storage and

Income during drought periods increased from 16 to 69 percent after interventions from non-governmental organizations (NGOs)



ensuring food security for the entire year. Interestingly, some groups took loans to release agricultural land mortgaged during the recent drought spell. The groups have repaid installments promptly, thereby enabling financing for others. The manager of a nearby bank branch comes on a predetermined date to the VIKSAT office in Satlasana to collect installments. In view of the one hundred percent repayment history, the bank has decided to open a branch in Satlasana.

## Conclusions

Women have shown more imagination than men by investing in livelihood enhancement activities such as livestock, fodder, agriculture and food security. This strengthens adaptive strategies and reduces vulnerability. Women have also shown greater vision by demonstrating a higher capacity for taking risks than men and releasing mortgaged land from moneylenders. Women have demonstrated money management skills by taking bank loans to invest in construction of check dams under the Swarn Jayanti Swarajgar Yojna (SJSY, a Government of India's program on promoting self-employment) scheme and repaying the loans when the scheme money was released. Within three years, the women of Satlasana formed a Mahila (women's) Federation.

Scaling up and sustainability dimensions have been demonstrated by a similar approach in the neighboring district where women have formed a Mahila Federation

and are negotiating with the bank for loans. Women are gaining prominence and are gradually becoming part of the decision-making process at the family, village and regional levels. They have restored the creditworthiness of their villages. A committed facilitating agency (an NGO), a financial institution and a committed, critical mass of women leaders along with the appropriate policy changes in banks and government schemes has the potential to mainstream women and empower them by providing sustainability to their adaptive strategies.

Beginning innocuously with a conventional savings and credit program three to four years ago, the women's groups have today evolved into a federation, which indicates institutionalization of the groups. They now extend finance for basic livelihood issues such as releasing land mortgaged during drought, constructing check dams and ensuring food and fodder security at the family level. Furthermore, the groups have also begun non-land based income through micro enterprise activities.

For the project, a village reconstruction committee was formed and everyone was invited to be part of it. Even elders could contribute. The main strategy was empowerment. The aim was to build a local institution and install local management. Technological and management capacities are built into the institution for all aspects of production and quality checking.

Women have shown more imagination than men by investing in livelihood enhancement activities such as livestock, fodder, agriculture and food security. This strengthens adaptive strategies and reduces vulnerability. Women have also shown greater vision by demonstrating a higher capacity for taking risks than men and releasing mortgaged land from moneylenders

Trainings are conducted to enable masons and artisans to be familiar with the technologies. This will provide economic opportunity through reconstruction and rehabilitation, involving local SHGs and other groups.

Currently, model demonstration houses have been constructed to showcase local technologies, and participatory exercises in the design and construction of the houses are being completed. The people are appreciative of these efforts in all areas, although some criticism is still being addressed.

The project called “Development Alternatives” intends to introduce alternative livelihoods, especially to women, thereby improving and influencing their economic condition. It also opens the possibility of strengthening local village institutional frameworks and thus facilitating a long-term sustainable development process. This will reduce the community’s

vulnerability to disasters and strengthen their resilience to future shocks – natural or man-made.

The project is investing in large-scale training and capacity building of masons and other artisans beyond the three villages identified in order to support safe and sustainable reconstruction activities and growth in the housing and infrastructure sectors. In this way, the project will be able to contribute to livelihoods and safe (re)construction processes in the whole region.

Families have been involved in the planning, reconstruction design and technology selection process in an interactive manner. The project has developed “indicators of effectiveness and sustainability” through a stakeholder-based interactive process. The SHGs are being encouraged to set up enterprises for the production of prefabricated building elements required for construction.

The project called “Development Alternatives” intends to introduce alternative livelihoods, especially to women, thereby improving and influencing their economic condition

# Key points raised in the discussions

## Parallel Session–2

### **1. Promoting participatory processes is key.**

Community-driven initiatives are essential to support the development of adaptive capacity. These foster local initiatives that support adaptation provided the larger issue of appropriate institutional arrangements is addressed.

### **2. Building adaptive capacity requires long-term support for the development of social assets.**

All the interventions presented in the session contribute in one or the other way to rural livelihoods by enhancing the natural resource base. In order to sustain flow of benefits equitably, larger issues of institutional development and strengthening needs to be carefully addressed. This is a long-term process.

### **3. Promoting equity builds adaptive capacity.**

Promoting equity helps create stronger institutions that

in turn help overcome barriers created by social-stratification. This requires effective facilitation of community-based organizations and non-governmental organizations over a long period.

### **4. Combination approach is essential.**

A combination approach targeting development of both natural and social capital with adequate investments over adequate duration is key in creating better adaptive capacities of communities.

### **5. Diversification of livelihoods system is key.**

Facilitating changes in the livelihoods system in which community shifts from farm-based livelihood dependence to other alternative non-farm-based livelihood options, which are more resilient to droughts, is one of the effective approaches to strengthen adaptive capacity.

# DAY-2

## Session-2

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# Climate change and drought: a Rajasthan experience

M.S. Rathore, *Institute of Development Studies (IDS)*

The manifestations of climate change in a specific desert area in Rajasthan were analyzed in a case study. Drought, groundwater and adaptation measures were examined. While drought and water scarcity have abrupt results, and people and communities are sensitive to extreme events, climate change, on the other hand is a gradual process, not explicit and, therefore, not understood by local communities. Climate change affects temperature, wind velocity, precipitation and humidity. Data relating to rainfall covering a period of a 100 years is available, and it has been observed that local communities have been able to adapt through coping mechanisms developed over time.

However, certain changes in weather patterns are expected to increase in severity and whether and how people adapt to extreme changes has yet to be assessed. Change in rainfall patterns lead to shifts in agricultural practices including moving away from rain dependent crops, changes in land usage and migration.

Adaptation measures require data and information on climate. It has been noticed that drought – one

manifestation of climate change – is increasing in frequency and is affecting larger areas. However, there are significant gaps in information on the patterns of climate change. Policymakers, therefore, do not address the issue of climate change, and policy is restricted to relief and rehabilitation. This is particularly true of groundwater. In Rajasthan, groundwater provides 90 percent of drinking water and 60 percent of irrigation water. Over time, the quality and availability of groundwater has been decreasing.

## Actions

Numerous efforts are being made by NGOs and the state. The Groundwater Act is part of the government's policy to address depletion of groundwater. Raising awareness for groundwater conservation is underway: sprinkler and drip irrigation systems are being promoted, and watersheds and water harvesting projects are being implemented. However, improvements are not visible.

In western Rajasthan, water is brackish. There is a need to use traditional wisdom to address water scarcity. Diversification is one solution. The government needs to

formulate different strategies for different locations as solutions are site-specific. Interventions in one area may not be appropriate for others.

In Rajasthan, migration is a traditional coping mechanism not encouraged by the state. The government has allocated between 200 and 800 hectares of wasteland for biofuel plantations; however, this land is currently being used for sustenance of livestock and marginal agriculture. The land use policy needs to consider local requirements. At government and local levels, the connection between climate change and groundwater is yet to be established. Unless a connection is established, policy will not address climate change.

# Groundwater management in Highland Balochistan: *karez* vs. tubewell in adaptation to climate change

Daanish Mustafa, *University of South Florida*

## ABSTRACT

A case study of transition from *karez* to tubewell irrigation in Balochistan, Pakistan, is used to illustrate the utility of engaging with contemporary water problems and religio/political reconstruction to glean insights on adaptation to climate change. Analyses reveal that the transition from *karez* to tubewell irrigation was neither inevitable nor necessarily more advantageous, but the outcome of deliberate policy choices by the government. The diffusion of tubewells is weakening the traditional resilience of the local communities to episodes of environmental stress, such as droughts. At the policy level, the differential power of the discourse of modernization coupled with the power of the large farmers is facilitating rapid diffusion of tubewells in Balochistan. It is proposed that climate change research agenda at its core is really about adaptation to an increasingly uncertain future. Modern groundwater management techniques, much the same as in other sectors, are predicated upon an assumption of past environmental averages prevailing into the future. Accumulative development strategies based on such assumptions are likely to render the future of fragile drylands like Balochistan much more perilous in any future climate change scenario.

The diffusion of tubewells is weakening the traditional resilience of the local communities to episodes of environmental stress, such as droughts

**F**our conceptual approaches: computer modeling – scenario building based on computerized General Circulation Model (GCM) results; anecdotal evidence of historic climate variability and environmental stress; contemporary water problems; and critical religious reconstruction, have been proposed to understand future impacts of global climate change on water resources in South Asia.

Although, international scholarly attention is mostly devoted to the

first and to a lesser extent, the second approach in informing mitigation and adaptation to global climate change, in the South Asian context, it might be the latter two which are more pertinent.

A case study of transition from *karez* to tubewell irrigation in Balochistan, Pakistan, is used to illustrate the utility of engaging with contemporary water problems and religio/political reconstruction to glean insights on adaptation to climate change.



The *karez* system consists of an underground channel connected with maintenance wells where the mother well operates through gravity. This technology is estimated to be 3,000 years old and similar systems existed in the Middle East, North Africa, Central Asia and as far as in Spain, Peru, Mexico and Japan.

The field study was conducted in seven villages in the districts of Mastung and Killa Saifullah of the Balochistan province in Pakistan, and covered both Pashtun and Dehwar areas. The region is arid and similar to Utah and New Mexico. There have been droughts in this area for the past seven years. The primary sources of income are through labor, agriculture, employment out of the village, business and livestock. The study was conducted through 147 questionnaires distributed to both males and females. Participatory Rural Appraisals (PRAs) were made along with interviews with decision makers and a review of published and gray literature. Of the respondents, 52 percent said that the *karez* had no future, 19 percent of the replies were maybe/conditional, and 22 percent felt that the *karez* had a future.

People need quick responses to their problems during drought, and free tubewells that are subsidized by the government are increasingly being used. This has resulted in declining water tables, resulting in the failure of the *karez* system.

The reasons for the success of the *karez* system were that it required

no electricity which was expensive, community interest, elite pressure, communal harmony, satisfactory productivity, better sustainability, and advantageous and well-protected water rights. The following quote by a local water user illustrates the communal harmony aspect of the *karez* system: “*Karez*es were a great source of social and communal life for us village folks. People would sit on their sides and discuss their issues and find solutions to their problems. But modern times, new technologies and tubewells have dried out the *karez*es and their resurrection is no longer possible, nor is there any future for the existing ones” (Ghaus Bux, *karez* Kunghar).

The reasons for drawing upon a supplementary irrigation, besides *karez*, are the decline of the *karez*, change of cropping pattern, inheritance, economy, individualism, social freedom, past water scarcity, drought cropping, and on demand water.

“People have turned to the tubewell because the *karez* went dry. Some people even sold their land and water right because of the drought which is considered extremely low and objectionable in ordinary circumstances” (Roohullah, Yakub *karez*).

“Times have changed. New technology is coming in, with new machines, and new people who like the latest machines. Traditional irrigation is being progressively forgotten” (Khaliqdad, *karez* Kunghar).

The main advantages of tubewell irrigation listed by the survey

The *karez* system consists of an underground channel connected with maintenance wells where the mother well operates through gravity. This technology is estimated to be 3,000 years old and similar systems existed in the Middle East, North Africa, Central Asia and as far as in Spain, Peru, Mexico and Japan

respondents were: expansion in cultivated area, higher productivity, and social freedom, and its role as a temporary drought coping mechanism that has now become permanent.

The use of tubewell irrigation has often led to community conflict. It is more expensive to install and has high operation and maintenance costs as electricity is expensive. There has been a decline in the water table, water wastage is high and soil erosion higher. It is more restrictive in use and cash-dependent.

### Consequences of tubewell adoption

There has been a decline in water tables that has led to rural to urban migration and greater pauperization of smaller farmers. Large farmers have become more powerful, and there is a breakdown of social capital. There has been a greater integration of rural Balochistan into the monetary economy of Pakistan. On the other hand, water quality for domestic use has improved and drought coping and sustaining some livelihoods increased.

Ninety-six percent of the respondents, some of them despite having switched to tubewells, prefer *karez* irrigation. The technique can be and should be saved.

### Groundwater management options

More research on *karez* related hydrology and engineering along with cultural attitudes toward groundwater management and

modernization needs to be undertaken. The cultural/social capital around *karez* must be used for developmental ends. Policy distortions that encourage tubewell development should be removed with the primary objective being on resilience to environmental stress instead of accumulation.

The *karez* system has sustained community life, economic well-being, and ecological balance in Balochistan through various natural climatic variations for millennia. Therein lies proof of its relevance for a future with humanly induced climate change.

Resource management attitudes and technologies of moister regions are being uncritically applied in the arid realm. The society and ecology of drylands will be extra vulnerable to climate change as a consequence.

Analyses of the field study results and policy context of groundwater management in Balochistan reveal that the transition from *karez* to tubewell irrigation was neither inevitable nor necessarily more advantageous, but rather the outcome of deliberate policy choices by the government. The diffusion of tubewells is weakening the traditional resilience of the local communities to episodes of environmental stress, such as droughts.

At the policy level, the differential power of the discourse of modernization coupled with the power of the large farmers is facilitating rapid diffusion of tubewells in Balochistan. The

The use of tubewell irrigation has often led to community conflict. It is more expensive to install and has high operation and maintenance costs as electricity is expensive. There has been a decline in the water table, water wastage is high and soil erosion higher. It is more restrictive in use and cash-dependent



## More voices

With the tubewell I plant new types of crops. I have given *bazgari* (tenancy) and jobs to people. There was no *bazgar* on my lands, now there are five families settled on it. My interaction with the village increased, so did the productivity and the cropped area (Abdul Malik, Soghai Allahdadzai).

For domestic use, *karez* water was not good. It was saltish and had iron in it. The tubewell water is sweet and clean (Khadija, *karez* Noth).

Tubewell works better for us because we can get water in the house which lessens our work burden (Amna, *karez* Kunghar).

*Karez* was better because we women could get together there and share the gossip, news and advice. It flowed perpetually and we could use it anytime (Gohar Khatoon, *karez* Noth)

In our area there is no government restriction on tubewells. Even if one of us wants to install a tubewell, he will have to do it by the villagers' consent. It is not going to happen without collective consent (Abdul Hakim, Peshra Morezai).

[With tubewells] I would go so far as to say that we are spending away our future generations' water today let alone [water for] the future of *karez* irrigation! (M. Ayub, *karez* Kunghar).

But a tubewell is owned by an individual from which two or three people are earning their living, but a *karez* is communally owned from which 500-1,000 people may be earning their living. So you figure out that when a tubewell gives an individual benefit, how many lose out (M. Ismael, Banghi *karez*).

transition from *karez* to tubewell irrigation has negative consequences for social equity and environmental quality.

The contemporary water problem of declining water tables because of over pumping of groundwater with tubewell is illustrative of the types of stresses that agro-ecological system in Balochistan is likely to face in the climate change future. Similarly, people's discursive engagement with the transition through the lens of the breakdown of traditional values and world views is illustrative of the relevance of engaging with the religio/cultural

political reconstruction of resource use by communities.

It is proposed that climate change research agenda at its core is really about adaptation to an increasingly uncertain future. Modern groundwater management techniques, much the same as in other sectors, are predicated upon an assumption of past environmental averages prevailing into the future. Accumulative development strategies based on such assumptions are likely to render the future of fragile drylands like Balochistan much more perilous in any future climate change scenario.

It is proposed that the climate change research agenda at its core is really about adaptation to an increasingly uncertain future. Modern groundwater management techniques, much the same as in other sectors, are predicated upon an assumption of past environmental averages prevailing into the future

# Improving adaptation and developing livelihood resilience

Himanshu Kulkarni, *Advanced Centre for Water Resources Development and Management (ACWADAM)*

## ABSTRACT

The issue of adaptation of groundwater-dependent livelihoods to the effects of climate change is very significant to a country like India. A large part of water use in India is through groundwater. The responses to extreme events are targeted at immediate relief. Despite efforts in improving disaster management systems, the responses still remain one-off events to a particular extremity like a flood or a drought or, more recently, the tsunami. It is increasingly becoming evident that sustainable disaster management, especially in case of water shortages induced by droughts, which themselves fall as imprints on groundwater problem areas, needs to develop further into long-term processes that continuously evolve with experience, information and technology. These processes ought to, among other things, include a set of intensive actions that develop resilience of livelihood and the capacity of such communities to adapt to climatic variability.

**T**his has special reference to groundwater-dependent communities. The biggest challenge is coming to terms with variability and scale. The basic premise is diversity of geology, common to many parts of India.

The effect of scanty rainfall is often labeled as drought. This, in reality, is scarcity. During these scarcity periods, people use more groundwater and the effect is reflected in the falling level of groundwater over the next few years. This is what “groundwater drought” really is. Over abstraction

of groundwater and deterioration in its quality have impacts on livestock, economy and even human health. Very often, the root of a groundwater drought may actually be after an abnormally high rainfall year, when people are prone to extract more groundwater for augmenting sources of income, especially through increased irrigation.

The response to this is immediate relief to the one-off event rather than long-term processes to address the problem(s). The common response is to mainly increase the

The effect of scanty rainfall is often labeled as drought. This, in reality, is scarcity. During these scarcity periods, people use more groundwater and the effect is reflected in the falling level of groundwater over the next few years

supply of water by increasing recharging and water harvesting, but these are linear and relatively short-term solutions.

There is a need for long-term responses to a changing environment and the response processes should evolve using scientific information, technology and experience. The process should address adaptation in the context of variability, change and scale along with livelihood resilience. To do this, resource understanding has to be corrected by understanding the livelihood requirement of the community and adaptation options beyond the conventional “have to” setup.

A two-way approach is required to meaningfully address reducing vulnerability. On the resource side, management of groundwater resources has to be based on demand and not supply. Until about 20 years ago there were buffers that were self-regulated. Now a conscious effort for formal/informal regulation is necessary. On the livelihoods side, there must be livelihood diversification within and outside agriculture. The answers to many groundwater-related problems are usually found in existing adaptation patterns, for which there is a need to perceive resource behavior under these patterns and also study the options exercised by different sections of one community as well as by a diverse set of communities.

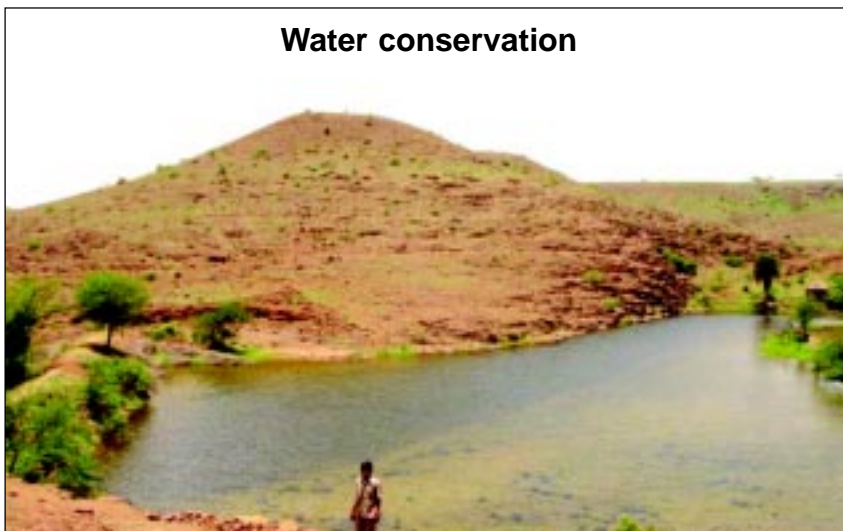
### Copping strategies to access depleted groundwater



### Droughts impacting groundwater



### Water conservation



# Community initiatives in enhancing resilience to cope with climatic variability and extreme weather: a case study in Maharashtra

Suruchi Bhadwal, *The Energy and Resources Institute (TERI)*

## ABSTRACT

Supported by the World Bank, this ongoing study seeks to identify issues and opportunities that enhance coping strategies of communities in dealing effectively with extreme weather events including droughts and floods. Of the 17 villages covered as part of this study, this case study to be presented discusses the preliminary findings from one of the villages surveyed in Maharashtra, India. It is an outstanding example of the role of community-based initiatives in enhancing resilience to cope with climatic variability and extreme weather conditions. Located in Ahmednagar district in the Nagar taluka, “Hiwre Bazaar” is presented as a model village where specific interventions taken up by the community itself resulted in improved living conditions.

The case study discusses the developments that have taken place in the village over the last 15 years and the resulting observed changes. It highlights how strong leadership at the village level can transform the conditions of a water-scarce village into one that is self-sufficient and sustainable. It highlights that ownership matters at the local level and promotes effective management of watersheds. Positive developments on the environmental front have been higher water tables and ecosystem restoration, and on the socioeconomic front, development of alternative income-generating activities and a check on out-migration. The village has introduced its own water regulations linked to its crop plans. They have changed their cropping patterns away from the profitable but water guzzling sugarcane crop. Annual decisions on cropping intensity are made collectively within the village, ensuring efficient management of the resource and equitable distribution of yields. The village thus represents a successful example of self-enhancement of resilience in coping effectively with climatic variability and conditions of extreme weather and highlights the role that communities themselves can play in achieving this result. Such examples are, however, very limited; the processes that worked need to be understood in order to replicate similar efforts in other drought-prone villages.

This ongoing study seeks to identify issues and opportunities that enhance coping strategies of communities in dealing effectively with extreme weather events including droughts and floods

**W**ith the support of the World Bank, The Energy and Resources Institute (TERI) carried out 17 surveys across India. The preliminary findings at Hiwre Bazaar, Maharashtra, highlights the difference that community initiatives can make in enhancing resilience and coping effectively with climatic variability and extreme weather conditions. The broader goals of the study were to assess coping capacities of communities and factors that influence the implementation of these measures, along with a cost-benefit analysis of action versus no-action for certain proposed interventions.

Hiwre Bazaar is located in Nagar taluka of Ahmednagar district. The major crop in the village is sugarcane. Ahmednagar lies in a zone of scarcity and is affected by drought. It is covered by both the Godavari and Krishna basins and the Mula and Parvata tributaries. Dams have been constructed in the high rainfall zone but they do not supply water to all talukas (administrative breakdown of a district). None of the thousands of villages in Nagar and Pathardi talukas receive any irrigation intervention programs, although their primary occupation is agriculture. In a few villages, however, some watershed development activities have been initiated under the government's Drought Prone Area Programme (DPAP).

About 15 years ago, Hiwre Bazaar did not fall under the DPAP and

### Soil conservation measures



was therefore not targeted for any watershed development. Because of suitable soils and easy access to markets, water intensive crops like sugarcane were grown. Water tables have been falling dramatically and water availability for irrigation as well as drinking has become a major problem. Agriculture is no longer viable, resulting in large-scale out-migration in search of alternative livelihoods.

Over the last 15 years, the village headman introduced soil conservation measures in the higher ground, including trenches to control soil erosion and improve fertility. While most villagers were initially not supportive of the initiative, a small number of people who were directly affected by the threat of water use upstream on the hill affecting its availability to them were interested. Runoff from the hillock, which bypassed the village, was high and recharge within the watershed low. People started

### Water storage and recharge





building and restoring large and small water tanks for storage and recharge. The tanks were located downhill in series.

These activities reduced runoff, increased recharge rates and increased water tables – water levels in open wells rose visibly. Community as well as bilateral investments in soil conservation and tank development began. Today, the water tables are at between 40 and 50 feet below ground and water is available for irrigation. This helps stop out-migration and opens avenues for other income generating opportunities. Other programs in the village are properly planned and implemented. An NGO has been established, the members of which are the villagers themselves. Several village development activities are being promoted, including education and health centers. In some cases, technical expertise has been sought from government bodies, especially the rural development department.

The villagers were convinced not to grow sugarcane but grow onions and maize instead, greatly reducing water usage. Which crops are planted each year are based on an annual review of the rainfall.

### Lessons learned

Strong leadership in the village has transformed the resilience of the community to cope through drought years. Examples can be



*Empowered panchayats have the capacities to develop self-sufficient villages, in meeting their needs and in strengthening the country as a whole*

quoted from elsewhere in the country where local level initiatives under strong leadership have been successful. One is Tarun Bharat Sangh, another are the initiatives taken by Shri Ana Hazare in village Ralegaon Sidhi. There is a strong need to understand the processes behind these successes and use them as testimonials for replication elsewhere.

The role of local institutions in enhancing capacities for community development is extremely important. Planned adaptation (government initiatives for proactive adaptation to climate variability and change) and socially-driven adaptation (local responses to climate extremes) do work together. Empowered *panchayats* (local village-level governing bodies) have the capacity to develop self-sufficient villages.

Strong leadership in the village has transformed the resilience of the community to cope through drought years

# Key points raised in the discussions

## Parallel Session–3

**1. Breakdown of traditional systems.** The introduction of new technologies, such as tubewells, often leads to the extinction of local systems. The advantages and appropriateness of traditional systems, which have worked for centuries, need to be reflected in education. In watershed management programs in Pakistan, community resources often become private property which leads to inequity. *Karez* was a system where households and the community were directly involved, as they had to be present for drawing water. The system functioned as an institution where issues were addressed and disputes were resolved. Now the *karez* system has been replaced by NGOs and the state.

**2. Impact of breakdown of traditional systems.** In Balochistan, the majority of people are dependent on

traditional systems such as *karez* as they cannot afford tubewells. The breakdown of the traditional *karez* system has led to migration, increased vulnerability and growth of illegal occupations such as smuggling and trafficking. *Karez* systems could be restored and used in conjunction with supplementary supplies from tubewells.

**3. Looking beyond hydrology.** Solutions to water scarcity are generally sought through direct interventions in the hydrologic cycle. Interventions such as watershed management, water harvesting and other water management activities are partial responses. A comprehensive solution needs to include factors that go beyond water management. Changes in agriculture practices and crop diversification can improve conditions of water demand as well as improved livelihoods.



# DAY-2

## Session-2

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102	HOUSEHOLD AND COMMUNITY RESPONSES TO FLOODS, DROUGHTS AND CLIMATIC VARIABILITY <i>Nafisa Barot, UTTHAN</i>
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# Playing with disasters: politics of flood and drought in Tamil Nadu

S. Janakarajan, *Madras Institute of Development Studies (MIDS)*

**A** disaster, natural or a man-made, can totally disrupt the normal functioning of a society. It can cause enormous damage to property and result in changes to human settlements, ecosystems and the environment. The more vulnerable sections of society are disproportionately affected, which often leads to migration and trafficking as people struggle to find new livelihoods. The people of Tamil Nadu suffered three disasters in a row – a drought that persisted for four years (from 2001 to 2005), the tsunami in 2004, and the flood of 2005.

The flood damage in November and December of 2005 left at least 672 people dead. Over 250,000 were rendered homeless, and 700,000 trapped in the floods. Over 350,000 hectares of agricultural land was destroyed, 3,000 irrigation tanks and 1,500 river banks and canals breached, and 20,000 km of road damaged.

The following questions must be asked in addressing these disasters:

- To what extent are the floods and droughts due to human activities?
- What are the lessons learned from past experiences, both at the local and state level?

- To what extent has conventional wisdom of the state, such as the distribution of relief materials and funds, helped in mitigating the impacts of these disasters?
- What are the coping strategies adopted by the most vulnerable?
- To what extent does politics play in disasters, and are their impacts better mitigated in a democracy?

The political community often uses disasters to promote its political agenda. Tamil Nadu's state assembly elections are due in May 2006 and, therefore, the drought, tsunami and flood have become hot political issues. Both the ruling and opposition parties have played into these disasters, criticizing the flood management and relief operations of the other in their campaigns. Relief material and funds following the 2005 flood, for example, were distributed to anyone who had a ration card, whether they were affected or not, whether they were poor or not, despite the fact that the state received only Rs. 10 billion (US \$225 million) out of the unprecedented Rs. 136.85 billion (US \$3.08 billion) it requested in relief funds from the central government. The opposition parties demanded an

The political community often uses disasters to promote its political agenda

all-party committee to disburse relief funds, but the ruling party refused.

The usual government response to disasters is relief. There is little proactive, long-term strategy development to mitigate the impacts of and to cope with disasters. Risk reduction strategies are almost non-existent. There has been a failure to understand the link between the long-term drought and the impacts of flood. Had the drought been better managed, the flood that came immediately afterward might have caused less damage and floodwaters could have been captured for future use by the water-starved state. Instead, about 15,000 million cubic feet of water in Chennai (two years' supply to the city) and around 200,000 million cubic feet in the Cauvery River were flushed out to the sea.

The impacts of disasters have been exacerbated by harmful human activities. In the city of Chennai, for example, 6,000 hectares of marshland on the outskirts of the

city have been reduced to 600 hectares. There are 150 temple tanks in the Chennai metropolitan area, traditionally used as water reservoirs, that are now used as dumps or are silted up. All the irrigation canals, rivers and water tanks in the entire state, including within Chennai city, have been encroached for construction works and filled with silt. Had these issues been addressed during the drought years, the damage caused by the flood would have been greatly reduced.

Vulnerability to disaster increases with decreasing economic and social status and lack of information. In the case of drought and flood, however, everyone was aware of the dangers posed by wanton construction of buildings over tanks and waterways. Although the state planning authorities have no control over these reckless builders, they still provide relief and compensation following a disaster in order to curry their support and vote during elections.

The usual government response to disasters is relief. There is little proactive, long-term strategy development to mitigate the impacts of and to cope with disasters

# Household and community responses to floods, droughts and climatic variability

Nafisa Barot, *UTTHAN*

## ABSTRACT

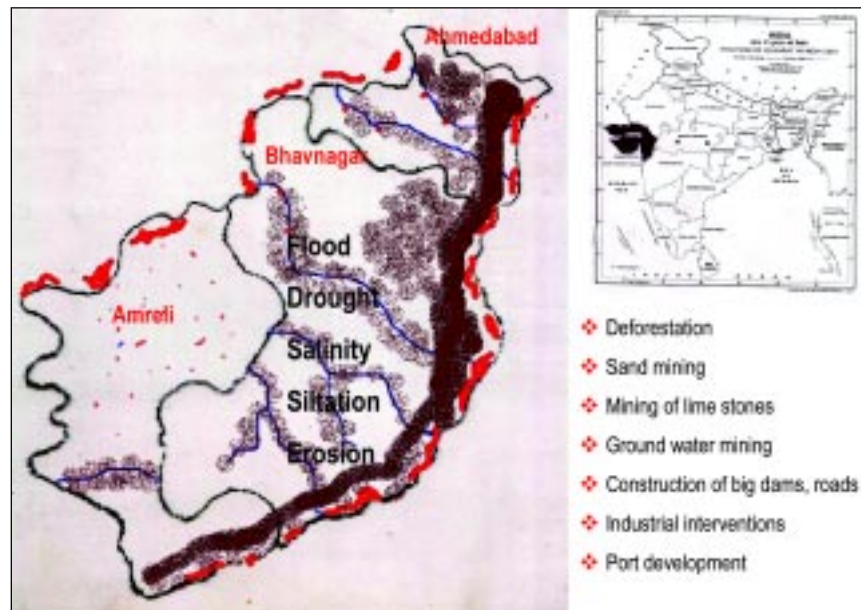
The recent disasters such as the earthquake, cyclone, tsunami and severe floods have highlighted the extreme vulnerability of coastal communities in Gujarat. The coastline is also one of the richest in terms of its ecological resources, culture and biodiversity. UTTHAN's experience over two decades has clearly shown that the rapid degradation of natural resources due to human interventions is the major cause of severe impacts. UTTHAN aims at facilitating community-based scientific action research and plans that will help in advocacy of issues.

Gujarat has the largest coastline in India with a sea board of 1,633 kilometers. The coastline is also one of the richest in terms of its ecological resources, culture and biodiversity. Recent disasters such as the earthquake, cyclone, tsunami and severe floods have highlighted the extreme vulnerability of coastal communities.

UTTHAN's experience in three districts of Gujarat – Ahmedabad, Bhavnagar and Amreli – over two decades has clearly shown that the rapid degradation of natural resources due to human interventions, including deforestation, mining of sand from the sides of the rivers, indiscriminate water mining, construction of big dams without

appropriate maintenance and regulatory systems, and changing land use patterns, is the major cause behind the severe impacts from floods and cyclones. These have

Recent disasters such as the earthquake, cyclone, tsunami and severe floods have highlighted the extreme vulnerability of coastal communities



resulted in siltation, land erosion, salinity, loss of property and livelihoods, increasing drudgery, poor health and the divide over access to livelihood resources – especially by vulnerable sections such as women, the poor, dalits and muslims.

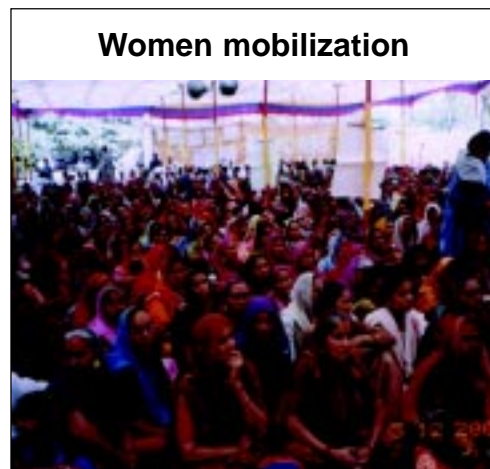
Vast stretches of flat, barren and saline land near the Dholera coast of Ahmedabad contained lush green mangrove forests, piloo (*salvadora persica*) and many other salt tolerant species some 50 years ago. Similarly, certain parts of Amreli and Bhavnagar were known for their rich orchards, and agriculture needed large-scale labor from outside. Now, the large-scale deforestation of mangroves and other species from the coast plus limestone mining and irresponsible change in land use patterns (especially by the industries in the coastal region and also from water mining upstream) has resulted in the formation of wide mud and salt flats where there were once rivers. These allow heavy seawater ingress, spreading salt over vast stretches of land. Simultaneously, silt from the mainland fills up river mouths. As a result, Dholera port has closed down and Bhavanagar port reports heavy and unmanageable siltation. Some of these areas get marooned during the rainy season only to face a severe drought in the following summer. Now, instead of immigration for tending to orchards and agriculture, there is large-scale emigration of communities.

With the changing ecological situation, people's own knowledge

of early warning systems and traditional strategies to respond to natural calamities, have been lost. They used to predict heavy or scarce rains and the direction of the flow of water from the behavior of some of the birds and animals.

### Impact

The major impact of extreme changes is on women and the poor, especially with regard to the severe scarcity of fresh water for drinking and other resources for livelihood. Sanitation is getting worse and emerging as a major issue of dignity and safety for women and girls. Taking credit for agricultural inputs, health and basic survival needs has resulted in major debts due to high interest rates that can reach 120 percent annually. The changing environment on the coast has led to greater inequity in resources, with small farmers selling land to big farmers who have wells and other resources. This is why a large section of the community migrates, either with the entire family or leaving behind the old and very





young who cannot work. These migrants mainly work in the diamond polishing industry as unskilled labor. A few work as skilled labor, too.

### Community responses

There have been various responses from the communities to adapt to situations over time, though some have had drawbacks. For example, the change from rainfed to groundwater irrigated agriculture in some places has yielded more salinity and crop failure. Also, the community realizes that migration as an adaptation is neither sustainable nor desirable. They know migration leads to disruption of children's education, increased conflict in the urban areas, and increased insecurities for women. On the positive side, this perception has led to the younger generation investing in rainwater harvesting in their villages for development of degraded water resources, for example. The groundwater recharge movement in Saurashtra was largely supported by the migrant communities.

### Government responses

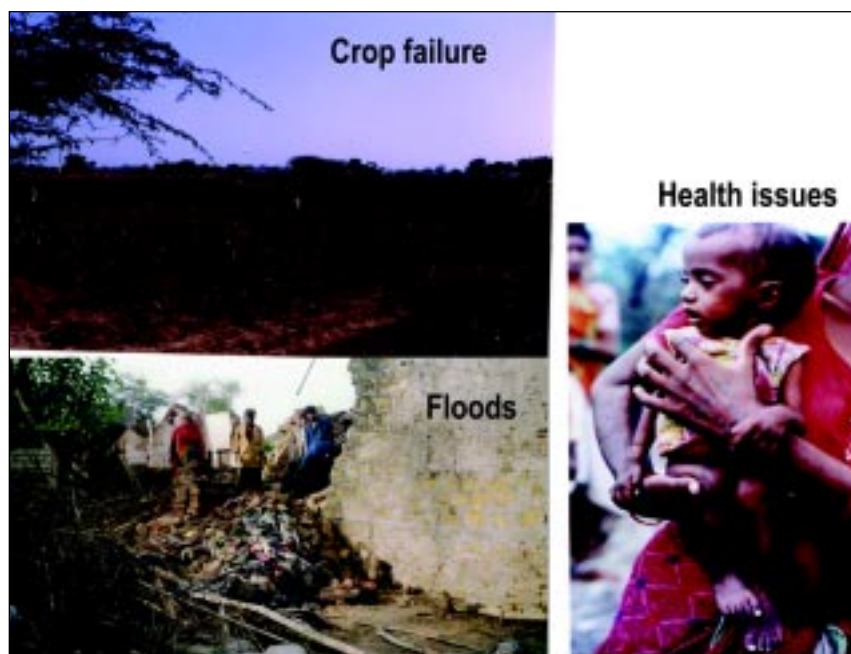
The government has not responded to these changes in a proactive manner, which has increased the impacts of disasters. Many communities have been demanding certain types of structures that would give them protection against heavy or scarce rains, embankments that are pitched, with appropriate drainage channels, for example, or the development of mangrove plantations to address salinity issues. However, government

responses are mostly late and relief work often begins after a large number of people have migrated from the areas. Because of shortsighted planning and corruption, structures are constructed that are often of no use and, in the process, people have lost faith in the system.

### Interventions

NGOs including UTTHAN, Aga Khan Rural Support Program – India (AKRSPI), Lokbharati Sanosara and Development Support Centre have received a good response from the communities for implementation of programs such as watershed management, recharging of well, development of good farming practices, and diversification of occupations such as fishing. In this way, the communities have been encouraged to adapt to newer practices for improving soil, water and other natural resources. UTTHAN's

The groundwater recharge movement in Saurashtra was largely supported by the migrant communities



major focus has been on empowerment of the communities by influencing the mindset of the people at different levels based on the values that will help install gender equity, peace and self-reliance in society. Dialogues with communities on the issues of gender equity and sustainability in the context of disasters and vulnerability have begun.

UTTHAN has four sets of strategic interventions. The first is to aim to facilitate community-based scientific action research and action plans that will help in advocacy of issues, including allocating land to the landless and women; proactive support for development of infrastructure as identified by the people instead of the government's present plans that do not take into consideration the needs of the community; and mobilizing resources to support community initiatives. The second strategic

intervention is adapting viable early warning systems found in other areas. The third is mainstreaming gender perspectives. The fourth strategic intervention is building and strengthening linkages with scientific and educational institutions, government departments and other networks, as well as connecting communities across the region.

Committees are being formed for disaster preparedness, watershed management, water and sanitation, river basin, health, and youth groups. A women's federation has also been established. These will network or/and collaborate with: PRAVAH, Water Supply and Sanitation Collaborative Council/ Water, Sanitation and Hygiene (WSSCC/WASH) in the area of water and sanitation; coastal area network; Mahila Swaraj Abhiyan; Sajjata Sangh, Jal Biradari, Groundwater Authority (GWA),

Committees are being formed for disaster preparedness, watershed management, water and sanitation, river basin, health, and youth groups. A women's federation has also been established



Integrated Water Resource Management (IWRM, watershed); and violence against women groups. They will also collaborate with current government programs, including Swajaldhara (WASMO), Watershed (DRDA), Ground Water Resource Development Corporation, Forest and Irrigation Department, and Salinity Ingress Prevention Cell.

### Challenges

The impact of globalization is felt in land allocation and in the influx of large industry (port building, cement, chemical, salt, sand and limestone mining and trawling). This leads to conflict between the industries and the local communities over natural resources and the kind of infrastructure needed. Another threat is rapid urbanization and communal conflict. All these are threats to the livelihoods and well-being of local communities. They give rise to increasing gender inequities and communal insecurity. There is a lack of appropriate policies and legitimate space for community-based organizations (CBOs) and civil society. There is no proper understanding of local knowledge – no scientific, socioeconomic or ecological studies; and documentation and dissemination of good practices have not yet been done.

Future actions include:

- establishing area-level gender-sensitive institutional mechanisms for knowledge and information exchange and collective actions;
- creating awareness through a coastal learning center and various

area-level institutions including *panchayats*;

- capacity building and sensitization at various levels for disaster preparedness and conflict transformation;
- management through CBOs, government, research and resource institutions; and
- action research and documentation that will
  - undertake a scientific study on resources (potential of reviving/modifying existing infrastructure, availability of land, government resources, and vulnerability at area level);
  - create a community-based action plan;
  - document major learning, good viable practices and people's initiatives; and
  - identify advocacy issues and strategies.

### Large-scale demonstration of viable alternatives and experiments being implemented by UTTAN

- Promotion of rainwater harvesting, conservation, sanitation (loans, contributions and government programs)
- Sealing the saline aquifers in the wells
- Implementation of good practices in agriculture, horticulture, plantation of mangroves, salt-tolerant species, medicinal plants
- Promotion of viable diversification through appropriate support – fishing, services, off-farm products
- Establishing and organizing local-level livelihood security systems/banks – drinking water and

Globalization leads to conflict between the industries and the local communities over natural resources and the kind of infrastructure needed. Another threat is rapid urbanization and communal conflict. All these are threats to the livelihoods and well-being of local communities



sanitation, food grains, fuel, fodder, medicines, etc

- Operationalizing early warning system – linking volunteers with reliable information source, mobiles, radio and ham operators
- Demanding collective land ownership
- Ensuring implementation of right to information through public hearing and access to relevant information
- Dialogue across the areas upstream, downstream and along the coast line in the areas of community norms and mechanism for equitable and sustainable resource use.

UTTHAN is currently advocating the government to undertake or support:

- a review of ongoing projects such as tidal regulators;
- development of degraded sites;
- land allocation to vulnerable sections especially women and landless groups;
- resource allocation and proactive support for disaster preparedness;
- support to communities to build disaster resistance structures – water structures, toilets, schools and health facilities;
- establishment of regulatory mechanisms – agricultural policies, norms for water use/pricing and monitoring; institutional reform through consultative processes at all levels; and
- convergence between forest, watershed, water and sanitation, and agriculture departments, the Groundwater Board, Salinity Ingress Prevention Cell and Gender Resource Centre.

One alternative is operationalizing early warning system – linking volunteers with reliable information source, mobiles, radio and ham operators

# Development Alternative's experience in addressing adaptation

Anish Chatterjee, *Development Alternatives (DA)*

Climate change is likely to threaten India's food security, increase water stress, result in sea level rise and increase the occurrence of diseases, especially malaria. Lack of availability and access to technological and financial resources coupled with a high dependence on climate sensitive sectors – agriculture, fisheries, forestry – have made India highly vulnerable to climate change. Adaptation to climate change is, therefore, critical for India.

Development Alternatives (DA) has been involved in addressing adaptation to climate change at various geographic scales. Over the last 22 years, a range of interventions related to adaptation have been accomplished. These include vulnerability assessments, development of adaptation strategies and their implementation, and rehabilitation and resettlement of disaster-affected populations. Successful interventions promoting self-governance, microfinance and insurance schemes, women's empowerment, social cohesion and self-help to meet basic needs in a sustained way have also been the key focus areas of the organization.

One area that DA focuses on is Rajasthan. The state of Rajasthan experiences both an arid and semi-arid climate; India's initial national communication to the United Nations Framework Convention on Climate Change (UNFCCC) projected that 60 percent of the area of Rajasthan is likely to experience acute physical water scarcity.

## Approach to building adaptive capacity

Droughts are increasing in frequency and intensity. They now occur in successive years and have a wider geographical impact, eliminating the option of moving cattle to nearby grazing grounds. Traditional agricultural practices that included growing less water intensive crops such as *jowar* and



Approach – stakeholder interaction

## Drought Impacts in Rajasthan, 2002-2003

Rainfall deficiency	-55%
Districts Affected	32
Villages Affected	41,000
Affected Population (million)	43.2
Affected Livestock (million)	54.3
Daily wages of manual labor have dropped from Rs. 60-70/day to Rs. 30-40/day	
Only half of the 500,000 jobs expected to be generated through the Food for Work Program were created.	



*bajra* (millets) had to be revived and contour bunds built around the fields to help retain available water. Wells had to be de-silted and cloth used for filtering drinking water during the droughts. New ponds and wells had to be dug and existing ones deepened.

Drought adaptation measures include constructing anicuts, which help not only store water but also recharge groundwater in nearby aquifers and wells. The use of vermi-compost as a fertilizer increased soil moisture and reduced the water requirements of crops. Non-governmental organizations (NGOs) provided guidance on less-water-intensive fodder and other crops to cultivate, including *sona mukhi* (*Casia angustifolia*), a drought-tolerant medicinal plant.

Water availability for both drinking and irrigation improved. Drinking water is now available almost


throughout the year, and the water storage structures have allowed villagers to irrigate their fields during the winter as well as the following cropping season.

The increased availability of water and fodder allowed wastelands to be reclaimed and used for agriculture and cattle rearing, which


Drought adaptation measures include constructing anicuts, which help not only store water but also recharge groundwater in nearby aquifers and wells

### Adaptation Measures

**Water Harvesting:**  
Construction of anicuts




**Water demand management:**  
Application of vermi-composting to increase soil moisture & reduce water requirement of the crops




*Vermi-composting*

**Adaptation Measures**

**Medicinal Plants:**  
 Increased incomes through cultivation of "Sona Mukhi" (*Cassia Angustifolia*), which requires less water.



*Sona Mukhi*



*Fodder Crop - Sorghum*

**Fodder Crops:**  
 Now they are growing fodder crops, with the active assistance and guidance from NGOs

contributed to greater incomes. Since there is a very high demand for medicinal plants, revenue from these was high. Growing vegetables in addition to the staple crops was possible thanks to improved water availability; the vegetables provide food security, better nutrition and revenue.

In addition to the above activities, NGOs should facilitate the formation of self-help groups (SHGs). These groups can initiate savings and credit schemes to help tide members through difficulties.

The strong presence of local NGOs in communities helps. These can help empower villagers, which includes raising their awareness

about water crises and training them in innovative, adaptive techniques. Simple agricultural risk mitigation schemes are needed to replace the existing ones that have limited coverage, are cumbersome and time consuming. Despite repeated crop failures, no effective crop insurance scheme has yet been introduced. The gap that often exists between project planning and implementation is due to a lack of awareness in communities, delay in tapping into government-funded schemes, complex and cumbersome procedures when dealing with the government, and lack of coordination among implementing agencies. Communities need to be empowered to take action and take things into their own hands.

The gap that often exists between project planning and implementation is due to a lack of awareness in communities, delay in tapping into government-funded schemes, complex and cumbersome procedures when dealing with the government, and lack of coordination among implementing agencies

# Livelihood challenges of central India

Vivek Sharma, *Centre for Advanced Research and Development (CARD)*

## ABSTRACT

In India, the tribal population largely consists of people who dwell in afforested and hilly areas that are remote and do not have good communication facilities. The result is extreme poverty. Development of remote, backward areas must address issues of poverty, illiteracy and ignorance. Madhya Pradesh has an abundance of natural resources but is one of the most backward regions in terms of socioeconomic progress. CARD has several livelihoods improvement and natural resource development projects underway in three remote locations of Madhya Pradesh, implemented with the involvement of all community members and through self-help groups (SHGs). These projects are proving successful.

**I**n India, the tribal population largely consists of people who dwell in afforested and hilly areas that are remote and do not have good communication facilities. The result is extreme poverty. Development of such rural areas must, therefore, address issues of poverty, illiteracy and ignorance.

Many NGO programs and government interventions exist for natural resource development and livelihood improvement, but their reach into remote areas is limited. The Centre for Advanced Research and Development (CARD) has conducted several evaluations of government programs for watershed development, and has

been involved in building capacity of various stakeholders in watershed programs. It also implements many of its own projects. In Madhya Pradesh, CARD is implementing several pilot projects in three field areas identified for representing three distinct regions of the state.

The tribal populations in the states of Madhya Pradesh and Chhattisgarh make up 27 percent of the total tribal population in India. These tribes are mainly concentrated in the eastern and western belt of these two states. The eastern region is dominated by the Gond tribe and has a large, poor population and poor infrastructure, though it is well endowed with forest resources.

Many NGO programs and government interventions exist for natural resource development and livelihood improvement, but their reach into remote areas is limited



The western belt is dominated by the Bhil tribe and has better communication facilities but suffers from greater depletion of natural resources. Feudal landlords inhabit the northern region with a scattered population of marginalized communities (Scheduled Castes and Other Backward Communities) often pursuing precarious livelihood opportunities.

Eastern Madhya Pradesh has an abundance of natural resources, mineral as well as forest, but is one of the most backward regions in terms of socioeconomic progress. Tribal groups are subjected to various degrees of exploitation and have limited access to development programs, even those designed for them. In addition, the remote areas in which they live are poorly connected to the rest of the district or state, which slows the development process of the district. Tribal groups are unable to reach markets to sell their produce. Healthcare is not available and students are forced to drop out of school during the rainy season when road access is cut off.

### Issues

In the eastern region, issues to be addressed include increasing the productivity of marginal holdings, introducing rainwater harvesting schemes, improving transportation, making livestock rearing economically viable, developing forests resources, adding value to surplus produce, and providing gainful employment during the non-growing season.

### Comparative Demographic Characteristics

Particular	Madhya Pradesh	Chhattisgarh
Population ( in 000)	60348	20833
Rural Population (%)	73.5	79.9
Tribal Population (%)	20.3	32.5
SC Population (%)	11.4	12.2
Literacy (%)	63.7	64.7
Gender Ratio	919	989
Workers Participation Rate	42.7	46.5
Infant Mortality Rate (per 000)	89	78

### Land Use Characteristics

Particular	Madhya Pradesh	Chhattisgarh
Geographical Area ('000 ha)	44437	13787
Net Sown Area (%)	48.01	34.54
Net Irrigated Area (%)	13.34	7.13
Area Under Forest (%)	27.81	45.72
Waste Lands (%)	20.28	19.58
Average Rainfall (annual in mm)	800-1000	1000-1200

The issues in the north that must be addressed, include the following:

- Reduction in poverty in areas inhabited by Scheduled Castes by increasing livelihood options and providing access to irrigation
- Scarcity of both surface and groundwater and the alarming rate of water depletion
- Water harvesting and storage in the upland water courses through ponds, tanks, and stop dams
- Increasing the productive capacity of small farms on slopes through application of large-scale field bunding
- Revival of traditional occupations of the landless
- The low level of selective development indicators – sex ratio, literacy, forest area, groundwater
- The absence of a strong local

institution or movement in the region.

The west is characterized by a degraded natural resource base due to inappropriate land and water management practices owing to declining farm productivity and population pressure. Lands, especially common lands, are barren with negligible vegetative cover, and there is an acute shortage of fodder, fuel wood and timber. Livestock are often undernourished. In addition, a lack of appropriate credit sources force people into debt. Besides, the low level of literacy and absence of civil society at the grassroots level have led to large-scale migration.

CARD's programs in the three remote locations of Madhya Pradesh are briefly described here. The Livelihood Promotion through Natural Resource Management Programme in eastern Madhya Pradesh involves value-addition to local non-timber forest products working through SHGs. Some of the value-added products – honey, natural fiber, medicinal plants and food processing – have drawn

regional and national recognition. Over 250 traditional honey hunters have been trained and 22 SHGs formed. The SHGs are networked into a federation and share technology, credit and marketing support.

CARD has established a Technology Resource Centre where training and demonstration in rural technologies are conducted. This centre is a nodal point for the Livelihood Promotion Programme. The Centre also addresses good governance through the Poorest Area Civil Society Programme, supported by the UK Department for International Development (DFID), organizes tribes into groups and links them with income generation activities, strengthens *panchayats*, and enables participation by and empowerment of women by networking with over 500 SHGs.

Other organizations are also partners to these activities in these remote areas of eastern Madhya Pradesh – they are Canada Fund for Local Initiatives, Toyota



*Poorest Area Civil Society Programme*

CARD has established a Technology Resource Centre where training and demonstration in rural technologies are conducted. This centre is a nodal point for the Livelihood Promotion Programme



*Intervention through Common Interest Groups*

Foundation, and the United Nations Development Programme.

In western Madhya Pradesh, there are several projects. These include the Natural Resource Management through Community Initiatives project which consists of a watershed based natural resource management project. A model watershed project, based on the National Watershed Guidelines and involving the entire community, is being implemented in three *panchayats*, covering over 1,500 hectares. Under the Child Sponsorship Based Development Programme, 1,000 households in 18 villages receive child-centered development sponsorship. The educational development of children, their healthcare and proper nurturing is monitored in conjunction with development initiatives based on natural resource regeneration. The Livelihood Promotion of Marginalized Communities Programme includes initiatives to reduce poverty through common interest groups, which cover 2,000 households in 20 villages with over 500 groups pursuing different livelihood options through over 100 infrastructure-based development initiatives. Through community initiatives, the project also addresses

unemployment and poverty with science demonstrations and technology applications to promote alternative livelihood options.

Under the Hasthshilp (Natural Fiber) Vikas Yojana, over 100 households have been trained and are involved in the production of quality natural fiber products. The raw material is produced and processed locally by group members and product marketing linkages established with emporiums, national fairs and through Maikal Hills Natural Products.

In Chhattisgarh, where two field pilot projects have been initiated, CARD has emerged as the primary support organization. The organization strengthens all levels of the project facilitation team and facilitation of common interest groups, its members, leaders and their organization. The strengthening mechanisms have been designed to revolve around income generating activities of the community, with judicious and systematic development of a field-based portfolio of action steps and empowerment programs for the community in general and tribal women in particular.

In Chhattisgarh, where two field pilot projects have been initiated, CARD has emerged as the primary support organization. The organization strengthens all levels of the project facilitation team and facilitation of common interest groups, its members, leaders and their organization

# Key points raised in the discussions

## Parallel Session–4

**1. Is adaptation affected by level of income?** The poor are not always the worst affected. In some cases they are more prepared to adapt. In the recent droughts in Gujarat, poor people often had more experience with regional labor markets and better job networks than the more wealthy “settled” farmers. As a result, they were able to access diverse income sources when drought affected farming. Vulnerability and the exposure to risk can contribute to development of coping strategies. As a result, it is a mistake to assume that groups are more or less vulnerable based on socioeconomic status alone.

**2. Institutional Linkages.** There is the absence of dialogue between government and NGOs. Linkages have to be established also between SHGs and Panchayati Raj Institutions. It is important that institutional linkages are established among the central and state governments and NGOs, technical institutes, private sector and markets.

**3. Developing synergy through coordination:** In the case of Tamil Nadu, after the tsunami, there was extensive coordination between NGOs and government agencies. The state government received information from the local level through the collector, and NGOs were able to deliver according to the community’s needs. Standards were laid down for NGO activities. Establishment of effective mechanisms for coordination also made it possible to draw on expertise from Anna University and the Indian Institutes of Technology in Chennai and Kanpur. With the help of the *panchayats*, NGOs were able to establish projects, select groups, and work with them on a long-term basis.



# DAY-2

## Session-3

Page No	PARALLEL SESSION 5 Coastal Vulnerability and Disaster – From Reconstruction to Resilience <i>CHAIR: Neeraj Mittal, Joint Commissioner, Relief and Rehabilitation, Tamil Nadu</i>
118	APPROACHES TO ASSESSING DISASTER VULNERABILITY AND BUILDING SUSTAINABLE LIVELIHOODS: INSIGHTS FROM SRI LANKA ONE YEAR AFTER THE TSUNAMI Frank Thomalla, <i>Stockholm Environment Institute (SEI)</i>
123	STRENGTHENING RESILIENCE OF COMMUNITIES TO DISASTERS USING THE DRSL FRAMEWORK: ITDG'S EXPERIENCE IN SOUTH ASIA <i>Practical Action, [Formerly Intermediate Technology Development Group (ITDG)]</i>
125	FROM RELIEF AND RESTORATION TO RESILIENCE: STRATEGIC DEVELOPMENT INITIATIVES WITH DISASTER-AFFECTED COMMUNITIES IN INDIA Somnath Bandyopadhyay, <i>Aga Khan Foundation (AKF), India</i>
128	KEY POINTS RAISED IN THE DISCUSSIONS

# Approaches to assessing disaster vulnerability and building sustainable livelihoods: insights from Sri Lanka one year after the tsunami

Fiona Miller, Frank Thomalla and Matthew Chadwick, *Stockholm Environment Institute (SEI)*

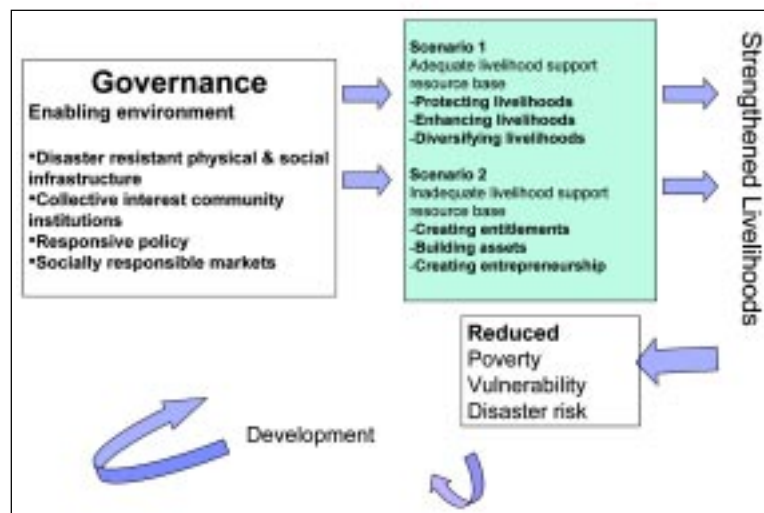
## ABSTRACT

The livelihoods approach to resilience building allows for holistic and integrated consideration of the institutions, capacities, natural resources and assets available to people to improve their quality of life without jeopardizing the livelihood options of others. The impacts of the 2004 tsunami on livelihoods and resources in Sri Lanka are outlined, with vulnerabilities emerging from the relief and reconstruction process identified. Vulnerability and capacity assessments are an important method by which social learning on disasters can be facilitated by linking directly with the needs, problems and solutions identified by decision makers and affected communities.

The livelihoods approach to resilience building allows for holistic and integrated consideration of the institutions, capacities, natural resources and assets available to people to improve their quality of life without jeopardizing the livelihood options of others

The presentation by Stockholm Environment Institute (SEI) outlined their approach to assessing vulnerability to disasters and identifying strategies for building more resilient and sustainable livelihoods. This approach is currently being applied in SEI's Swedish International Development Agency (SIDA)-funded post-tsunami program which aims at addressing the longer-term livelihood and environmental implications of the 2004 tsunami. The approach is based on three key concepts – vulnerability, resilience, and sustainable livelihoods. The first major activity of the program is

a vulnerability and capacity assessment (VCA) designed to support both immediate and longer-term sustainable recovery. The



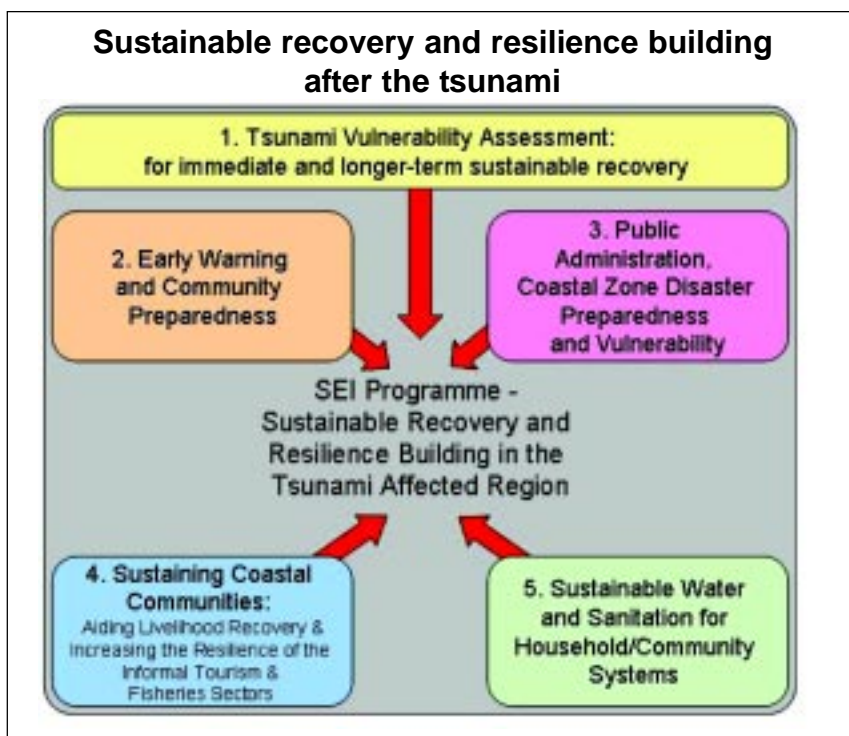
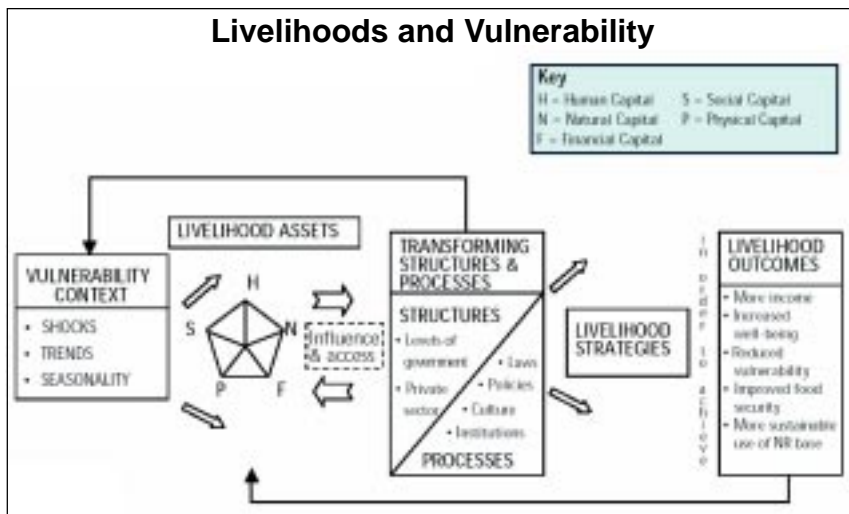
assessment involves a detailed study covering the multitude of factors that make livelihoods resilient to the impacts of change and hazards.

The livelihoods approach to resilience building allows for a more holistic and integrated consideration of the institutions, capacities and assets of people. Sustainable livelihoods imply the capability of people to make a living and improve their quality of life without jeopardizing the livelihood options of others. This includes the ability to cope with and recover from stresses and shocks, including natural hazards. Social equity, social learning, and the sustainable use of ecosystems are crucial to building resilience.

Disasters are often only perceived and reported in terms of their humanitarian costs and physical impacts. However, the livelihood dimension is also crucial as disasters have the potential to transform landscapes and resource profiles. Disasters obviously have different impacts on regions, communities and households, with the severity of impacts and ease of recovery influenced considerably by gender, ethnicity, age, occupation and participation in social networks.

Not all aspects of disaster are ultimately negative, however, as disasters can provide opportunities for resource base enhancement and social learning.

Key factors in rebuilding resilient livelihoods after disasters, as identified by the Intermediate



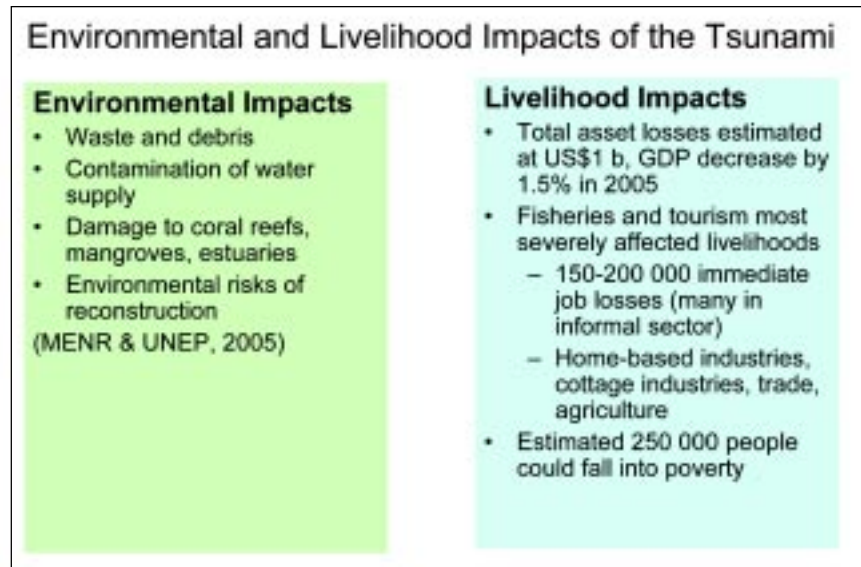
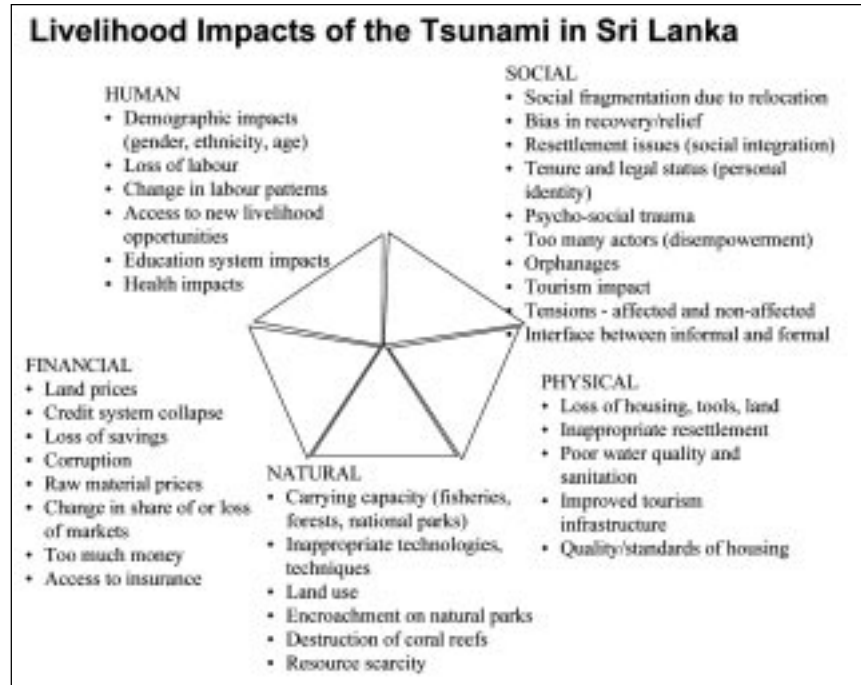
Technology Development Group (ITDG) and others, include: (1) establishing a diversified income base; (2) securing and strengthening the asset base; (3) developing appropriate structural and non-structural measures that enhance entitlements and negotiating power; and (4) supporting the



development of community-based solutions that allow for flexibility and adaptation to change.

In Sri Lanka, the tsunami severely affected coastal livelihoods, demographic profiles, and health. Total losses in economic assets are estimated at US \$1 billion and the Gross Domestic Product (GDP) was estimated to decline by 1.5 percent in 2005. Livelihoods dependent on fisheries and tourism were most severely affected. There were 150,000-200,000 immediate job losses with many of these lost from the informal sector. Home-based industries, cottage industries, trade and agriculture were also seriously affected, and it is estimated that an additional 250,000 people could slip into poverty.

Social fragmentation as a result of the relief and reconstruction process is a real concern, as community members were distributed between different temporary housing sites and communities are now being potentially split up within new housing settlements. Relocation of communities, due to the buffer zone, has also created new challenges for people as the resources they previously had access to for their livelihoods are in some cases no longer accessible. The uncertainty associated with relocation and biases in the recovery process have in some cases exacerbated psycho-social trauma. The proliferation of actors involved in relief affected the decision-making space available to communities and contributed to



processes of disempowerment. Tensions have also arisen between affected and non-affected communities, as poorer communities who were not affected are concerned that socioeconomic differences may be exacerbated by assistance only targeting affected communities. Financial consequences have included a rise in

land prices, collapse of local credit systems, loss of savings, and a rise in the cost of raw materials.

The tsunami has also raised the profile of important environmental issues that were of concern prior to the disaster. These include pressing coastal zone management issues, such as carrying capacity of the fisheries sector, destruction of coral reefs and mangroves, and water resource scarcity. Environmental impacts have been well documented in Sri Lanka, and include such problems as waste and debris disposal, contamination of water supply, damage to coral reefs, mangroves, and estuaries, and the environmental risks of reconstruction. The connection between such environmental impacts and livelihoods has, however, not been so well addressed and needs to be considered in order that reconstruction occurs in a sustainable way.

### Vulnerability

Vulnerability is an anticipatory concept which entails knowing who might be vulnerable to a particular stress or threat and why. As a concept, it goes far beyond the particular impacts of an event or process, to investigating the underlying causes of why the impacts occurred or could occur. Increasingly, in vulnerability research, there has been more attention given to the agency of people in the face of multiple stresses, their resilience, and the perspectives and experiences of marginalized groups. Vulnerability can be evaluated through the use of

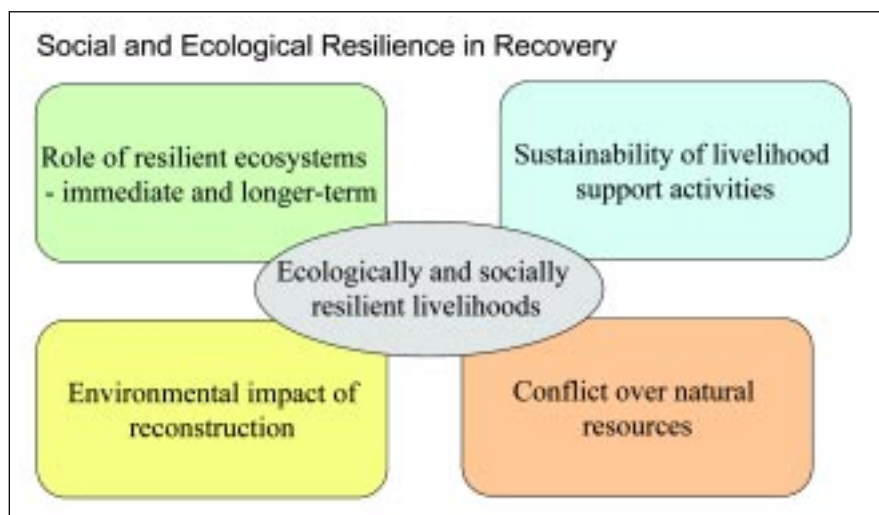
participatory or action-oriented research methods, such as the VCA methodology currently employed by the International Federation of Red Cross (IFRC).

### Vulnerability assessment

SEI is working in partnership with the IFRC and the Sri Lankan Red Cross Society to undertake various VCAs with affected communities in Sri Lanka. These are being undertaken in a capacity building framework, to ensure knowledge and skills in VCA stay with the relevant stakeholders in-country.

VCA's focus is on detailed place and group-specific vulnerability and capacity to build resilience. Such assessments broadly cover livelihoods, stakeholder and institutional capacity at local and sub-national scales, and to identify important cross-level processes. They purposely identify problems and constraints, but also, importantly, generate solutions and strategies. Typically, VCAs include evaluation of differences in gender, access to resources, equity, and

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direct and indirect and short- and longer-term impacts. VCAs also evaluate the extent to which resource use is sustainable, and whether there are ways that livelihood strategies might be supported to become more sustainable. Results of VCAs should feed directly into the formulation of livelihood and other program activities. As such, it is important that the VCAs also identify key indicators for baseline data collection and monitoring and evaluation purposes.

As vulnerability is a dynamic process, particularly in the context of a rapidly changing post-disaster environment, SEI intends to undertake repeat VCAs in 2007 to analyze changes over time. Factors which have strongly influenced people's ability to recover from the impacts of the tsunami will be identified so as to support community-level resilience building and inform future disaster management.

As vulnerability is constructed by processes operating at multiple scales, a synthesis of regional vulnerability is also being undertaken. This regional analysis focuses on:

- key factors contributing to vulnerability and differential impacts;
- groups that are particularly vulnerable in the recovery process; and
- knowledge about the extent and type of environmental, economic, and social impacts. This analysis is undertaken to identify specific policy lessons on how to reduce vulnerability.

### Emerging vulnerabilities

Emerging vulnerabilities from the reconstruction process span vulnerability to poverty (largely due to distance from previous livelihoods base), disempowerment, future environmental risks (water scarcity, flooding, pollution), conflict, and future coastal hazards. Factors contributing to the creation of these vulnerabilities include the uncertainty and delays associated with relocation and housing, social fragmentation, limited institutional capacity, decline in community decision-making space with "actor jam," corruption and use of aid as a political tool, inequities in terms of access to relief and inappropriate assistance which does not take account of appropriate local technologies or sustainability issues.

The scale of the impacts of the tsunami and the subsequent relief and reconstruction operations are unprecedented and require new approaches to research that facilitate social learning by linking directly with the needs, problems and solutions identified by decisionmakers and affected communities. For reconstruction to contribute to the sustainable recovery of the region, there needs to be a clear understanding of who is most vulnerable to the impacts of this event and why. This understanding needs to inform assistance to the region and future policy, to ensure that recovery does not recreate vulnerability to poverty, conflict, environmental risks or natural hazards but rather builds social and ecological resilience to future shocks and stresses.

The scale of the impacts of the tsunami and the subsequent relief and reconstruction operations are unprecedented and require new approaches to research that facilitate social learning by linking directly with the needs, problems and solutions identified by decision-makers and affected communities

# Strengthening resilience of communities to disasters using the DRSL framework: ITDG's experience in South Asia

*Practical Action, \* [Formerly Intermediate Technology Development Group (ITDG)]*

## ABSTRACT

Rural and coastal populations in South Asia depend largely on natural resources for their livelihoods. As in most other parts of the developing world, the clash between current livelihood needs and longer-term conservation is as apparent as ever. Further, when disasters occur and disrupt the environment, communities dependent solely on natural resources are the worst hit. Communities generally develop coping strategies for seasonal climatic variations such as predictable floods and droughts. For unexpected, longer events, coping strategies are limited. So looking at strategies that help communities adapt better is crucial. The Disaster-resistant Sustainable Livelihoods framework (DSRL) provides for a livelihood-centered approach to disaster risk management both in policy and practice. It is based on the experience in disaster management of ITDG and partner organizations.

**R**ural and coastal populations in South Asia are largely dependent on natural resources for their livelihoods. As in most other parts of the developing world, the clash between current livelihood needs and longer-term conservation is apparent in the region. Further, when disasters occur and disrupt the environment, communities dependent solely on natural resources are the worst hits.

Communities, however, generally develop coping strategies for seasonal climatic variations such as

predictable floods and droughts. For unexpected, longer flash floods, coping strategies are limited though. So looking at strategies that help communities adapt better is crucial.

In the aftermath of the tsunami in December 2004, many organizations entered for relief and reconstruction – as is the case in the wake of disasters. The livelihoods of people in coastal Sri Lanka, for instance, were incomparably devastated and, as a response, organizations started livelihood rebuilding programs here.

Communities generally develop coping strategies for seasonal climatic variations such as predictable floods and droughts. For unexpected, longer events, coping strategies are limited though. So looking at strategies that help communities adapt better is crucial



\*Represented by Ramona Miranda and Suvira Srivastava

However, while the need was recognized, many of the organizations were not development-oriented but more equipped to manage crisis rather than rebuild livelihoods. Therefore, most of the current livelihood related programs emphasize strengthening only physical and financial capital. The strengthening of other capital referred to in the sustainable livelihoods framework is missing from the programs. Further, most assessments focus on key livelihoods such as fisheries and agriculture. Many of the smaller and varied forms of livelihoods were not captured by the assessments, and as a result there was no proper plan for appropriate rehabilitation. This has been found to be the case in other disasters, too.

Peoples Action's experience in disaster-prone areas in South Asia has helped it to develop a disaster-resistant sustainable livelihoods framework (DRSL). The application of this framework can be seen with relation to strengthening the resilience of communities to cope with both expected and unexpected disasters.

The DRSL framework provides for a livelihood-centered approach to disaster risk management, both in policy and practice. It is based on the experience in disaster management of ITDG and partner organizations.

The Duryog Nivaran network is a movement for disaster risk mitigation in South Asia.

Governance must provide an enabling environment, which has disaster-resistant physical and social infrastructure, responsive policies, and socially responsible markets. Implementation should be done through collective interest community institutions. If the livelihood support resource base is adequate, then people should have access to assets that are functional and have the potential to generate livelihood outcomes. These will help protect, enhance and diversify livelihoods. But, if the livelihood support resource base is inadequate, then people should be provided with the minimum assets for livelihood options for marginal to support subsistence. This will create entitlements, build assets, and promote entrepreneurship. The approach will lead to reduction in poverty, vulnerability and risk from disasters, and therefore is a sustainable development approach.

### Ongoing research

The application of the framework uses different models in the rebuilding context. One of these is the Rural Business Incubation Center. Knowledge of the DRSL framework enables development agencies at the grassroots level to improve sustainable livelihoods. One has to arrive at the right combinations and mix of communication channels that ensure a better knowledge uptake process and the factors that contribute to or hinder the effective transfer of knowledge. Community members must be trained in skills for livelihood generation as well as for awareness about resources.



Governance must provide an enabling environment, which has disaster-resistant physical and social infrastructure, responsive policies, and socially responsible markets

# From relief and restoration to resilience: strategic development initiatives with disaster-affected communities in India

Somnath Bandyopadhyay, *Aga Khan Foundation (AKF), India*

## ABSTRACT

Over the past few decades, there has been an increase in the occurrence of disasters due to natural or anthropogenic causes with associated increasing economic costs. Meanwhile, in several developing countries, considerable resources are spent on development programs for the poor, aimed at improving socioeconomic conditions and quality of life through access to education, health services, safe drinking water and sanitation, and improved livelihoods. A cross-sectoral approach was adopted by the Aga Khan Development Network (AKDN) to support earthquake-affected communities in Gujarat and tsunami-affected communities in Andhra Pradesh. Secure livelihoods will focus on involving community institutions/self-help groups for disaster preparedness, water and sanitation facilities (roof-top rainwater harvesting system, traditional tanks), health systems, and quality of education.

Over the past few decades there has been an increase in the occurrence of disasters due to natural or anthropogenic causes with associated increasing economic costs. Meanwhile, in several developing countries, considerable resources are spent on development programs for the poor, aimed at improving socioeconomic conditions and quality of life through access to education, health services, safe drinking water and sanitation, and improved livelihoods.

A cross-sectoral approach was adopted by the Aga Khan Development Network (AKDN) to

support earthquake-affected communities in Gujarat and tsunami-affected communities in Andhra Pradesh. In Gujarat, a multi-sector rehabilitation and reconstruction program was initiated while in Andhra Pradesh, it was a post-tsunami coastal livelihoods improvement program.

Disasters bring in disorder and disharmony, subjecting the poor to aggravating factors including the disruption of social capital, often through death of kin, physical injury and psychosocial disharmony. This is more so in the case of women. There is disruption of livelihoods through loss of

Disasters bring in disorder and disharmony, subjecting the poor to aggravating factors including the disruption of social capital, often through death of kin, physical injury and psychosocial disharmony

productive assets, erosion of the resource base and economic stagnation. Essential services, including physical infrastructure, education and health, financial institutions, and such others are also dislocated.

These impact the poor most, and ensure that the poor remain poor and trapped in a vicious cycle of poverty from where it becomes difficult for them to escape. After a disaster, these communities end up even lower on the socioeconomic ladder, finding it next to impossible to reach even their previous socioeconomic “status.”

Disaster preparedness must, therefore, be integrated into development programs. This has been stated in the Tenth Five-year Plan of the Government of India and the United Nations International Strategy for Disaster Reduction (UNISDR). Attempts to integrate development into post-disaster reconstruction programs must recognize the strong links between poverty and disaster-proneness. Sustaining the gains of reconstruction will be achieved only by providing a more comprehensive package.

After the earthquake in Gujarat in 2001, a three-year Multi-sector Rehabilitation and Reconstruction Project (MSRRP) was launched from 2002 to 2005. The project was implemented in three villages, with 9,000 people in Anjar taluka. Specialized agencies of the AKDN contributed to a multi-sector program conceptualized and

coordinated by the Aga Khan Foundation (AKF).

The development outlook and “whole village” approach led to the building of strong village organizations, and provision of basic healthcare, day-care centers for children, drinking water supply systems, sanitation facilities, natural resources management, agriculture enhancement, and drip irrigation and horticulture. Training and technologies for disaster preparedness were adopted coupled with life insurance.

After the tsunami, relief measures were provided to 13 villages with about 11,000 people in Machilipatnam and Nagayalanka mandals of the Krishna district in Andhra Pradesh.

Focus Humanitarian Assistance (India), an affiliate of the AKDN, provided food, non-food items and psychosocial care. A post-tsunami development program, converging long-term development interests in distinct areas, was initiated and clear mechanisms for collaboration established with the cooperation of the district administration.

During phase one of the Coastal Livelihoods Improvement Program (June 2005–May 2006), the objective was to rebuild livelihoods; the core of the strategy was to provide assets. These included 30 Fiberglass Reinforced Plastic (FRP) boats to groups of 5 beneficiaries, 200 wooden boats (*nava*) to individuals, accessories such as nets, iceboxes, and community assets,

Attempts to integrate development into post-disaster reconstruction programs must recognize the strong links between poverty and disaster-proneness

drying platforms, boat shelters, roads, freshwater storage, etc.

Communities were central to the decision-making processes, such as in identifying beneficiaries, determining cost and labor contributions, laying down norms and processes for procurement, operations and maintenance of assets, etc. Close coordination was maintained with the government and local administration. Village adoption and record utilization and update complemented government resources and strengthened local village organizations.

The objectives of the phase two of the program (2006-2008) include strengthening, diversifying and securing livelihoods. A two-way approach will be used to strengthen livelihoods by introducing options for marketing and value-addition. Marketing options include providing market information, facilitating group selling, encouraging sale at source, and developing links with investors. Value-addition was both asset-based (e.g., iceboxes, solar dryers, fish-drying platforms) and enterprise-based (smoking units, small-scale units, improved standards, and branding/packaging).

Diversifying livelihoods will focus on creating and developing skills, and pilots and experiments. These

will be farm-based and non-farm based. Farm-based livelihoods relate to aquaculture, horticulture, integrated farming, and niche product development. Non-farm based livelihoods relate to fisheries (mechanics to repair engines, boats, nets), agriculture, and indigenous skills (carpentry, shell-crafts).

Secure livelihoods will focus on involving community institutions/ SHGs for disaster preparedness, water and sanitation facilities (roof-top rainwater harvesting system, traditional tanks), health systems, and quality of education. Links will be established with insurance markets and government schemes/ programs.

### Key lessons learned

There is a need to factor in disasters into development frameworks; disasters offer a chance to make strategic interventions with affected communities. There is a need for a long-term strategic approach that helps to address more fundamental issues of enhancing livelihoods, ensuring access (to markets, essential services, basic information), and preparing individuals and institutions adequately to deal with disasters.

A participatory learning approach that will provide opportunities to innovate, assess and learn from restoration of assets; enhance the

resource-base and new livelihoods options; new institutional arrangements; collaborations and systems of management; share experiences; critically assess work done; and generate new ideas.

A collaborative approach that will provide opportunities to link and benefit from specializations in providing services such as health, education, financial and others; linking markets; creating systems of governance and administration; and delivering appropriate training and other necessary inputs for inducing change.

A livelihoods approach that will provide a realistic framework for achieving resilience through transparent systems of rebuilding assets by introducing basic elements of marketing and value-addition to strengthen livelihoods; investing in skills development and allowing for experiments to diversify livelihoods; and securing livelihoods through improved human capacities and external linkages for sharing of risks.

The project has not only achieved the short-term objective of food security but also the long-term objective of drought proofing. The village panchayat's initiative and involvement in resource mobilization, utilization and regeneration was an effective tool toward this end.



# Key points raised in the discussions

## Parallel Session-5

**1. Adaptation is not about rebuilding but about doing something new.** In the case of fishing, livelihoods destroyed by the tsunami, for example FAO reports that the number of people dependent on fishing is more than what the water resources can sustain and this leads to vulnerability. Long-term environmental degradation leads to decreasing income generation of the poor. Following the tsunami, boats which were destroyed were replaced by unsuitable boats. The right kind of boats have to be given to the right kind of people. Furthermore, this may be a key time to move away from earlier unsustainable livelihoods, whatever the approach, solutions must be based on community needs.

**2. The poor remain poor due to poor human development.** This means that the entire society will have to cope. The state must receive inputs from the scientific community along with from NGOs who understand community needs.

**3. The government has enacted legislation to integrate development with disaster response.** There are risks in all occupations, but empowerment is enabling the people and community to make choices. After the tsunami, the Government of Tamil Nadu began providing choices, and it is expected that within three years the communities in all 13 districts covered by the Disaster Preparedness Program will be equipped to cope with disasters. In Andhra Pradesh, the government was unable to act and so people collaborated with each other. The government provided the fishing community with boats, which needed repairs. The community established an association and started repairing the boats. This activity now includes construction of boats. After Hurricane Katrina, work initiated by the community has been rapid as compared to that of the governments.

**4. All major disasters are generally not handled well.** The rich are able to reconstruct better, but not the poor.

This happened after the hurricane in 1992. After floods in 1994, the disaster response was handled well. However, governments do not work well and NGOs do not work together. There needs to be a systemic effort to involve the scientific community and donors to understand the complex linkages between environmental degradation, climate change and the social factors, and to mainstream this into the system.

**5. Events in prior years have led to the initiation of preparedness planning.** The UNDP has started district level planning. After the tsunami, there was considerable improvement in the response effort. Coastal planning is difficult. The government has not mapped buffer zones and people tend to make informal choices and build in these zones. There has to be a balance between immediate recovery and long-term development. Different systems are in place in different parts of the country. Financial instruments like insurance were introduced, where the first installment was paid for by the NGO. There is also group insurance. Tamil Nadu is building 5,300 houses in the Non-coastal Regulatory Zone. These houses have been insured for 10 years. Registration of boats is being encouraged, even though boat insurance costs are high. A policy-level change includes provision of health insurance from the Prime Minister's Fund for survivors living below the poverty line. People have realized the value of such initiatives.

The following lessons have been drawn from the tsunami:

- Natural disasters affect the poor, who are least equipped to handle the situation, disproportionately
- Disasters affect multiple sectors with some problems cutting across all sectors
- Disasters can create an opportunity for changes that improve living conditions
- The link between impacts and development processes are sustainable livelihoods

# DAY-2

## Session-3

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# Disaster and vulnerability – reconstruction to resilience

Kalipada Chatterjee, *Winrock International India (WII)*

## ABSTRACT

Disasters, particularly climate related, such as severe droughts, flash floods, cyclones, storm surges and extreme events continue to impose substantial human, economic, biodiversity losses to developing countries every year. The Orissa Super Cyclone was the second most severe in the recorded history of Indian cyclones. Sustainable development and adaptation to climate change need policies that reduce pressure on resources, improve management of environmental risks, and increase the well-being of the poorest members of the society. They can simultaneously advance sustainable development and equity, enhance adaptive capacity, reduce vulnerability, and increase resilience and coping capacity of the vulnerable community to climate change and other stresses.

Disasters, particularly climate related, such as severe droughts, flash floods, cyclones, storm surges and extreme events continue to impose substantial human, economic, biodiversity losses to developing countries every year. India is considered to be the second-most disaster-prone country in the world. A large and growing population, densely populated and a low-lying coastline, and an economy closely tied to its natural resource base, makes India highly vulnerable to climate change. In this context, devastation caused by the Orissa Super Cyclone of October 1999 is briefly discussed.

The Orissa Super Cyclone was the second most severe in the recorded

history of Indian cyclones since 1885 with a wind speed of more than 260 kilometer per hour. The state was battered for more than two days by fierce winds, a large storm surge between 5 and 6 meter, and catastrophic floods and flash floods. The cyclone affected areas experienced unprecedented rain for 36 hours causing devastating floods. The reasons cited included an open and flat coastal belt; mangroves which are a protection from high winds and storm surges; and the cyclone remained practically stationary, an unusual feature.

More than 10,000 human lives were lost and 300,000 cattle died. (The fishing sector contributes 3.5 percent of the state GDP amounting to Rs 700 crore.) About

India is considered to be the second-most disaster-prone country in the world. A large and growing population, densely populated and a low-lying coastline, and an economy closely tied to its natural resource base, makes India highly vulnerable to climate change

67,000 fishermen families in 13 districts were affected. About 30,000 fishing boats and 60,000 nets were damaged. More than 22,000 weavers were affected and 14,000 looms and accessories were damaged. More than 9 million trees along the coasts were destroyed and it also affected some of the reserve forests in the vicinity.

There is a need for nationally and internationally coordinated research to develop a simple but robust early warning system to alert the communities and the state government to enable evacuation of people to safe areas advance of disasters.

After such disasters, agricultural fields fill up with sea water and, thereafter, are unsuitable for agriculture. Research needs to look into possible agricultural and other livelihood activities that can be taken up by the communities as an alternate. Some of the successful proven interventions in such disaster-prone areas should also be examined and introduced wherever possible.

There is a need for well-organized awareness generation programs among vulnerable communities in such disaster-prone areas. Innovative awareness generation can be achieved through village theatres, for instance; pictorial depiction developed and widely disseminated will also help.

All these will increase the adaptive capacities and resilience of the vulnerable communities, but such adaptations will cost the society and the country. There should be an international mechanism for transfer of large funds to address these adaptation measures and programs in developing countries like India.

Interventions must be technology-driven and innovative for providing livelihood security. Financial interventions should include microfinance interventions. At the Munich Climate Insurance Initiative, insurance related options for adaptation to climate change were discussed.

All these interventions are likely to increase the economic well-being and fulfill social needs of vulnerable communities.

Sustainable development and adaptation to climate change need policies that reduce pressure on resources, improve management of environmental risks and increase well-being of the poorest members of the society. They can simultaneously advance sustainable development, equity, enhance adaptive capacity, reduce vulnerability, and increase resilience and coping capacity of the vulnerable community to climate change and other stresses.

There is a need for nationally and internationally coordinated research to develop a simple but robust early warning system to alert the communities and the state government to enable evacuation of people to safe areas advance of disasters

# Water and sanitary interventions in post-tsunami rehabilitation work in southern India

R. Srikanth, *WaterAid India*

**T**he damage caused by tsunami and climate change puts the Millennium Development Goals (MDGs) at risk. There is strong evidence of the impact of climate change on vector-borne diseases (i.e., malaria, dengue, leishmaniasis, etc.) and global warming, which is leading to lower yields of some crops and salinization of coastal areas.

## Vulnerabilities in the Indian context

Groundwater levels and quality are likely to be under greater stress. Frequency of high intensity rainfalls have increased, resulting in soil erosion, flash floods, and storm sewer overflow and consequently water contamination. The rise in sea level, combined with more winter storms, poses major flood and erosion risks in coastal areas including salt water intrusion and loss of cultivable land. This leads to loss of livelihood among fishing and agricultural communities. There is also an increase in outbreak and prevalence of vector-borne diseases such as malaria and dengue in new geographical areas.

## General adaptation needs to tackle disasters such as those linked to tsunami and climate change

There is a need to integrate climate and hydrological science (techniques and experience) into Integrated Water Resource Management (IWRM). Greater emphasis on planning and preparedness for droughts and severe floods with special emphasis on coastal regions and expanded efforts are needed at protecting water quality from agricultural, industrial and human wastes. Sanitation must be improved to prevent outbreak of vector-borne diseases such as dengue and malaria to epidemic proportions. Integrated planning through local, participatory multi-stakeholder dialogues can help create enabling environments and build coping capacity in developing countries, which will reduce flood risks by developing capacity to monitor their magnitude, duration, timing and location.

## Impact of the Asian Tsunami

In WaterAid projects that are underway in the state of Tamil Nadu (Pondicherry), it has been noted that much of the existing sanitation facilities and drinking

Integrated planning through local, participatory multi-stakeholder dialogues can help create enabling environments and build coping capacity in developing countries, which will reduce flood risks by developing capacity to monitor their magnitude, duration, timing and location

water has been irreversibly affected along with a loss of livelihoods in the fishing and agriculture communities.

### Reconstruction plan

The project's aim is regeneration of communities affected by the tsunami through capacity building and the revival of the damaged water and sanitation infrastructure. In addition, alternative livelihood opportunities related to construction activities in the area of water and sanitation will be promoted. Funding will be provided by the Union Bank of Switzerland.

The reconstruction process will include the following measures:

- Facilitating the improvement of water and sanitation infrastructure through Community Led Total Sanitation (CLTS) in tsunami affected areas through financial and technical assistance and by developing appropriate technology to complement the existing water sources. Sanitation facilities will include an appropriate number of structures that are user-friendly for disabled people.
- Regenerating the human and institutional capacity through the establishment of a regional resource center to train trainers and enhance the communities' knowledge and skills in water and sanitation.
- Redefining livelihood options by introducing alternative opportunities linked to water, sanitation and hygiene education. Livelihood opportunities, including paid jobs and training in relation to project activities, will be prioritized for women, disabled people and

SHGs who are the poorest sections of the community.

- Replicating and scaling up and promoting best practice models for implementing water and sanitation projects, which are more cost-effective, sustainable, and have greater impact than approaches currently being used will be developed.
- The project will promote strategic alliances and cooperation of water agencies with leading scientific organizations that can facilitate the exchange of information on the state-of-the-art thinking about climate change and impact on water resources. There is a need to facilitate water managers to work with climate experts to review national policy and programs on the water sector in India.
- Issues related to the impact of climate change have been largely addressed by experts and there is very little awareness among grassroots NGOs working in the water sector regarding the impacts likely to occur. Therefore, there is a need to create a network for dissemination of information related to climate change among civil society and vulnerable communities for future action.
- Development of cheaper desalination technology should become a priority in coastal regions since drinking water is being increasingly threatened along the coast. A study should be undertaken for identifying geographically vulnerable areas and communities likely to be threatened by climate variability and change. This would help in launching programs and policies to combat the threats from climate variability and change.

Issues related to the impact of climate change have been largely addressed by experts and there is very little awareness among grassroots NGOs working in the water sector regarding the impacts likely to occur

# Enabling adaptation: the role of technology, infrastructure and institutions

Prabodh Mohanty, *i-Concept Initiative*

## ABSTRACT

India is the second-most disaster-prone country and has a history of high recurrence of disasters in the last 50 years. A significant amount of time and money is spent combating these natural calamities. Global climate change will result in new socio-natural hazards in the context of financial, economic, social, environmental and capital resources. The Government of India's commitment toward the Millennium Development Goals (MDGs) is the eradication of poverty by 2015. This will need the participation of people at all levels.

India is the second-most disaster-prone country and has a history of high recurrence of disasters in the last 50 years. These include cyclones, earthquakes, environmental extremes and floods. A significant amount of time and money is spent combating these natural calamities.

Orissa, situated in the east coast, has a plethora of natural resources but is still one of the poorest states. The high frequency of disasters in some form is the main cause of poverty and backwardness. The cause and effects of disasters are multidimensional by nature. It ranges from natural to man-made and from coast to the arid zones. Floods, droughts, heat waves and village fires are the worst among all disasters that the state suffers from every year. These have affected the ecosystem and economy rendering

thousands of people homeless and without livelihoods. The aftermath of the last Super Cyclone in Orissa coast is still evident all around. The state of Orissa has a coastline of 480 kilometers. During last 100 years, Orissa has faced 90 years of disasters – floods 49 years, drought 30 and cyclones 11. The poverty index of 47.15 is the highest and the state per capita income of Rs. 6,767 is the lowest in the country. Poverty is on the rise due to regular floods, cyclones, droughts, heat waves, and forest fires apart from air and water pollution.

Despite aid from around the world, the marginalized and impoverished remain in the same condition as they have lost their traditional livelihoods. The frequency and risk of disasters is increasing and future societies will probably witness new

Orissa, situated in the east coast, has a plethora of natural resources but is still one of the poorest states. The high frequency of disasters in some form is the main cause of poverty and backwardness



*Collective action for risk mitigation*

and more complex disasters. Global climate change will result in new socio-natural hazards in the context of financial, economic, social, environmental and capital resources. The Government of India's commitment towards the MDGs is eradication of poverty by 2015. This will need the participation of people at all levels.

During the last few years, there has been a shift in approach and strategy in the area of disaster management and the role assigned to the state, the private sector and civil society. It is now widely accepted that updated training and capacity building is essential for proactive involvement in a disaster management program. Therefore, there is a need to build the capacity of all stakeholders and enhance their skills to address disaster management.

### Role of Information and Communication Technology in disaster management

Disaster management in India would possibly have managed floods and droughts better if space applications were used more effectively. Mapping the earth's surface and early risk warnings pertaining to storms and floods are now more accurate. These advances, however, have yet to be translated into large-scale use in India.

The growth of Information and Communication Technology (ICT) and its varied use has enriched the sphere of knowledge of many fields in social science. However, the

advantages of ICT have not been properly harnessed in risk and vulnerability analysis at the micro level and disaster management. All three – institutions, technology and infrastructure – need to operate together for vulnerability reduction. Each one will have limited chances of success by operating alone.

Technologically, the advances in early warning capabilities and other disaster management tools can help in reducing losses and promoting livelihoods among vulnerable sections. However, in the absence of information, technology, infrastructure and institutions risk reduction has not had significant success.

Information is the key for managing cyclones, floods and droughts. Timely and appropriate information provides tangible benefits in terms of minimizing losses and reducing vulnerability; serving as a commodity for public good, especially weather information; providing the backbone for contextual knowledge and wisdom; and creating a tangible environment that fosters growth by reducing expenditure otherwise meant for disaster rehabilitation.

The application of ICT in disaster management involves more than collecting information through remote sensing satellites and Global Positioning System (GPS) equipment. It involves an enabling environment wherein the information obtained from these sources can be used. This information needs to be matched

During the last few years, there has been a shift in approach and strategy in the area of disaster management and the role assigned to the state, the private sector and civil society. It is now widely accepted that updated training and capacity building is essential for proactive involvement in a disaster management program





with traditional perceptions and indigenous practices and a synergy built between different components of society. The initial step begins with creating a platform for sharing of technical information and developing tools that address the requirements of people in the area with a user-friendly approach.

The growth of ICT in disaster management highlights the paradigm shift from post-disaster relief and rehabilitation to pre-disaster preparedness.

### Role of institutions

Institutions play a major role in disaster management. Government institutions are the key players in disaster management. The strength and role of other institutions at all levels vary according to their activities – raising advocacy levels, relief and rescue, and operation monitoring.

Key organizations such as *panchayats*, non-governmental organizations (NGOs) and Community Village Organizations

(CVOs) disseminate available information to people at the grassroots level. Institutions at the national level try to create new strategies for managing disasters and coordinate operations within government and between government and other institutions.

At the state level, preventive measures and initiatives for strengthening community capacities, to withstand natural hazards, are apparently still limited, especially in implementation. Most government departments and NGOs face financial shortages to build capacities at various levels. These institutions and organizations restrict themselves to implementing projects or activities. Hence, disaster risk management continues to be a secondary priority and is not integrated into the government's development plans or programs. A holistic approach to capacity building is required, which needs to prioritize capacity building of NGOs, PRIs or the most vulnerable – the poor who get affected by the disasters.

Most government departments and NGOs face financial shortages to build capacities at various levels. These institutions and organizations restrict themselves to implementing projects or activities

# Risk reduction and livelihoods promotion: a community initiative

Pradeep Mohapatra, *Udyama*

**T**ikrapada is a drought-prone village where agriculture, the only source of livelihood, depends on the monsoon. Most people belong to the Scheduled Castes (SCs), Scheduled Tribes (STs) and other backward communities (OBCs). People meet their water needs from four ponds, five tubewells, and a number of private dug-wells. During the summer months, the water table recedes, drying the ponds and dug-wells. The village lacks irrigation systems and adequate health facilities, including educational and communication facilities.

The skewed land distribution, erratic and heavy rainfall, poor soil and water conservation, more unbounded uplands, and low production lead to distress sales, credit/debt traps and distress migration. Natural disasters and climatic and man-made factors have

Year	Frequency of drought
1950-60	Twice
1960-70	Twice
1970-80	Five times
1980-90	Six times
1990-2001	Thrice
2002-2003	Statewide



*Deforested barren lands*

made hunger, starvation, selling children and trafficking in women common occurrences. Risk and vulnerability is getting compounded owing to the devastations in the natural, social, physical, economical and environmental capital.

During the drought of 2002, there was food scarcity, diseases and distress migration from loss of existing livelihoods. Drinking water became scarce due to receding groundwater levels and drying rivers. Women traveled to the nearby river to dig *chuan* (small wells) on the riverbed and wait for hours for seepage water to collect in them.

A program was implemented in village Tikrapada in collaboration with grassroots level organizations and active involvement of the village panchayat. The panchayat was responsible for problem identification, resource mobilization, site and beneficiary selection; the program was implemented by Sramika Sakti Sangha (SSS), a community-based organization based there for the past three decades.

PRI initiatives in livelihood diversification through the village microplan in the first step included the following:

- The village panchayat prepared a village microplan involving the entire population. After extensive deliberations, the villagers identified problems and the means to address these. During the exercise, the people came up with their own ideas for water conservation, design of structures and implementation.
- While fulfilling the immediate objective of ensuring food as a short-term benefit, the village panchayat converted the opportunity into long-term benefits

for drought proofing. The challenge was to create the maximum number of man days possible and utilize human labor in an innovative manner. Additional water harvesting structures were created utilizing the villagers and through livelihoods diversification through farm and non-farm activities.

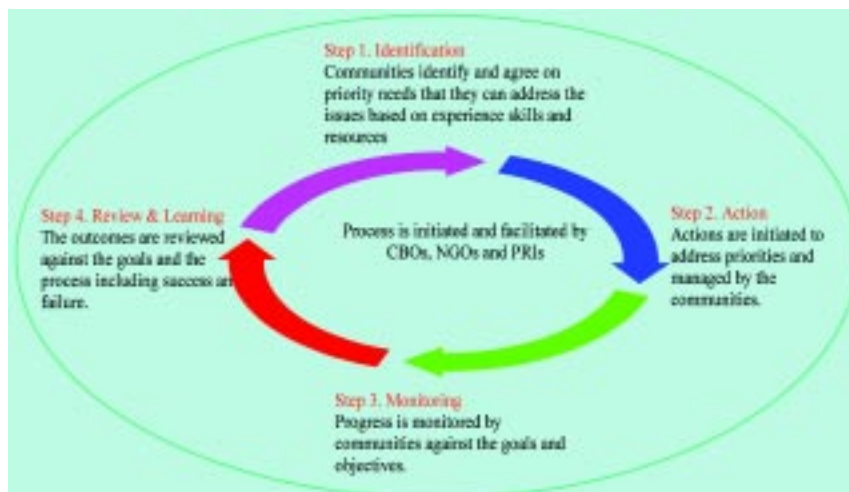
### Land and water management

The community decided to construct water-harvesting structures to meet livelihood needs and address water problems in the long term. Under the program, five water-harvesting structures were constructed. Stone bunding, gully plugging, *nala* and canal treatment and upland bunding were done to prevent soil erosion from the nearby mountain. Grass patching over 18,000 sq ft of the embankment helped prevent soil erosion and silting.

### Forest management

The villagers knew that there was depletion of forest wealth, which provides livelihoods through minor forest produce. Regeneration of forest cover through extensive

After extensive deliberations, the villagers identified problems and the means to address these. During the exercise, the people came up with their own ideas for water conservation, design of structures and implementation



plantation was supervised by panchayat representatives in the periphery of the water harvesting structures. The village appointed a watchman and contributed for his labor in the form of paddy during harvesting time.

### Agro-horticultural practice

Since paddy cultivation is non-remunerative and water-intensive, vegetable cultivation and horticultural activity provide better options. An attempt was made by the panchayat and SSS to provide the people with saplings of horticultural trees. Now mango, lemon, guava, drumstick and papaya have been planted both in private and public lands. In order to encourage vegetable farming, SSS distributed seeds of black gram and onion and vegetable kits to over 250 families for backyard plantation.

### Adoption of new technology

Panchayat representatives used agro-horticultural practices for better productivity, and these were later adopted by others. Practices like pot irrigation, orchards, organic farming, and vermi-culture were introduced. Udyama, a voluntary agency specializing in such innovations, was the resource agency and they built similar capacities in SSS. Post training, SSS developed a nursery in the village to meet the need for seedlings.

### Training and capacity-building

An effort was made to train the women, youth and village leaders on various aspects of community

development. The village panchayat selected beneficiaries who were trained in modern methods of agricultural practice, judicious use of water, and land-water and natural resources management. These training programs were aimed at long-term sustainability. The panchayat monitored the training program and its replication on ground.

### Women empowerment

The responsibility of fetching drinking water, fuel and fodder is borne by women. An SHG model was used to train and educate the women on facing droughts in a prepared manner. Three SHGs are now operating in the village. They provide training on thrift and credit. All three groups have become self-sufficient and now have surplus money to help the needy, who are not members of the SHGs. The three SHGs also inter-lend among themselves. The SHG leaders have also attended training programs outside the district. Many of the SHG members have started

As the entire project was planned, implemented and monitored by the community, there is a sense of ownership reflected in the care they take in guarding the forest and horticultural plantations



*Women mobilization*

small businesses such as poultry farming, rice processing, petty businesses, goat rearing, etc, which gives them additional income. One of the groups has taken the village pond on lease and started pisciculture. They have released around 3,000 fish hatchlings into the pond and hope to get a rich harvest. The village panchayat has asked SHG women to undertake village development work contracts through the local block office.

### Impact of the program

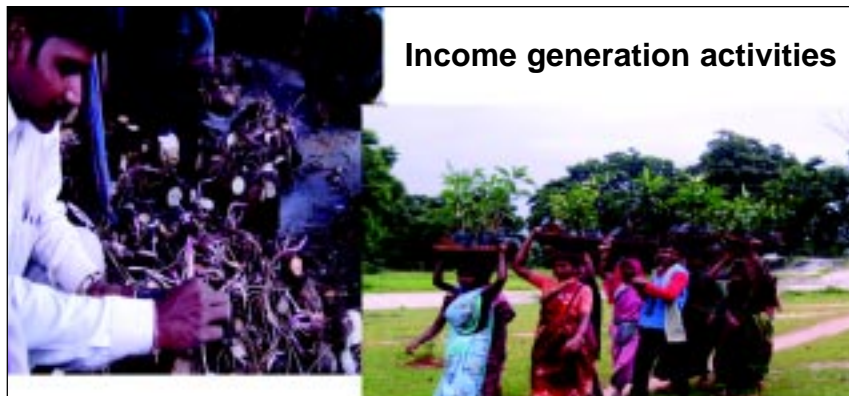
The change in the people is not just physical but social, economic, structural and environmental.

### Social changes

There is renewed confidence among the villagers. Women are not afraid to voice their opinion anymore. As the entire project was planned, implemented and monitored by the community, there is a sense of ownership reflected in the care they take in guarding the forest and horticultural plantations.

### Economic changes

The people no longer fear a drought, since timely and effective project implementation can provide a short-term food supply to sustain themselves in times of crisis. A visible economic impact was the check on distress migration. The program generated 50,000 man-days, which was enough to provide work to anybody in the village willing to do so. The project was able to ensure at least one *kharif* crop. It also helped in producing a *rabi* crop owing to increased availability of water. The SHG



members have formed a grain-bank operated on revolving principles.

### Structural changes

There are many water harvesting structures with clear water in them. Some of those whose land lies under the structures have already started *rabi* cultivation with the seepage water. Others are planning wells in the hope that the water table has increased.

### Environmental changes

Earlier, the entire hillock was barren and the forest cover destroyed. Now, people are aware of the consequences of destroying the forest cover and are therefore contributing to its protection.

### Sustainability

The project has an in-built mechanism for self-sustenance. The people have planned to interconnect the two large water harvesting structures to avoid wastage and ensure availability throughout the year. Once water is available in all three water harvesting structures, at least one crop will be insured and another 100 acres of land irrigated for a *rabi* crop. More agricultural production will create additional

man-days for local wage laborers and discourage migration during scarcity. Capacity has been built to protect the forest cover and more people will diversify into vegetable and horticultural farming.

### Project intervention process

Apart from the five water harvesting structures built through this initiative, there are two more built by the government. But these structures failed to yield the desired objectives. This is because the people were not involved in the process of planning, implementation and monitoring. As there was no sense of ownership among the people regarding the project, the people did not care for their maintenance.

### Conclusion

The project has not only achieved the short-term objective of food security but also the long-term objective of drought proofing. The village panchayat's initiative and involvement in resource mobilization, utilization and regeneration was an effective tool toward this end.

# DAY-3

## Session-1

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# The media's role in 26/7 in Mumbai

Darryl D'Monte, *Media Consultant*

## ABSTRACT

Due to the increasing preoccupation with lifestyle issues, environment is rarely reported in the Indian media. Natural disasters are being portrayed as one-off events, rather than being seen often as the culmination of processes where human intervention, if not actually causing such occurrences, have accentuated and intensified their impact. A typical case in point is the Asian Tsunami, the first anniversary of which took place last week. On July 26, 2005, Mumbai, India, received 944 mm of rain. Had newspapers been more diligent, monsoon after every monsoon, finding out why certain areas were perennially flooded and what could be done to avoid these occurrences, they would have been able to cope with the aftermath of 26/7 more effectively. The media – TV news channels in particular – wrongly identified locations which had been severely flooded. Subsequently, reporters fanned out across the suburbs and informed people which areas were to be avoided and which could be accessed. There was considerable discussion and analysis on television, which brought Mumbai's plight to the attention of the rest of the country.

Data assembled by US academics show that with climate change, the chances of cities being deluged in this manner are getting higher and higher. If these once-in-a-hundred-year downpours had occurred in New York, another coastal city, its century-old subway system would have been flooded and the commercial capital of the US would have ground to a halt, as Mumbai did.

Data assembled by US academics show that with climate change, the chances of cities being deluged in this manner are getting higher and higher

**D**ue to the increasing preoccupation with lifestyle issues, environment is rarely reported in the Indian media. Natural disasters are being portrayed as one-off events, rather than being seen often as the culmination of processes where human intervention, if not actually causing such occurrences, have accentuated and intensified their impact.

A typical case in point is the Asian Tsunami, the first anniversary of which took place last week. While it can be nobody's case that human factors were responsible for triggering off the tectonic movement which in turn unleashed catastrophic tidal waves thousands of miles away, the reckless construction of houses and resorts along the coasts of many island and larger countries compounded the problem. This is in contrast to traditional tribal wisdom, which prompted, for example, Andaman islanders to build homes on heights away from the beach.

Droughts and floods have also been seen in India as unrelated phenomena, even though they are inextricably linked. The media is becoming increasingly metro-centric, to the exclusion of concern for issues in the countryside. While power blackouts in cities are staple news items, the chronic and virtually perennial shortage of power and water in rural areas are rarely raised. Against this backdrop, it has almost become fashionable for many in the metropolitan dailies to ignore climate change. After the

Kyoto Protocol and COP-11 in Montreal, India's leading daily carried an article on the editorial page which began with the astounding statement that GHGs did not cause global warming. While the writer may have made a genuine mistake, the editors were either unaware or unconcerned.

Newspapers in Mumbai have been negligent in reporting the weather during the monsoon, as well as related phenomena like the levels in the lakes that provide the city's water. This was standard fare earlier, because the well-being of so many millions depend on whether the two major lakes in the city, and a few further away, filled during the rains so that citizens were assured of a regular supply of this most precious resource till after the following summer.

On July 26, 2005, Mumbai received 944 mm of rain. The weather bureau had only reported "very heavy to heavy" rain for the preceding – and subsequent – days. Had newspapers been more diligent, monsoon after every monsoon, finding out why certain areas were perennially flooded and what could be done to avoid these occurrences, they would have been able to cope with the aftermath of 26/7 more effectively.

The media – TV news channels in particular – wrongly identified locations that had been severely flooded. Subsequently, reporters fanned out across the suburbs and informed people which areas were to be avoided and which could be

The media is becoming increasingly metro-centric, to the exclusion of concern for issues in the countryside. While power blackouts in cities are staple news items, the chronic and virtually perennial shortage of power and water in rural areas are rarely raised



accessed. There was considerable discussion and analysis on television, which brought Mumbai's plight to the attention of the rest of the country.

Due to the central government's continuing and inexplicable ban on FM radio stations carrying news, this vital potential source of information, which was functioning throughout the deluge, was not put into operation. The simple expedient of telling people not to leave their offices on July 26, or children to stay in school or go to their friends' nearby homes rather than risk returning home, would have saved enormous anxiety, hardship and, in some cases, lives.

Ironically, Mumbai's ham radio operators, who have volunteered to provide information in the Latur earthquake and several international disasters, were not contacted. Nor were the contemporary tribe of bloggers: one, living in Mumbai's western suburbs, actually helped tsunami victims throughout Asia and, more recently, helped put victims of Hurricane Katrina in contact with those who were providing relief in Louisiana. Ironically, Mumbai's Municipal Commissioner helped formulate the Disaster Management Plan for the whole of Maharashtra, which was put in place after the Latur earthquake, where he was the point person for relief and rehabilitation.

Many in the media suddenly discovered how the country's most populous metropolis had turned its back on nature. For instance, not

too many journalists were even aware of the Mithi river, believing it to be a drain or gutter, rather than a water course which relieved the northern suburbs of excess rainfall. And as for the wetlands and mangroves which fringed the river, these were treated as wastelands, the only option for which was reclamation and construction. What other explanation is there for the fact that the Mumbai Metropolitan Region Development Authority (MMRDA), which was the city's supreme planning body, was itself located on these natural sponges.

Had the media been more proactive, it would have taken more notice of the report of the Indian People's Tribunal on Human Rights a few years previously which warned that the sewerage and road schemes that blocked the mouth of the Mithi in the Mahim Bay could one day prove disastrous. The fact that in the Sanjay Gandhi National Park, stretching over 104 sq km – almost a quarter of Greater Mumbai – nature had provided one of the city's best sponges and regulators of water, was completely ignored by the media. Indeed, the “north-south” divide in the media was accentuated after 26/7, when many editors became conscious of areas of darkness like Jari-Mari for the very first time. It also showed how the slum population was most vulnerable to these climate events.

It took some soul-searching by the well-known editor of the *Hindustan Times* to begin a Sunday column at the time with the observation that there was nothing that cleared the

Due to the Central government's continuing and inexplicable ban on FM radio stations carrying news, this vital potential source of information, which was functioning throughout the deluge, was not put into operation

mind more effectively than having to wade through waist-deep water in the Mumbai floods, which caught rich and poor alike for once. While only 9 percent of the commuting traffic uses private, motorized transport the media missed the anomaly of how the state constructs flyovers, freeways and sea links, even though this mode of transport generates 60 percent of the air pollution, not to mention the noise and traffic hazards.

However, the media did carry detailed analysis of the causes and consequences of the downpour. It reported, for instance, how the Indian Institute of Tropical Meteorology in Pune described the event as a “supercell,” one of the rarest and worst kinds of thunderstorms.

“Scientists have found a name for what happened on July 26, 2005, when a record-breaking 94 cm of rain submerged Mumbai in a day. The deluge was not a cloudburst, as some thought, or divine retribution, as others feared, but something more improbable: a supercell.

“Supercells are the rarest, worst kind of thunderstorms, invariably wreaking disaster in the form of hail, torrential rain, floods and even tornadoes. Hidden in the heart of the supercell – which looks like a tall, dense cloud with a rim at the top – lies a vertical column of air spinning at speeds of over 50 miles per hour to keep the storm alive.

“It is this hyper-efficient wind-and-rain machine that was squatting over Mumbai’s suburbs for the better part of 26/7, claim scientists from Pune’s Indian Institute of Tropical Meteorology (IITM) in a report to be submitted shortly to the state government. A supercell, say scientists at the institute, is the best explanation for why so much water poured down in such a short span of time over such a small area.” (*Times of India.*)

A few days after, there was a meeting on the urbanization of Mumbai. An academic from New School of Architecture, New York, talked about data in Buenos Aires that showed that the frequency of supercells will increase. The media should take note of that.

While no one could have predicted this kind of downpour, the likelihood of it happening was very real – and there is no reason why it cannot happen again. Data assembled by US academics show that with climate change, the chances of cities being deluged in this manner are getting higher and higher. If these once-in-a-hundred-year downpours had occurred in New York, another coastal city, its century-old subway system would have been flooded and the commercial capital of the US would have ground to a halt, as Mumbai did.

Scientists have found a name for what happened on July 26, 2005, when a record-breaking 94 cm of rain submerged Mumbai in a day. The deluge was not a cloudburst, as some thought, or divine retribution, as others feared, but something more improbable: a supercell

# Communications and early warning systems: building *Alive* systems

Vijay Pratap Singh Aditya, *Ekgaon Technologies*

## ABSTRACT

Effective communication tends to inform audiences of available choices. However, communication for “early warning” requires defining the choices to trigger stimuli for an effective and timely response. It has been observed and is common knowledge that culturally embedded information systems tend to be more “alive” than modern “information communication technology” (ICT) tools. For effective preparedness, the challenge is to build communication systems, which, while they may have modern ICTs in the back end, have simplified, culturally appropriate and adaptive interfaces in the front end.

Communities must first understand adaptation before any kind of response mechanism can be developed for them. The challenge lies in making communities understand the concept of an early warning system in the context of communication. Over a period various kinds of response and systemic responses keep happening and keep being proposed. Information technology (IT) is developing faster and is now able to reach remote areas, and this could lead to its application in adaptation to climate change. Considerable efforts have been made to ensure information delivery in the context of immediate situation change. For this purpose, it is necessary to define the kind of information to be

communicated, the context in which it is delivered, what the community needs to understand from that information, and their response to it.

Over a period, Ekgaon Technologies has worked on the system side of IT and the various kinds of information technologies which can be developed or should be developed, to further development processes, particularly in rural areas. These development processes, specifically, encompass all areas of development, and do not focus on just one aspect. The primary work entails looking into what kind of information processing is required and the kind of interaction between communities, or people, and the

The challenge lies in making communities understand the concept of an early warning system in the context of communication

system or how adaptive technologies can be used for people to respond. The technologies used for this process include data interface gadgets, mobile phones and even paper. Response to each of these depends on what type of information is being given and whether the information and the system are able to provide value to the community.

Microfinance and credit delivery is one of the areas where financial management could be enabled at the primary level. India has a few unique and successful models in microfinance or microcredit delivery through institutions like SHGs, which work at the community level. This is particularly important as the concept of a co-guarantor of a loan made to groups is difficult to

understand in the case of group management of finance, unlike individual management of loans. In the case of group management of finances, there are issues which arise as the community institution is interacting with external institutions. External institutions use formal processes while community institutions use informal processes and systems for financial management. It is difficult to use formal processes in community institutions.

Therefore, an attempt was made to bring in change in the context of how people understand the meaning of managing finance and interacting with financial institutions. This was achieved by changing the way money was managed using simple key

Microfinance and credit delivery is one of the areas where financial management could be enabled at the primary level



*Members of a women's self-help group in the Ranga Reddy district of Andhra Pradesh, feel empowered by maintaining account books on their own*

processes, by using color-coded paper, for instance. This was done by reducing management account keeping, which uses ledgers at multiple levels to one single paper format which was color coded, to interface with the community. For example, red represented loans and green represented savings. The color choices were designed to give various layers of information. Data on red paper and red forms were transferred to red note books, and the same applied to data on green paper. Thus the same data was being replicated into various forms, simplifying understanding. The understanding of colors was as powerful as the understanding of the language itself, which is significant considering the literacy levels. Paper is one form of an interface, others include computers, peripheral devices like radio or TV which receive and convey information, and sometimes process it. All these need to be understood in the context in which they are used. If the mobile phone has more adaptive capacity to a rural rather than to an urban consumer, it is because the interface provides value and therefore the person adapts to the mobile phone since the mobile phone companies do not provide an urban or a rural interface but a single interface. There are variations

in models. The utility being transferred is the ability to communicate, and this is the key toward adaptation of a device.

If communication is the key, the communication system needs to be defined. It is necessary to understand what is communicated and its value to know how soon it is adapted or used by the people. This means that to make adaptation possible, understanding information conveyed, whether from early warning systems or preparedness information, by the entire community is required. This, because, in the rural society, communal and collective decision-making plays a prominent role and response to critical situations is always collective.

Adaptation of information needs to be based on both individual-centric as well as collective group-centric information delivery. There is also the need to define how understanding of a communication system is ensured and how it can be assimilated within local contexts. To do this, it needs to be understood in a specific context, and requires an information technology base where specific data being conveyed is translated into a message, an alarm or an understanding generated.

Adaptation of information needs to be based on both individual-centric as well as collective group-centric information delivery

# Key points raised in the discussions

## Session-1

**1. Poor Urban planning exacerbates floods.** Floods often occur due to bad town planning and mismanagement of water bodies. Construction on river banks leads to reductions in the width of rivers. Floods occur every year. The reasons for these floods are known, solutions exist, infrastructure and a governance system are in place and yet these continue to occur annually.

**2. Innovative Strategies exist to cope with floods.** In villages people have marked flood levels in their houses, and built shelves at a high level to safeguard valuables. Additional floors are also constructed. People are using these simple coping mechanisms. To be more effective support from the government is vital for adaptation.

**3. Traditional Knowledge can play a role in advance warning.** For centuries, there has been no recorded evidence of Tsunami in South Asia. Yet, one tribe, which lived near the coast of Andaman and Nicobar Islands knew 'when the earth shakes, the big wave comes' and they warned others before moving to higher levels. This tribe lives in houses built on stilts that are about 2 metres high yet, they knew the Tsunami wave would destroy these houses. These people had the same amount of time to respond as others who did not survive. Traditional knowledge of tsunamis saved them.

**4. Gaps in Communication systems.** Early warning systems need to provide information in a structured way that can be understood by many different users. Effective communication depends on the interface between 'the information' and the user so that they can effectively interpret and understand it. The media channels were operational as there were functioning systems like FM transmissions and yet, during the Mumbai floods, better communication could have saved lives. There are no formal systems to enable the flow of early warning information from official sources to communication companies. The Mumbai floods illustrates, on a small scale, how rapid information flow is lacking in an emergency

situation and how governmental procedures, sometimes, prevent vital communications.

**5. Just early warning is not enough.** An early warning system provides information but it also needs to be communicated effectively. Forecasts for Hurricane Katrina existed and the information was available yet response was lacking. In developing countries, in spite of the numerous organized interventions and cooperation between government departments, early warnings systems often do not work. Simple systems can work. The media reaches people but the large volume of information conveyed often hides the core information people need. Where TV is concerned, for example, different satellite channels have different interpretations of the same situation. Coordination between them could help people receive relevant information in a manner that can be acted upon.

**6. Reliable Forecasting.** Forecasting future climate impacts is currently impossible. Data from the recent past can, however, help develop reasonable scenarios for the present and the present can be a guide for the immediate future.

**7. Preparedness is key.** The Mumbai Floods may not have been predictable and preparedness may not have been possible but they contain numerous lessons for risk assessment, vulnerability and resilience. Some extreme events can be prepared for. Hurricane Katrina was predicted, warnings existed and models were projected, and yet coping mechanisms were not in place, when it happened. Vulnerable areas such as this can be identified and effective response strategies can be developed.

**8. Impact of Media reporting.** The media is beginning to report on climate change and its impact. This has political implications. In the United Kingdom, climate change is being covered extensively in the media, partly due to floods that have affected some areas during the

past three years. This has an impact on the middle class and the economy. As a result, the issue of climate change is on the political agenda of the government. Until recently the Indian Meteorological Department refused to divulge meteorological information. This situation is now changing. In Sri Lanka, there has been an increase in reporting disasters though preparedness is not talked about much.

**9. Environment and Climate change reporting in India.** In India, the media has played a limited role in increasing awareness of climate change and the impacts of environmental degradation. Reporting on the environment and climate change, especially in India, is difficult as climate change is an obtuse subject. Many

freelance reporters and staff of newspapers say editors are not interested in climate change. This is also true with other environmental issues. During an international conference on the disappearance of tigers in India, for example, there were only one or two journalists from Delhi. Journalists, editors, and more important owners of newspapers have to be sensitized about climate change.

**10. Role of Civil society in media reporting.** Civil society needs to provide input to the media. In Pakistan, experiences show that building links between NGOs and media works. The media must be provided information to refer and quote from. If information is more readily available, reporting will be increased.

# DAY-3

## Session-2

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# Risk resilience, adaptation to disasters and data democratization

Dipak Gyawali, *Institute for Social and Environmental Transition (ISET)*

**I**nstitutions are defined as “working rules for going concerns.” Often they are confused with organizations, especially government-run ones that are but a subset of the larger picture. Kinship systems, for instance, where people reciprocate favors through unwritten rules, are institutions. Indeed, much of Himalayan irrigation is managed by such informal outfits.

Decision-making, one way or the other, is what institutions have to manage within the everyday pressures, including very heavy political ones. This really means that the average decision-maker does not have all the time he or she would wish for, and furthermore, has to do so within an uncertain context. Governments change and therefore decision-makers change; but any long-term vision or goal requires a commensurate institution capable of maintaining the required level of activities during the duration required to reach that goal. While frequent changes of government (as happened in Nepal since 1995) do hamper implementing long-term plans such as those related to mitigating climate change impacts, more fundamental is the part played

by different social solidarities in the overall dynamical inter-relations between them.

To most decision-makers, whether in government or business, climate change is a fairly long-term proposition, while floods and droughts are yearly occurrences. They find it easier to justify attention to the latter rather than the former, which is why they have to be constantly reminded by environmental activists not to ignore long-term climate change issues. Social solidarities – three active and one passive, as our analysis further below will indicate – have varying risk perceptions that give rise to different time horizons, as well as different problem definitions and proposed solutions.

To explain these “contradictory certitudes” of different institutional settings, as they are called, let us first look at the different social solidarities and then examine their social response to groundwater overdraft as well as climate change. If one only considered conventional “policy-makers,” who are the government bureaucracy or even ministers, one would be missing other forces that influence policymaking.

To most decision-makers, whether in government or business, climate change is a fairly long-term proposition, while floods and droughts are yearly occurrences

The sole policymaker is not necessarily the government. If policy be defined as the “formula for the use of power,” then different social solidarities have different power and hence different styles of their deployment. While there may be government policies, there are also policies that the market forces deploy and the socio-environmental activists counter-deploy. There will be a serious impasse if the government in its *hubris* ignores any one of these two forces. It must be remembered that the market deploys its individualist power through networks, the government through laws and sanctioned procedures, and the activists through critique.

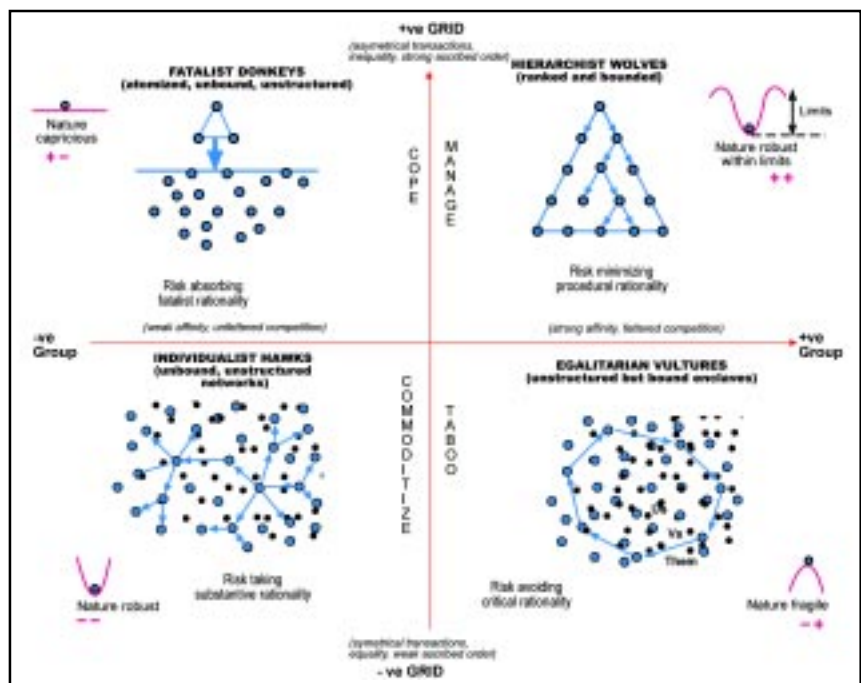
A policy impasse will also be reached if one goes by the assumption that facts are there to be known. This is incorrect, as facts generated by the different pressure groups for different purposes and with different objectives. Facts are often in dispute because of value disputes, which are embedded in social contestation so deeply that solutions cannot be found based on one solidarity’s marshalling of data. A different approach needs to be taken, that can be called constructive engagement where disputed facts can be engaged with and a way found for integration through the very process of engagement rather than through procedural means alone as most bureaucracies are wont to do.

The aim cannot be finding a single neat solution because they would suffer from rigidity and be prone to

cracking under unexpected surprises that the world is fond of throwing upon the best plans of men and mice. Rigid solutions collapse when all pressure groups bring forth their own agendas. The aim has to be for a solution which may be clumsy and messy, found through a democratic process of constructive engagement. This is the framework that the Institute for Social and Environmental Transition (ISET) has been working with, and this involves generalizing out of the knowledge derived from many years of social sciences done in exotic lands and climes.

In this generalization (called Cultural Theory), two parameters are considered: the X-axis depicts whether there is fettered or unfettered competition and the Y-axis whether transactions are symmetrical or asymmetrical between members of the solidarity.

The sole policymaker is not necessarily the government. If policy be defined as the “formula for the use of power,” then different social solidarities have different power and hence different styles of their deployment



The possible permutations generate four different styles of organization. Fettered competition and asymmetrical transactions give rise to bureaucratic hierarchism dominated by procedural rationalism of “who has the right to do what to whom.” Unfettered competition and symmetrical transactions lead to market individualism. Social scientists are often stuck between the two dualistic extremes of free markets and bureaucratic socialism, missing the dynamism imparted by the other two permutations.

Fettered competition and symmetrical transactions give rise to egalitarian enclavism, the stuff of most social and environmental activist movements that are guided by a critical rationality. (These rationalities arise from the way the solidarities are organized: egalitarian, by lacking hierarchic command structure but strong group boundary, need to be critical of the outside to maintain group cohesion.) The fourth permutation – unfettered competition and asymmetrical transaction – generates the fatalism of the conscripts. All four solidarities are present in social disputes be they local, national or global.

The risk perception and strategic proclivities of these solidarities also differ dramatically. Fatalist enclavism is a passive solidarity that is strategized upon by the other three active solidarities; but, being risk absorbers, they can withhold consent and hence defeat the solidarity propounding the

particular strategy they dislike having imposed upon them. Markets are risk takers and innovators, while the enclavists are risk evaders critical of the actions of markets and governments. Hierarchic bureaucracies are risk managers, doing the managing through procedures and laws defined through properly sanctioned expertise.

How social solidarities are organized also determines the length of their vision and their view of nature. Markets have a notoriously short-term vision where nature is seen as robust (that one can do anything to it and it will take care of itself). Egalitarian activists, on the other hand, have a long-term millennia vision. Their risk-averse nature forces them to view nature as fragile and the action of governments and markets (such as building highways and high dams) as unacceptably dangerous. Hierarchic bureaucracies try to balance the two by maintaining that nature is robust but within limits – limits that are set by their experts through environmental guidelines and procedures.

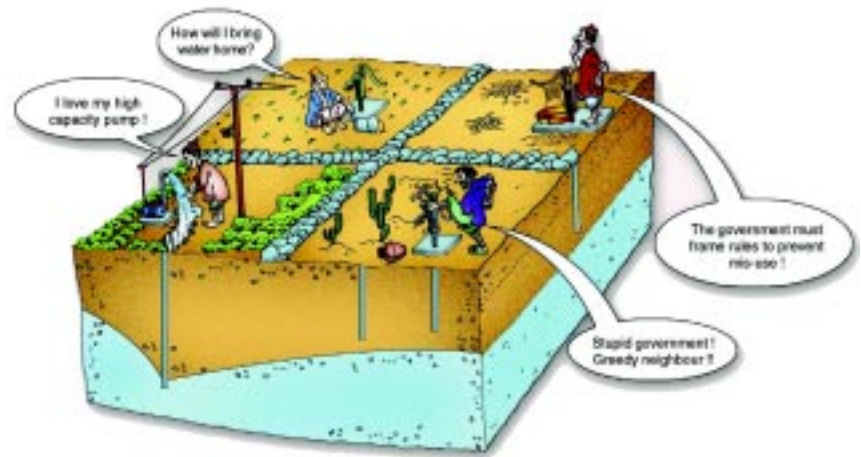
The social response to groundwater overdraft illustrates the behavior of different social solidarities. The individualist does not care how low the groundwater table falls as long as he is able to get more powerful pumps. The activist is concerned that the poor are suffering and rails against the government for not enacting laws. Governments try to enforce procedures for groundwater utilization, ineffective though they

The social response to groundwater overdraft illustrates the behavior of different social solidarities. The individualist does not care how low the groundwater table falls as long as he is able to get more powerful pumps. The activist is concerned that the poor are suffering and rails against the government for not enacting laws. Governments try to enforce procedures for groundwater utilization, ineffective though they may be

may be; and the fatalist farmers cope as best they can before succumbing to fate and migrating out.

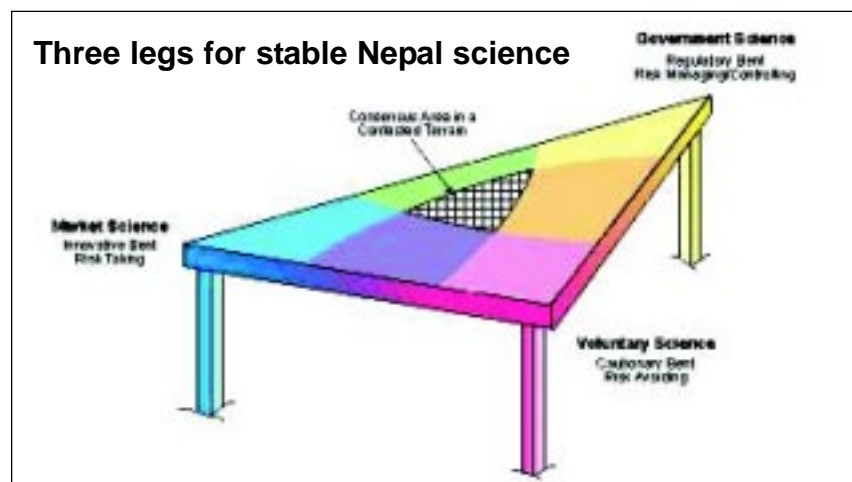
Climate change presents a similar picture. Hierarchy defines the problem as too many people with population control being the preferred solution. To the market, more people means more consumers and hence far from being a problem. Wrong pricing and market-distorting subsidies, etc., are for these networking individualists the real problem that need correcting. To the egalitarian, however, profligacy and human greed are the problem with voluntary frugality being the answer. Hence, one can see that a single problem (climate change) has three different definitions of what the issue is and what needs to be done to solve it. It must be remembered that no solidarity is wholly right or wholly wrong: all three need each other to define themselves against.

For policy-making, all the three active social solidarities –



governments, markets and civil activists – need information that they will construct from data they collect and interpret. Policy failure results when space is not provided to any single solidarity, when the three-legged policy terrain stool is lame by one or two legs. Constructive engagement and contestation (unlike destructive impasse) between the three will result in a policy that may not be all that each group wishes but which has something for everyone, certainly more than the nothing they would have if there was an impasse. The Ozone Treaty and the Montreal Protocol are good

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examples of constructive engagement, as is the Nepali response to the report of the World Commission on Dams.

Many of the countries in South Asia treat their hydrometeorological data with extreme secrecy. This fact contributes to its nonuse by the disaster mitigation communities, especially at the local level. In Nepal, the egalitarian activists have begun working with local flood-affected communities to generate their own data on rainfall and temperature. It is not very expensive to install rain gauges in schools and with farmer groups managing their irrigation systems; and linking these groups and their collected data with FM radio stations has made the system “live” and of everyday use. Now, with access to alternative data, they can challenge government or market conclusions based on secret data.

An aggressive way to force governments into divulging climate related data (collected by using public funds and which is needed by a slew of professions) is to take the position that unpublished data that has in addition not been peer reviewed, is not science but merely modern witchcraft that is not really credible. Without plural sources of data and their interpretation, in essence “data democratization,” robust policy will not emerge: instead one may be visited by policy that is prone to unpleasant surprises. Since climate change is defined in a plural way, the solutions are also bound to be plural, with different solidarities

collecting and interpreting data according to their risk perceptions.

The risk resilience of communities to extreme event stress is enhanced if they have a better grip on the science and a better confidence in its conclusions. This would allow them to base their development decisions on scientific conclusions rather than on traditional “old wives’ tales.” That can be achieved through making science less esoteric and more of a “people’s science.” Adaptation is about coping (by the fatalists), commoditizing (by the market), tabooing (by the egalitarian), or managing (by the hierarchs). Managing with grandiose master-plans alone is not the answer because it is a solution amenable only to control-oriented hierarchs and not the other three who also plan and deploy their strengths as per their own risk perception proclivities and power endowment (critique for egalitarian, networking for profit for individualists, and withholding consent for the fatalists).

Overall system resilience comes from having all the three legs of the policy stool in place; but moving to a plural system of constructive engagement from that of closed hegemony requires vision and statesmanship in the government bureaucracies and the activist community, while markets have to look at the long term when looking for innovations. The policy terrain cannot be “integrated”: it has to be democratized, with climate related data democratization a good place to start.

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# Development Alternative's initiative in tsunami-affected regions

Ashish Bahal, *Development Alternatives (DA)*

The project “Sustainable Reconstruction Initiative in Tsunami Affected Villages of Karaikal, Pondicherry” is being implemented to provide an appropriate response to the reconstruction and rehabilitation needs of 1,175 families in three predominantly tribal villages in the Karaikal region that were severely affected by the tsunami. The Karaikal region is approximately 300 km south of Chennai on the southeastern coast of India.

The guiding principle for this project is that vulnerability to disaster is not purely inherent, but is amplified by individual and community decisions. This is especially true in the choices of housing construction. Inappropriate building construction makes people more vulnerable, while strong and sustainable housing builds more resilience. Development Alternative's (DA's) approach in this project, therefore, is to adopt an integrated adaptive management strategy that incorporates disaster mitigation through reconstruction and rehabilitation. The strategic approach for the project is to develop the villages in a sustainable manner with all basic amenities

such as domestic energy, water and sanitation, and physical infrastructure in place. Given the inadequacy of access to potable water and sanitation facilities in these villages before the tsunami, the project also aims to upgrade these settlements and derive related health impacts.

Through this project, DA intends to introduce alternative livelihoods especially to women, thus improving/influencing the overall economic condition. It also opens the possibilities of strengthening the local village institutional framework, thus facilitating a long-term sustainable development process in the villages, which should simultaneously reduce the community's vulnerability to disasters and strengthen its resilience to future shocks – natural or man-made.

Empowerment of and participation by the local population is another central part of this project. A village reconstruction committee has been formed which has enabled families to be involved in planning, in the design of physical reconstruction, and in the selection of technological processes in an interactive manner.

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Beyond that, the project has also developed “indicators of effectiveness and sustainability” through a stakeholder based interactive process.

Other aspects of the strategy are to provide direct employment, to enable entrepreneurial initiatives and to provide training related to these activities to the local population. Direct employment is provided through construction activities: houses are being built for each family, and schools and other infrastructure are also being built, as they are seen as an essential basis for the development of alternative livelihoods. Entrepreneurial, income generating initiatives are being developed. Specifically, assessments of building materials have been made in conjunction with the communities, and it has been decided to use cost-effective, precast blocks that can be manufactured locally. Model houses have been constructed to demonstrate such local technologies, and participatory exercises concerning the design and construction of the settlement are being completed. SHGs are being

encouraged to set up enterprises for the production of such prefabricated building elements required for construction. Likewise, local institutions, such as SHGs of the fishing community are being encouraged to involve members in the non-fishing season to create such alternative livelihoods. In this way, the village economy will benefit and local knowledge will be strengthened. Efforts will be made to develop new markets, so that after the project period, these alternative livelihoods will be sustainable.

Large-scale training and capacity building of masons and other artisans beyond the three identified villages is being undertaken to support safe and sustainable reconstruction activities and growth in the housing and infrastructure sectors in the long term. Besides technical capacities, management capacities are also being developed. In all these ways the project will be able to contribute to livelihood (re)development and safe (re)construction processes in the whole region.

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# Mapping and “managing” floods in India: perceptions, policies and realities

Sanjay Chaturvedi, *Punjab University*

## ABSTRACT

The current dominant trend in interstate relations is to manage natural calamities in ways that fundamentally challenge neither current asymmetries in national or regional geopolitical economy nor the ecologically destructive practices. One of the key assumptions underlying this is that technological maneuvering and social engineering combined could possibly address difficulties posed by gradual climate change and natural calamities. The acknowledgment of a possibility that vulnerability of livelihood and ecosystems might be reduced, through engagement with variability and change rather than attempting to master and regulate these systemic processes, is absent. The key overarching question relates to the extent to which the “official” perceptions and policies of government agencies in India are both able and willing to move beyond the structural approach and respond to the dynamic and changing nature of both society and ecosystems.

For most people, disasters occur on a day-to-day basis and whether they are called disasters or not is a matter of perception

**M**apping is the intellectual process of constructing, conveying, accepting and resisting intellectual conceptions of places, people, climatic variability and change, hazards, disasters and calamities. The movement from perceptions to reality is illustrated by the impression that those who are engaged in making policy are driven by perceptions, in addition to different solidarities, in terms of critical and cultural theory with their own perceptions. This leads to the conclusion that managing perceptions, to reach or identify

points of convergence is a very challenging task.

### The key question

Who adapts (or does not adapt) to what (climate variability, change, calamity, and disaster (natural? Social?)), why, when, where and how?

For most people, disasters occur on a day-to-day basis and whether they are called disasters or not is a matter of perception. A vast majority of people are simply unable to adapt and for them it is not adaptation but survival. The dominant



developmental growth paradigm will result in disasters increasing in frequency and magnitude. In the cultural theory, there is not one rationality but competing rationalities. In South Asia and maybe beyond, there is a paradigm conflict – one is a dominant state-centric paradigm of geopolitics; the second is of ecological sustainability. Over the years, ecological security has been increasingly co-opted by the dominant state-centric paradigm of geopolitics.

In critical cultural theory, there are four solidarities represented by a circular form because they are bound by an inward looking exclusivist circular rationality, and in between is the hermit, which is critical solidarity.

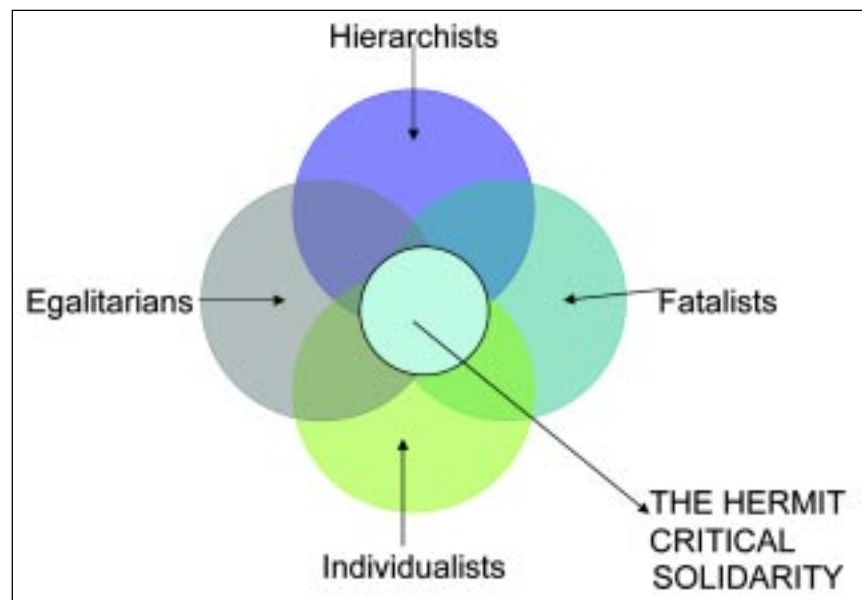
“Floods being natural phenomena, total elimination or control of floods is neither practically possible nor economically viable. Hence, flood management aims at providing a reasonable degree of protection against flood damage at economic costs,” says the “Report on Achievement in Flood Management, 2000” of the Ministry of Water Resources, Government of India.

The rationality of hierarchy shows how the bureaucratic top-down and reductionist approach to flood management tends to divorce nature from development. There is duality between development and disaster and development managers cannot be disaster managers – since part of the problem cannot be a part of the solution. The vulnerability of

livelihood and ecosystems can be reduced to engagement with variability and change rather than attempting to master and regulate these systemic processes.

Rather than looking at socioeconomic transformation in both urban and rural landscapes, variability, human mobility and adaptability as the starting point, conventional wisdom rules out entirely the scope for innovation and adaptation. A key question is “to what extent are the official ‘perceptions’ and policies of government agencies in India able to move beyond the structural approach and respond to the dynamic and changing nature of both society and water resource conditions?” The Ninth Five-year Plan saw the beginning of a gradual shift away from purely structural measures toward other forms of non-structural mitigation. In the Ninth Plan (1997-2001), it was observed that in addition to the

The rationality of hierarchy shows how the bureaucratic top-down and reductionist approach to flood management tends to divorce nature from development



progress made in implementing structural flood protection measures, flood forecasting and warning systems had played a great role in mitigating the loss of life and enabling the protection of movable property. Flood and Drought Response Synthesis – the response of governments to floods and droughts – are remarkably alike. While Nepal's plans remain dominantly on paper, they are broadly similar to those in India. In both cases, investment strategies focus on structures and other physical interventions designed to increase control over water availability and flow. In the case of droughts this investment emphasizes water harvesting and, to a lesser extent, improving vegetative cover in watersheds. These investments are intended primarily to increase the physical availability of water during dry periods. In the case of floods, most investments are directed toward the construction and maintenance of embankments and other flood control structures. Both floods and droughts, at least in the practical sense of investment, are seen as external events that can be controlled through the construction of physical structures.

Concepts of flood and drought-proofing exist and do include the recognition of wide measures related to the vulnerability of livelihoods. Translating such concepts into governmental programs that actually direct significant investment into something other than the construction of water control

structures has not, however, occurred on a widespread basis. As early insights from colonial efforts toward flood control indicate, conventional courses of action often increase long-term vulnerability.<sup>1</sup>

There has been a gradual shift from purely structural measures to non-structural measures for flood mitigation. This is reflected in the Tenth Five-year Plan of the Government of India, although much of the shift still remains on paper.

### Key findings

The broader and deeper geopolitical dynamics of center-state relations continue to influence both official perceptions and policies toward flood management. In many, if not most, cases the allocation of responsibility among key agencies within each state and between states and the Central government, is both highly politicized and far from clear. The shift toward a non-structural approach has been both slow and hesitant. The state government of Bihar continues to frame solutions to the problem of floods largely in terms of viability and vitality of structural measures.

When each solidarity is bound by terms of its own rationality, who is or can be the hermit and what is the role? The hermit is a value, criticality, a practice and an outcome. The hermit is the fifth solidarity who does get the attention it deserves in cultural

There has been a gradual shift from purely structural measures to non-structural measures for flood mitigation. This is reflected in the Tenth Five-year Plan of the Government of India, although much of the shift still remains on paper

<sup>1</sup> See *Adaptive Capacity and Livelihood Resilience: Adaptive Strategies for Responding to Floods and Droughts in South Asia*. Edited by Marcus Moench and Ajaya Dixit (2004)

theory, though the role played by the hermit is both important and central. Neither of the four solidarities with exclusive-circular rationalities and perceptions become the hermit.

The challenge, therefore, is to make the paradigm shift from a “dialectical dialogue” (thesis versus antithesis) to a “dialogic dialogue.”

### Hierarchy solidarity

There is no one rationality in hierarchical solidarity in the institutional landscape of India, Nepal or any other country in South Asia. Even within the hierarchical rational solidarity, there are diverse, parallel, competing, converging, diverging hierarchical rationalities, and these are important.

And only dialogic dialogue can engage with the challenge of climate change and variability. As institutions grow and specialize, they become rigid and are not in a position to adapt to climate variability because their reasoning of variability is simply absent.

The hermit is a dialogic dialogue. Hermit is criticality.

### Concluding observations

The conventional “command-and-control” management, undertaken by “specialized” and rigid institutions, dictated and driven by govern-mentality, is full of pitfalls.

It seriously lacks the capacity to respond to climate variability and change with wisdom and persistence. There is a clash of paradigms which is natural resource into a geopolitical resource. The nationalization and territorialization of nature and natural resources for reasons of the state lead to economic growth and exploitation of nature and natural resources. There is a need to return to pre-colonial geographies that will also mean a return to human and cultural geographies.

### Tasks/challenges before the “Argumentative” hermit

- Ensure that no no-claim to knowledge (or for that matter no individual perception of threat/risk/hazard/variability, change, calamity, disaster) becomes a regime of truth. When information comes from the perspective of only one solidarity, it is often presented as the only truth.
- Question relentlessly the tendencies and the trends that aim at transforming pluralism and argumentative traditions that are tolerant of criticisms into criticism-allergic/resistant binaries of a dialectical dialogue.
- Broaden and deepen the nature and scope of on-going dialogues to encompass the entire subcontinent. There is no such thing as “our or your climate/environment.”
- Search for a common will. Common ways (grounds) are likely to follow.

There is no one rationality in hierarchical solidarity in the institutional landscape of India, Nepal or any other country in South Asia

# Post-tsunami interventions by UNDP GEF Small Grants Program-India

P.S. Sodhi, *UNDP GEF Small Grants Program (SGP)-India*

The tsunami of December 2004 devastated and isolated the coastal communities near Pichavaran in southeastern Tamil Nadu. Many lives were lost, livelihoods were destroyed and, with water coming two kilometers inland, important mangrove swamps were wiped out. After coordinating with three or four partners to evaluate an appropriate post-disaster response, the UNDP GEF Small Grants Program (SGP-India) undertook four projects, addressing the needs of 2,374 beneficiaries in this area. The program strategy involved post-disaster rehabilitation with a focus on generating sustainable livelihoods. Relief was just a small component of the grant. Activities included networking with the government and other agencies, transparent planning through participatory processes and facilitating networking between institutions. The program process was replicated by different agencies in another village in the Tsunami affected area.

To aid community participation and priority identification through participatory techniques, a problem matrix was developed in advance of

meeting with the affected populations. Then, within a month of the tsunami, five days of meetings were held in the four villages. These were held separately with each affected group involved, including agriculturists, the fishing community, small farmers, the landless, women and leaders. The participatory planning process took a successful consensus approach; apparently this was the first time this sort of consensus had been built.<sup>1</sup>

With the help of this process, participatory and joint rehabilitation plans were developed for each village, involving all socioeconomic groups, focusing on rehabilitation and relief issues. This led to building confidence with the government and non-governmental organizations as the planning process was open and transparent.

Meetings with the district authorities and stakeholders identified the required resources, actions and responses. After negotiations, it was estimated that



*Community based planning through Participatory Rural Appraisal*

<sup>1</sup> It was notable that the prime focus of each of these groups was on the development of livelihood options. The authorities were trying to develop an immediate strategy for risk reduction and found the matrix to be a very useful tool.



*Participatory community need assessment*

the resources required would be about US \$200,000 for each village, over three years, based on the threat scale that was planned for. Initially, the identified funding needs were a significant constraint, but ultimately funding came through. The UNDP GEF SGP provided US \$83,575 and an additional US \$760,067 was raised in a co-financing effort from the community, local and state governments, NGOs and other donors. Co-financing by other groups was a strong focus of the UNDP GEF SGP.

Among other things, small SHGs were formed based on kinship and common interest and beneficiaries were required to select livelihood skills and trades to be taken up the scale. This was difficult as there was conflict between affected groups. The fishing community blamed the agricultural communities, who felt

most affected as they had lost livestock, their wells were ruined due to salt water, and they had loans they were unable to repay.

In conjunction with successes at the initial community meetings other constraints had also been revealed: there was division and competition among the stakeholder groups, the problem matrix showed that the number of needs were more than could be met and, simultaneously, there was a rapid ballooning of unrealistic expectations.

### **Actions taken for achieving project objectives**

- Identification of:
  - 1) actual project stakeholders (affected fishermen, non-fishermen, landless);
  - 2) needs assessment through Tsunami Responsive PRA (participatory rural appraisal);
  - 3) identification of common land

Among other things, small SHGs were formed based on kinship and common interest and beneficiaries were required to select livelihood skills and trades to be taken up the scale

for trees and nurseries; and

4) identification and demarcation of land for tree cover

- Orientation of community teams, preparation of training modules, and conducting training including training on alternative employment and value additions
- Installation of a PV (solar powered) fish drier unit
- Building linkages with other stakeholders through Knowledge Networking
- Documenting traditional healing systems in operation
- Environmental curriculum building and school awareness campaigns
- Internal planning and review meetings with SHGs
- Monitoring, evaluation and documentation

### Lessons

- Networking with the government and other agencies by SGP and partners helped in converging resources, increasing the spread of activities, and avoiding replication
- Open and transparent planning through participatory processes raised the confidence of the community
- Facilitating networking between NGOs and the district administration through sharing of work plans built the credibility of the NGOs in government and the community as delivery organizations
- The process built the consensus

approach and the other donors also networked into the operations

- SGP funded environment related issues: fish drying units, establishment of the systems approach in nursery raising for plantations
- Establishing certain income generating actions through the SHGs led to confidence in the delivery system

### Perspectives, problems and constraints

- There was a disjuncture between raised expectations and the ability to deliver
- Conflicts were widespread in equity and resource sharing
- With gender down-streaming, women and children were worst affected
- There were disparities in social and economic standards
- Expressions of sympathy led to internalization and counter-dependency
- There was a lack of data availability
- There were management and functional deficiencies in micro-planning with the possibility of duplication
- There was evidence of gaps (and “stop-gaps”) between initial relief measures and measures for interim and long-term reconstruction processes

Facilitating networking between NGOs and the district administration through sharing of work plans built the credibility of the NGOs in government and the community as delivery organizations

# Mitigating natural disasters through preparedness measures

Aditi Kapoor, *Oxfam (India) Trust*

## ABSTRACT

More than sudden disasters, it is recurring natural disasters that have the most direct link with climatic changes and the ecology of the place where these disasters strike. Oxfam's experience with humanitarian work across the globe has shown that socially and economically it is more cost-effective to prepare well for such disasters than only to respond to the crisis. A major lesson has been that livelihoods protection has to be integral to disaster mitigation strategies. It is better to learn to live with floods, droughts and cyclones than to cope with the aftermath. In the flood-prone areas of Bangladesh, Assam, Bihar and Orissa, for example, poor women and men have enhanced their incomes and saved their families by undertaking practical measures to reduce the risk. This is because of high levels of awareness and motivation among the communities to gain from the benefits of preparedness when this is introduced to them. Insurance of houses, assets and lives of poor people living in perpetual threat of cyclones in eastern Andhra Pradesh and floods in Orissa has been another successful instrument to help people live with recurring disasters and even sudden ones.

**M**ore than sudden disasters, like an earthquake or a volcanic eruption, it is the recurring natural disasters such as floods, droughts and cyclones that have the most direct link with climatic changes and the ecology of the place where these disasters strike. These disasters also affect poor people the most as their asset base keeps getting eroded and they are so busy coping with nature's fury year after year that

they are unable to build a better life for themselves. Addressing the exposure of people to natural disasters and supporting their ability to adapt requires effective coping mechanisms and management plans. South Asia is the hub of recurring disasters and is also where a lot of the poor live.

Oxfam works with communities, the government and other institutions to be prepared for

It is better to learn to live with floods, droughts and cyclones than to cope with the aftermath

disasters, both to cope with them and to respond to them. Its work involves innovation and creativity. Traditional and modern knowledge, techniques and technologies are used in these interventions with people themselves integrating these interventions into existing knowledge, processes and institutions to meet the needs on the ground. Oxfam's work focuses on the key issue of livelihoods of the poor by integrating safe and sustainable livelihoods into disaster preparedness.

Oxfam began by responding to natural disasters (and “man-made” conflicts) but soon found that repeated response was limiting; it had to be combined with preparedness. Now, Oxfam's humanitarian program revolves around both preparedness and response. Preparedness helps people respond better and actually increases their income and social security as they are ready to deal with natural upheavals. There have been numerous successes in implementing preparedness measures on the ground through existing institutions. A few examples illustrate this.

In the flood-prone areas of Assam, for example, flood shelters built on raised land have proven to be highly effective. Oxfam and its local partner organization, Rural Volunteers Centre (RVC), also succeeded in getting this adopted by the local administration to build similar flood shelters as part of the district development work through the District Rural Development



*Raised drinking water for safety during floods*



*Raised earth-work flood shelter*

Agency (DRDA). Oxfam and RVC are now actively advocating the integration of flood shelters into the government's poverty alleviation program so that employment will be generated in their construction.

Another example comes from Bangladesh. In village Khonchapara in district Gaibandha in North Bangladesh, Oxfam and its local partner organization, Samaj Kallyan Sangsthan (SKS) introduced a new variety of bean and papaya seeds,



each set costing 40 Taka so that farmers could harvest the produce after floods, in the “Moga” season. “Moga” comes just after the flood season when all paddy crop is destroyed. It is called the crisis period for food and employment for flood-affected people. The crop grown with the 40 Taka worth of seeds was sold for worth 2,900 Taka in the Moga season by Dalimon, a poor woman farmer. This new agricultural crop helped diversify livelihoods and created a new source of income during a critical period of the year.

In cyclone preparedness work in coastal Andhra Pradesh and coastal Orissa, men and women in villages now know who to approach for what relief and for what purpose. District officials have begun addressing cyclones by planning cyclone shelters. Flood-proof houses have also been built. Villagers now cope with cyclones and even floods in the flood-prone areas in Orissa. In 2003, for example, no lives were lost due to floods in the villages where flood preparedness work had been done, unlike in the villages where Oxfam had not worked on preparedness. In Bangladesh, a multi-risk mitigation standard for housing is being advocated.

In the area of preparedness, people’s institutions need to work with government. There is a view that governments are ineffective but the government is the only institution that has the machinery and infrastructure that can address preparedness everywhere. A relatively new area of activity for

Oxfam involves insurance as a disaster preparedness measure. Insurance has had some success in cyclone-prone Andhra Pradesh. Even poor people are willing to pay a premium to safeguard their assets such as boats, fishing nets and houses. National insurance companies are now getting interested in expanding their base in disaster-prone areas. The case of Lakshamma of Thane Lanka village in coastal East Godavari district of Andhra Pradesh illustrates the way insurance can support the local poor.

Lakshamma claimed Rs 45,000 when a fire engulfed her hut, her fishing boat and all her household goods in 2002. The availability of insurance has enabled her to rebuild her livelihood.

There are examples from outside Oxfam where preparedness can safeguard livelihoods. In Gujarat, for example, the Self-Employed Women’s Association (SEWA) successfully used the government’s drought relief fund as a revolving fund for investing in women artisans who could make embroider during the drought season and sell the product, again through SEWA cooperatives. The fund grew as women repaid the loan from their earnings and used it as an available capital resource. Simultaneously, several drought-proofing initiatives were taken in their villages through watershed development. Thanks to the watershed activities, their desert villages have become green again and birds are flocking to the rejuvenated ponds as ground tables have risen.

In the area of preparedness, people’s institutions need to work with government. There is a view that governments are ineffective but the government is the only institution that has the machinery and infrastructure that can address preparedness everywhere

# Key points raised in the discussions

## Session-2

- 1. Models from Cultural Theory can provide critical insights on perceptions and approaches from different groups within society or “solidarities.”** While a better model will eventually evolve, the existing one has a large number of uses. Risk-makers have to be seen in terms of the risk absorbed. Once fatalists refuse to accept risk, they become one of the other solidarities, but risk-makers belong to all three. The risk taken by an individualist for his benefit creates risk for others. The ones who avoid risk the most are egalitarian movements. They do not want to build a dam, for example, because it is a risk to someone else.
- 2. Intellectual models, such as the Cultural Theory model presented in this session, play an important role in determining response strategies.** They enable better understanding and have some merit as explanatory and, in some cases, predictive tools. However, they also lend legitimacy to concepts of how society works. These discourses create a social reality and get a life of their own, leading to profound political implications of how policy is constructed. This may legitimize a concept that has been used all along, altering reality to the detriment of many.
- 3. Different social solidarities operate in their own ways.** The perspectives of bureaucracies, market actors and NGOs tend to be different for a variety of inherent social reasons. As a result, the approaches and solutions they advocate to climate change and disasters are generally different.
- 4. Concerns with the use of cultural theory.** Concerns were expressed with regard to the use of Cultural Theory, particularly with regard to the assumption that different groups are homogeneous, the absence of agency, and what use of theoretical frameworks may mean for development of a practical agenda and going forward.
- 5. Data issues are central to social action and are heavily influenced by the nature of the solidarity**
- generating and using the data.** Governments and formal processes rarely use data from informal sources – but these are often the most effective in enabling communities to take action. When we think of data or information it is generally through a very formal structured set, which we essentially see in governments, such as in India and Nepal, or universities for that matter. One reason that Cultural Theory is useful is that it highlights the logic and incentives underlying different sources of data. Market actors collect data for specific reasons, NGOs for other reasons, and governments for yet other reasons. If we wish to inform and support adaptation, we need to recognize where data are generated and the interests or world views that inform that collection. Institutional contexts generate certain proclivities. Many problems relate to the ownership of data and the tendency to structure the data. Each solidarity has its own in-built filters, which provide different perspectives and values. The government filters out some data if it shows them in a bad light, so do activists and markets. However, all data rejected by one solidarity is data required by another. Causes must be studied, especially those not conventionally seen at international or national levels.
- 6. Many debates over disaster response and adaptation strategies come down to a war of attitude rather than technology, resources or know-how.** This is a major point of conflict between governments and NGOs.
- 7. Recognition of the need for adaptation and improved disaster response is increasing but has yet to lead to effective action.** Recognition is yet to be translated into a more effective and more convincing policy and collaboration. One reason for this reluctance still persists is because each solidarity looks at problems from its own rationality. To resolve this, reasons and perceptions need to be brought together in a dialogue mode. From the government point of view, the preparation of a recent paper on flood risk involved the departments of space,

information and broadcasting, communications and information, meteorology, urban development, finance, relief, the state government of West Bengal and the Institutions of Engineers. NGO and social actors were not involved. This shows as to how a particular solidarity or a particular hierarchy decides as to what kind of information would constitute knowledge and who should be asked to provide the strategy. It is very important to not be dependent on a theory because theories are always evolving.

**8. Advocacy is essential.** Because recognition of problems has yet to translate into action, advocacy is essential. Advocacy is a very slow process. To increase awareness of the need for disaster risk reduction, professionals need to advocate with government, media and other institutions. Information is power that moves not only the hierarchies, not just people in the government, but it creates the abilities for activities such as Oxfam's to become models. This is the basis of advocacy. We need to learn to talk in a language that the other person understands. Advocacy marrying development with disaster mitigation is a language the government understands, if you push enough.

**9. Investments in preparedness have proven to be very useful.** There are two primary ways of increasing preparedness. One is preparing for disaster mitigation (risk reduction) and the other is long-term – starting with prediction and the development of institutional and infrastructural platforms for response. Small-scale local interventions, such as construction of raised platforms and other facilities in flood-prone areas, can be effective. In the projects of the Red Cross Society during 2001 and 2002, raised platforms helped keep people and livestock safe for two weeks. Raised wells and raised sanitation facilities have proved to be important, especially for women, in a community-based cyclone preparedness program in Bangladesh, where in 1970 a cyclone killed about half a million people. Community-based programs of building shelters through social mobilization helped reduce deaths to a few hundreds when a similar cyclone hit Bangladesh in 1997. This investment had a visible impact and has proven that preparedness works.

**10. NGOs can play a vital role in disaster relief.** During the Orissa floods, not a single life was lost in the villages where Oxfam was working. In comparison, in other areas, lives were lost.

## Moderated panel discussion

This session was structured as a moderated question–answer session with disaster response experts from UNDP, OXFAM and government representatives directly involved in the types of disasters likely to occur as a consequence of climate change

### Moderator

What are the practical links between disaster risk reduction and adaptation to climate change and, after the practical links, what are the key operational and policy issues you face in effecting them? Finally, as a way forward, what do you see as the critical unknowns, areas for experimentation or research that we all need to be thinking about?

### G. Padmanabhan (UNDP)

The UNDP Disaster Risk Management Program is being implemented in India. It covers 169 most vulnerable districts in 17 states. It consists of activities that support extensive community capacity building on disaster risk management. It also involves activities to build capacity at various levels within the government system. The Disaster Risk Management Program was designed jointly by UNDP and the Government of India and is being implemented by state governments. When senior bureaucrats at the state level are convinced of the need for disaster preparedness and mitigation then the project is implemented well. Without this support, in spite of genuine interest of the people involved, there will be setbacks. Implementation is done through a steering committee, with the chief secretary heading it; and departmental heads are involved in establishing linkages to address mitigation plans at various levels. In areas where there is no experience of any major disaster, interest will be lacking. Large-scale awareness promotion has to be conducted showcasing disaster concepts and the importance of disaster prevention and mitigation.

It is difficult to change the mindset of people who have not really experienced disasters. When the earthquake occurred in Gujarat, people in Maharashtra were uninterested in preparedness or mitigation activities. Whereas, in Gujarat, policies have been formed and capacity building done. In Delhi, there was little interest, earlier, but now there is a disaster response committee.

One of the challenges is to shift from disaster response to proactive preparedness, and mitigation is one of the challenges. There is a need to examine legal instruments that exist. In Delhi, earthquake-resistant houses are required, but there are no regular legal instruments to implement building standards.

### Aditi Kapoor (Oxfam)

Some of the practical links between risk reduction, disaster response and adaptation have shown that the poor are affected more and the poor are more responsive. Women are affected more and the women are more responsive. It is an effect and an opportunity. South Asia is the most affected by natural disasters of all kinds. More than 80 percent of India's landmass is subject to disaster, whether floods, cyclones, droughts, earthquakes or landslides. The practical links between risk reduction, disaster response and climate adaptation seem to lend themselves better to some disasters. In the case of drought, reducing the risk, initiating available responses, and adaptive strategies are easier than in the case of cyclones or floods, where the causes need to be studied. Cyclones, which are more natural, are easier to cope with. It is more difficult to cope with recurring floods or droughts.

Different actors come into play for risk reduction, disaster response and adaptation. This poses a practical problem. There is very little information available in a form that can be articulated and communicated across the spectrum of relevant actors. It is essential to collect the information that is available on risk reduction, disaster response and adaptation and to put it together in a way it can be articulated to different sectors of society. Different communication tools should be used for policymakers, donors, communities and the media. Preparedness is one tool, which is good for linking all three and should be the focus for government and all those working in this area.

Neeraj Mittal (Joint Commissioner, Relief and Rehabilitation, Government of Tamil Nadu)

*Institutional memory and capturing experiences from past disasters to understand what happened and why is very important.* This is true for small and medium as well as large disasters. Because the combined effects of small and medium disasters exceed the major events, small and medium disasters are telling you stories of risk.

Kamal Kishore (UNDP)

It is essential to enhance dialogue between different disciplines because disaster risk reduction issues (whether they involve floods and climate effects or earthquakes) cut across disciplines and institutions. When you look at different institutions, people have different parts of the puzzle and very few attempts have been made to put them together toward problem solving. Interdisciplinary activities are talked about in a very superficial way. Five years ago, I was at an interdisciplinary conference among synoptic meteorologists, meteorologists, hydro-meteorologists, hydrologists and climatologists, and intra-seasonal oscillation experts. A lot can come out of a dialogue, but even in this relatively narrow group of specialists, most discussion was intra-disciplinary. In Bangladesh, at a meeting that we had organized, we realized that *for the first time* the director general of the agricultural department was seated next to the person who gives out the annual forecast. The director general did not even know that the forecast was available in a particular format. Therefore, a lot of the problem can be solved through dialogue.

In terms of practical linkages, *I do not think we understand the different time and temporal scale effects that influence vulnerability well enough.* Take the recent Kashmir earthquake. We did not understand how the recovery would happen there. Because local people are often at the lead in recovery activities, one of the key questions that came to my mind was what are the people doing for themselves? The answer – very little. Why? Because of conflicts, the economy has been subsidized. People are accustomed to being given assistance. Food prices are the lowest in the country. As a result, over the years a certain kind of vulnerability has been built. Social vulnerability has reduced the initiative that is otherwise found in such situations. There are a lot of factors that are very hard to grapple with that contribute to people's vulnerability. Many of these are independent of the kind of hazards being talked about.

Finally, when we talk about documenting past disasters it is also important to see what we did to recover from that disaster; what we did to build back better; and, if we did not build back better, why not. There are complex socio-political reasons, vested interests and even cases of plain negligence. What can we do to successively reduce risk after disaster, what works and what does not. Understanding of this needs to be increased. There are many examples where small interventions have actually led to major changes in the long term. Take the case of what happened after the Maharashtra earthquake. After the quake, the title deeds of all houses were issued in the name of the couple instead of the traditional way. That created a precedent for Gujarat and Orissa and it is a step forward.

Finally, I am growing wary of pilots. If you look at earthquake risk reduction in this country and all related to, whether in climate, a lot of things that need to be done are actually quite simple and straight forward. So I urge us to move from piloting to benchmarking. Simple benchmarking, knowing a good practice, means it should be done as a part of the general way of doing things.

### Moderator

The discussion over the past few days focused on the link between pulse change and the type of thing that is going to happen over the long term in climate and the types of questions that are very practical in the disaster context. The point has been made that if there is no disaster experience, there is no interest. That is the central challenge for the climate community – there is no experience so climate issues are very hard to sell. We are getting some of the experience with events such as Katrina but is it related to climate change or is it not? Can information be communicated to people? That has been a central challenge in this meeting. Different dialogues are on. To talk beyond this meeting, we have to talk to a much wider group. Furthermore, discussions have to be maintained because there is very little institutional memory.

In terms of operational issues, what do you see a most practical way of supporting forms of disaster risk protection that might respond to the long-run impacts of climate change while also recognizing that some forms of climate changes can be very fast? What are the key operational issues that you face in getting some of the ideas you talked about in relation to disaster risk reduction implemented?

### G. Padmanabhan (UNDP)

One of the practical difficulties we face is how to explain to people that a particular phenomenon is or is not happening mainly because of climate change or global warming. Mumbai and other cities have experienced a substantial growth in urban flooding. It is difficult to determine how much of this might be due to climate change. Is an event such as the Mumbai floods this year a stray incident? Planning for urban floods may look at the record of the past 30 or 40 years and use that to develop preparedness measures. You do not see cities looking at events that have not occurred in the last 150 years and developing response plans to be prepared for that. This is, I think, a critical constraint in planning for the types of events that may occur as a consequence of climate change. How do we know that, for example, in Delhi the rains during the next monsoon may be something we have not seen in 200 years and is happening because of climate change? How do you convince the bureaucracy and other people that this is going to happen? How do you predict it? You need to be prepared for it. So communities one after another face it and then realize it was because of climate change. This slowly creates the demand for preparedness.

### Aditi Kapoor (Oxfam)

Trying to convince people that certain events are occurring because of climate change is complicated by the question of institutional memory that you spoke of. Winters have become less severe but the meteorological department says so many degrees Celsius above normal or below. How do you encapsulate such observations and get a scientific basis for relating them to climate change and then go to the media and convince them it is an important “newsworthy” topic? That is a challenge that all institutions need to address and find answers to. *We also need to start thinking about multi-risk reduction.* In Andaman, the fact that the earth shifted has made people aware that earthquakes are a possibility. The potential for volcanic destruction is also being recognized in Andaman and Nicobar because the earth moved. When we talk about risk reduction and disaster response and adaptation we need to take a multi-risk perspective. We cannot talk about one single risk. The practical difficulty when one is trying to implement is when different actors are involved. For implementing a program, we need to work with a lot of people and this also means behavioral change which is something which must be worked on – changing perceptions and the differential impacts on men and women. Behavioral change and attitudinal change will

become key in trying to reduce risks in times to come. All these pilot cases that are being conducted should be pooled together and the learnings shared to support this type of attitudinal change. Information sharing on viable models and seeing how we can adapt, not only to climatic change, but to a variety of risks. One practical solution, when working across sectors is to find a common denominator and everyone comes together when there is a common issue and then they separate again. If there are enough common denominators and if the language we talk together can be changed, it might work better. We need practical tools – more acts, codes, guidelines, more practical research rather than statistics. *There is an urgent need for research that can be translated into practical action.*

### Neeraj Mittal (Joint Commissioner, Relief and Rehabilitation, Government of Tamil Nadu)

People are aware of disasters but they do not know the kind of risks they take. This makes information dissemination issues critical. It also makes questions of risk zoning equally critical. The government of India is planning to do a risk zoning of the entire country. That is a key operational issue as far as strategies to deal with disasters are concerned. We cannot train everybody in everything. With limited resources we need to train people to deal with specific kinds of disasters that they are susceptible to.

### Kamal Kishore (UNDP)

In terms of operational issues, at the cutting edge level of the administration, we maintain disaster management plans. There is an imperative need to update them and that leads to the question of institutional memory. Where such a plan exists, updating it with details of past disasters gives administrators a good handle to work on from that point onward. Zoning maps also link to building bylaws and those need to be changed as experience is gained. In Delhi, this has not happened in spite of the recent earthquake. The use of IT is also critical for maintaining databases of people having baseline information on many things relevant to disaster management, including the socioeconomic status of people. We have no unified database. Government departments have different databases for different purposes. There is no cost benefit between one database and the other. Each database is independent of the other. There is no correlation. When a disaster strikes, another survey is done and another database is generated. Unification is needed. A very severe drawback exists when you do not have accurate information in a disaster situation.

One of the practical issues in linking adaptation to climate change that stands out is institutional. If you start listing institutions that are responsible for dealing with different aspects of risk, you will find the necessity for linking such as within India the three states of Gujarat, Orissa and Uttaranchal have three different agencies for disaster management. Other states have other ways of dealing with disaster management issues. And when it comes to dealing with climate change, there are separate institutions, some in the Ministry of Agriculture, some in the Home Ministry, some in the Ministry of Environment. I do not have a solution and do not know how it can be harmonized. Those of us who play a catalytic role tend to go to institutions we are comfortable with. When it comes to disaster management, I go to the National Institute of Disaster Management (NIDM) and talk to them – but they may not be the best people to talk to. There are many layers to setting up new institutions and designing their mandates. As a result, mistakes will be repeated. Without learning from our own mistakes and other countries' mistakes, it is difficult to make progress. The positioning of the meteorology department in different countries illustrates this. If you look around Asia, in some countries, meteorology is part of defense, in some it is part of transportation, in some communications, and in others environment. In some countries there are two meteorology departments – one with agriculture and one with science and technology. Differences are also present with respect to how these are placed and how they are aligned. How influential they are, what is the kind of resources they get, and how accountable they are also different. In India, Gujarat State Disaster Management Authority (GSDMA), Orissa State Disaster Management Authority (OSDMA) and the ministries working on disaster management are working in three different ways in three different states. There are reasons for that, but they have not focused on these issues.

### Moderator

In many ways, the question of institutions and institutional duplication was the central theme of the last session. There are a number of organizations – particularly when we added climate change – and a lot of understanding in different areas. The complexity is evident from this diversity. In the post-disaster context, we are talking about risk reduction. This is very similar to the need for risk reduction as part of adaptation to climate change.

What are the policy issues that become central when you

are trying to reduce risks either before a disaster or when you are in the process of post-disaster recovery and rebuilding? What should we do that is different from what is already being done? And what are the policy issues that emerge in that context?

### G. Padmanabhan (UNDP)

After the tsunami, the Tamil Nadu government spent a lot of time thinking about the kind of reconstruction strategy it should adopt. It did not want to do something and realize later that it was not the right thing to do. As a result, it undertook an extensive evaluation of alternatives before developing a strategy.

If we know the risk profile of an area, we can reduce risks in advance. Suppose a major cyclone happened and there was major devastation in the coastal areas. Can we think in advance about the kind of damage such an event would cause? If we do, we can develop construction and other policies to reduce the risk. In Jammu and Kashmir (J&K), following the recent earthquake, the government initially decided to go ahead rapidly with the construction of permanent earthquake-resistant houses. It attempted to promote appropriate earthquake-resilient reconstruction using local materials and respecting the local tradition. Unfortunately, after a substantial time was spent it realized that the masons who construct houses in J&K mainly come from Bihar and go back in November for the festival *Chat*. So there was no way to train the local masons in earthquake-resilient construction. As a result, it ended up relying on temporary constructions. Substantial money could have been saved if they had been able to focus on permanent construction – but without advance planning the ability to bring in new techniques is often limited after disasters. In Tamil Nadu, discussions on resettlement issues are trying to develop mechanisms to consider all this in their resettlement strategies to avoid wasting time and resources.

### Aditi Kapoor (Oxfam)

I agree that risk mapping is required to understand the implications of climate change for vulnerability to different disasters. That is, however, not something the government should do alone. It should be a collaborative exercise and one that accounts for other risks in addition to climate change alone. Our programs on quake-proof or cyclone-proof houses have met with great success in communities with respect to both employment and the building of new skills. The point here is that *risk reduction activities can have more benefits than one*.

At the policy level, disasters can present opportunities for changing policies in ways that respond to the differential impacts on men and women and can empower communities. In Kerala and Tamil Nadu, for example, policies were changed to issue of joint title deeds for houses after the tsunami. This gave many women a level of ownership they lacked before. Another change would be to make the panchayat more responsible for filing insurance claims for the poor who are unfamiliar with the mechanics of bureaucracies. Such changes are needed.

On a theoretical level, substantial learning is required to effectively link disaster risk reduction into development. Risk and disaster considerations need to guide development policy-making but there are practical issues in how you link the two. We all need to be in a constant learning mode. Climate change with all its unknowns will require this. In addition, we need to influence policy from the outside and at the same time we want to win over friends from inside the government. They need to be influenced from within and without.

Neeraj Mittal (Joint Commissioner, Relief and Rehabilitation, Government of Tamil Nadu)

From the government perspective, there should be continuity in terms of an institutional setup to deal with disasters. This capacity is not just needed when a disaster strikes. There should be a permanent setup with experts involved in a state of readiness at all times. In Tamil Nadu, disasters have occurred one after another. When there are no disasters, everything tends to rust. Response systems, reserves and information bases are not current. When disaster strikes, we respond for a year or two and then forget. Public memory is very short.

At the policy level, the government can do a lot by promoting planned development. The ability to do this is evident in recent court decisions that have resulted in a lot of encroachments being removed in Delhi and Chennai. If this can be done continuously, we reduce human loss in the case of any disaster. Whether or not climate change occurs is a moot point.

Kamal Kishore (UNDP)

The first book on disaster and development entitled *Disaster and Development* was published 23 years ago. The entire book is relevant today. We understand linkages but delivery is ultimately all about accountability. We know what needs to be done. Let us do it. Take the earthquake

in Bam. For eight hours after the earthquake nothing was done. There was no response. Then the government of Iran airlifted 11,000 people within 18 hours and put them in hospitals outside the affected area. It was a spectacular response. But the need for this response in some ways illustrated the lack of advance planning. The area was well known to have a high risk of earthquakes and there were 91 hospitals in the affected area. None of these hospitals survived the quake. Thousands of people could have been saved if even half of the hospitals had survived. This is in an area where we know there is a risk. It is in the zone and no one is asking why these hospitals fell down. Assessments after disasters are not done well and there is no accountability for the lack of advance planning even where risks are well known. Building models and rhetoric on disasters and development will not be of any use. Accountability has to be improved in a tangible way not in a conceptual way.

**Moderator**

The climate change community is coming from a very technical perspective. It has focused on modeling global changes. For the members, the topic of adaptation is very new. There is, however, a huge amount of existing knowledge regarding what can be done for disaster management. Since extreme events, and consequently disasters, are likely to increase as a consequence of climate change this knowledge is directly relevant for adaptation.

We know coastal areas are vulnerable to Tsunami. If sea levels are going to rise as a result of climate change, coastal areas vulnerable to storm surges and even non-climate related events (such as tsunamis) will increase. We can map this out now. As the last speaker emphasized, basic knowledge on disaster risk reduction was written 30 years ago. This throws the issue back to convincing people and institutional memory. We need to recognize memory is short. We also need to recognize that new information on the specific sources of vulnerability created by climate change must be generated. As a result, a final question relates to the major unknowns or areas for experimentation or research that the panelists still see as important.

If, as the previous speaker emphasized, we already know effective response strategies, why were not these implemented? What questions must be answered to effectively link climate adaptation with disaster risk reduction and resolve the kinds of accountability issues that were just raised?



### G. Padmanabham (UNDP)

Some hazards such as cyclones and floods are common in specific areas such as Assam and Bihar. They have, in effect, become a way of life. People have developed local coping mechanisms. Many traditional coping mechanisms are dying as people move into market crops such as paddy. We need to document these traditional mechanisms and see if their effectiveness can be scientifically improved. If we do not understand existing coping mechanisms we might promote forms of disaster relief or development that increase vulnerability. This is a key unknown area.

### Aditi Kapoor (Oxfam)

In the forests of Uttaranchal, the World Bank carried out a study and concluded that the forest dwellers should actually lop branches in rotation. Villagers have been doing this for generations but it became the World Bank's conclusion to save the forests. A lot of these traditional coping measures need research. An additional critical unknown is the effect climate change will have on livelihoods in a practical way – “what can I do to save myself, my family and my livelihood.” When we understand these practical issues, we will have crossed a lot of the hurdles discussed here.

### Neeraj Mittal (Joint Commissioner, Relief and Rehabilitation, Government of Tamil Nadu)

Zoning in vulnerable areas is important. At present there is a regulatory zone of 200 m from the ocean but as far as I understand it has little to do with disaster risk reduction. The zoning requirement basically arose from the need to protect sensitive coastal areas. If one looks at the effect of the tsunami flooding in coastal areas, in some places it went inland by 500 m in other places by 1 km. This was because the slope in the area is different. Slope is a critical part in modeling tsunami impact or developing an effective tsunami impact prediction model. This is an area where a lot of research needs to be done. We need effective prediction to help administrators respond to coastal events. A second area where research is needed has to do with behavioral changes in people. We need to know what alternative technologies are available and how people can alter their behavior to reduce the impact of climate change. Third, some amount of research is required to see if some curriculum changes can be made in the education system to make kids aware from the very beginning regarding the disasters that plague them and what can be done. We just need some simple rules of thumb even though the

curriculum is already burdened. Finally, some research is required to separate myth from reality, particularly with response to early warning from non-conventional anecdotes. We hear a lot of stories about animals and how they move in advance of disasters in response to some sixth sense. Scientific study of animal behavior and its potential use for predicting disasters is needed. The truth needs to be known.

### Kamal Kishore (UNDP)

There are many critical unknowns. Climate change manifests itself at both local level and sectoral levels but nobody is able to predict precisely how. We need to strengthen what we already know about the current state of the climate on different time scales and how we can make the most of this understanding in decision making. In India, the April monsoon forecast has been used for the last 15 years as the basis on which many decisions are made. Understanding of the Indian monsoon has greatly improved over this period. There are huge variations in time and space. We know from studies of normal years that 2002 was a dry year. The reduction in the all India rainfall index was, however, not that huge. Most risk is emanating from fluctuations within seasons. There is a need to know about the current status of the climate on a daily timescale – on 5-day timescale, a 20-day timescale, and a seasonal timescale.

The Disaster Management Bill has recently come into force in India. This fills a major gap in recognition of the problem. Since institutional memory of disasters is very low, formal recognition of problems in managing disasters and the role of government in risk reduction is essential. A pilot project to document disasters and identify risk factors has recently been completed in Orissa and is being initiated in Tamil Nadu. This project involves documenting all kinds of disasters and studying the risk factors in areas that are prone to extreme events. It is not being done using a specific scientific method, but instead involves a deductive way of using historical data related to disasters. *A practical way must be found to increase the memory of institutions with regard to each kind of disaster – chemical, man-made or natural. Institutional memory and capturing past disasters – big, small and medium – and their understanding is very important.* The combined effects of small and medium disasters exceed the major events, therefore small and medium disasters are good indicators of risk.

# Key points raised in the open dialogue

## Day–3

Following the main moderated panel question–answer session, the final portion of the conference shifted to an open dialogue format. The points below highlight the key issues and questions raised in this discussion.

1. **Costs of adaptation.** Understanding what adaptation means to different partners and knowing how much it would cost is essential. While substantial understanding exists regarding the way livelihoods are affected by climate variability, *very little is known about how much it will cost to adapt.*
2. **Institutional memory.** Several participants emphasized this as a critical issue for responding to climate change and other forms of disaster. As Dinesh K. Mishra commented, “Institutional memory and capturing past disasters – big, small and medium – and their understanding is very important. The combined effects of small and medium disasters exceed that of major events, therefore small and medium disasters are good indicators of risk.”
3. **Interdisciplinary dialogue.** Dialogue between different disciplines must be increased because disaster risk reduction issues, whether floods or earthquakes, are viewed from different perspectives by different institutions and different people.
4. **Vulnerability and timescales.** The causes of vulnerabilities over short and longer timescales are often different. Many factors contribute to the vulnerability of different groups that are independent of the type of hazard.
5. **The effectiveness of recovery.** As one commentator mentioned, “When we talk about documenting past disasters, it is important to see what we did to recover from that disaster and what we did to build back better – and if we did not build back better, then why not?”
6. **The need for communication.** The lack of experience with the impacts of climate change reduces societal interest in devoting resources to response. When changes are both pulsed and gradual, it is difficult to bring them together and communicate both response needs and uncertainties in a way that catalyzes action. In addition, tremendous communication challenges arise because of the difficulty in attributing specific events to climate change. As a result, there is a need for more effective mechanisms to communicate the links between responding to climate change and responses to disaster events whether or not they are specifically climate related. Most dialogue now occurs in narrow circles of specialists; a much wider group needs to be addressed.
7. **The need for multi-risk perspectives.** Because climate and other risk responses are closely related, development of effective strategies for responding to multiple risks – rather than trying to isolate them by their causal source – is essential.
8. **The need for practical tools that support information dissemination and capacity building.** Risk zone maps are being prepared for the entire country by the Government of India. This kind of mapping, though essential, is difficult to do.
9. **Vulnerability mapping.** Understanding of vulnerability has to be improved. In order to capture the capacity to cope and adapt, or resilience, there is a need, not for risk maps, but vulnerability maps. This goes beyond mapping the exposure zone where there is actually direct impact from climate change or other causes of disaster. There is a need to know the kind of structures that are available in the areas, the kind of people who live there, and their capacities to cope.
10. **Capacity building.** Everyone cannot be trained to respond to all kinds of disasters. With limited resources,

there is a need to train people to deal with the specific kinds of disasters that are most relevant to them.

11. **Databases.** Databases need to be coordinated. Different government departments have different databases for different purposes. Each database is independent of the other and there is no correlation. It is essential to have baseline information for effective disaster response. Effective use of information technology is central to this.

12. **Institutional coordination.** There are multiple institutions dealing with different aspects of risk. Some states have different agencies with different operating procedures. This has to be harmonized. Those who play a catalytic role tend to go to institutions they are comfortable with even though the institution they work with may not be the best one. The situation is the same in other Asian countries. It is difficult to understand which ministries, departments or agencies are involved, the areas

where they work, how they are aligned, and their resources and accountability.

13. **Data democratization.** To change behavior, information has to have meaning and legitimacy among users. This needs to be addressed by exploring alternative mechanisms for data generation (such as through schools) and by improving access to data sources.

14. **Impact of disasters on the poor and the benefits of risk reduction.** Oxfam studies show the maximum impact of disasters generally fall on the poor, and the economic and social cost declines dramatically if preparedness works well. Disaster risk reduction is, as a result, essential for poverty alleviation.

15. **Mainstreaming adaptation to climate change.** A significant challenge is trying to mainstream responses to climate change in development and other activities.

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