



TECHNICAL REPORT

Towards Integrating Disaster Risk Reduction and Climate Change Adaptation

Understanding Flood Risk and Resilience in
Eastern India

Partners



Institute of Social and Environmental Transition



National Institute of Disaster Management

Lead



Gorakhpur Environmental Action Group
Post Box # 60, Gorakhpur-273001 (U.P.)

List of Acronyms and abbreviations

ACCCRN	Asian Cities Climate Change Resilience Network
CCA	Climate Change Adaptation
CRF	Climate Resilience Framework
DDMA	District Disaster Management Authority
DDMP	Disaster Management Plan
DRR	Disaster Risk Reduction
HFA	Hyogo Framework for Action
IPCC	Intergovernmental Panel on Climate Change
ISET	Institute for Social and Environmental Transition
NIDM	National Institute of Disaster Management
MNREGA	Mahatama Gandhi National Rural Employment Guarantee Act
GEAG	Gorakhpur Environmental Action Group
NAPCC	National Action Plan for climate change
SDMA	State Disaster Management Authority
NDMA	National Disaster management authority
GCM	General Circulation Model
RCM	Regional Circulation Model
RCPs	Representative concentration pathways
ADM-FR	Additional District Magistrate (Finance and revenue)
SLD	Shared learning dialogue
GOs	Government orders
PHCs	Primary Health Centres
CHCs	Community Health centers

Abstract

The issues related to climate change and DRR have indicated negative impact on development pattern in the country like India, where development is under transition stage and the parameters related to socio-economic development such as social welfare, quality of life, infrastructure development, livelihood etc. are on stake due to increasing numbers of disastrous events with increased intensities. Though at the national level, the government of India has introduced legislative and policy frameworks for disaster risk reduction, established early warning system, raising the level of preparedness to respond to disaster. However, the goals of the Hyogo framework for action are still far from being achieved. A massive effort is needed to bring change from national to local level through the involvement of all the sectors and stakeholders in the disaster risk reduction.

The overall goal of this CDKN-START programme was to incorporate climate change consideration into disaster management planning within local level. In this process the study was piloted in Gorakhpur district, which is one the most flood affected districts in eastern Uttar Pradesh. The rigorous interaction with line departments has improved understanding of the systemic factors contributing to flood resilience under changing climate conditions. It has identified practical strategies for integrating disaster risk management and climate change adaptation.

Project Information

- Principal Investigator: **Dr Shiraz. A. Wajih**, Gorakhpur Environmental action Group
- Partners : Co- investigator: **Marcus Moench**, Institute of Social and Environmental Transition (ISET – International)
Co investigator –**Prof. Anil Kumar Gupta**, National institute of Disaster Management, New Delhi,
- Budget : Rs 3156300.00
- Duration : 22 months

Key Points in Brief

- Flooding and water logging has emerged as major problem for the people of Gorakhpur. Not only they lead to losses in income and assets, but they also contribute to rising problem of endemic vector borne diseases such as Japanese encephalitis and dengue and malaria.
- Climate change may increase the intensity of Gorakhpur's extreme rainfall, particularly the intensity of shorter , more common events that already cause significant flooding in city and its peri urban parts
- The District Disaster Management Plans (DDMPs) created as a result of India's Disaster Management Act (2005) can be an effective mechanism for promoting climate-sensitive planning at district level.
- Integrating climate concerns in DDMPs requires proper facilitation of the Shared Learning process with various departments at district level using the Climate Resilience Framework.
- Climate projections must be appropriately interpreted and presented in a way that fosters understanding of their implications for development programmes in various departments
- The Shared Learning process is critical to developing the capacity of various departments to understand, appreciate, plan and respond to climate risks.

Background

Climate change and disaster risk are fundamental threats to development and the eradication of poverty¹. The negative impacts threaten to roll back decades of development gains. Building resilient societies means addressing both climate and disaster risks, and integrating these risks, as well as potential opportunities, into development planning and budgeting. Natural hazards destroy lives and livelihoods, and have long-term consequences for human and economic development. The detrimental impacts of these events on development have been seen over and over, with destruction of lives and livelihoods setting back development progress and increasing levels of poverty, or even forcing new groups into poverty.

It has been predicted that changes in climate and weather patterns will lead to increased exposure to climatic impacts and enhancement in the vulnerability of people. IPCC 2013 report mentions that increased exposure and vulnerability are generally the outcomes of skewed development processes such as those associated with environmental degradation, rapid and unplanned urbanization in hazardous areas, failures of governance, and the scarcity of livelihood options for the poor. The issues related to climate change and DRR have indicated negative impact of development pattern in the country like India, where

¹ sustainabledevelopment.un.org/.../2301TST%20Issue%20Brief_CC&DRR.

development is under transition stage and the parameters related to socio-economic development such as social welfare, quality of life, infrastructure development, livelihood etc. are on stake due to increasing number of disastrous events with increased intensities.

Several recent studies indicates that there is an increasing recognition that disaster risk reduction (DRR) should include climate change adaptation (O'Brien et.al,2006). CCA and DRR have similar aims of reducing vulnerability and hazard exposure in order to increase resilience to the potential adverse impacts of climate change. Both DRR and CCA require collaborative and coordinated actions (Shaw, R et.al, 2010). The integration of the two fields provides opportunities to strengthen the common parts and improve the management of present and future hazards and risks (Sperling, F. and Szekely, F. ,2005). Moreover, it is commonly accepted that development and sustainable goals may be facilitated by integrating CCA into DRR (Kelman, I. and Gaillard, J. C. 2010).

Globally, people seek ways to reduce disaster risks in some ways or the other. But in many cases poverty and marginalization restrict their effectiveness and options, and rural-to-urban migration exposes them to unfamiliar situations in which they lack the knowledge and means to manage new risks. Today, there is increasing awareness that states—within their obligation to respect, fulfil and protect human rights—have primary responsibility for reducing disaster risk, and that the international community has a duty to provide support and create an enabling environment for this obligation to be met. By signing the Hyogo Framework for Action² (HFA) at the World Conference on Disaster Reduction in 2005, 168 governments and all leading development and humanitarian actors committed to a 10 year multi-stakeholder and multi-sectoral plan to invest in disaster risk reduction as a means to building disaster-resilient societies. Since the HFA was agreed, many governments have introduced legislative and policy frameworks for disaster risk reduction, established early warning systems and increased their level of preparedness to respond to disasters. However, the goals of the HFA are still far from being achieved, particularly in terms of addressing the causes of risk and ensuring full participation of at-risk populations in risk assessments, planning processes and programs. A massive effort is needed to bring about change at the heart of each country's 'development system' through the involvement of all sectors and all stakeholders—from local to national—in disaster risk reduction.

The need to address DRR and CCA simultaneously in order to achieve coordinated actions has been stressed by both UNISDR³ and IPCC-SREX report⁴. However, till date, the climate change and disaster risk management communities have operated largely in isolation from each other. This calls for an urgent change in the situation in which they operate. CCA and DRR policy makers, practitioners and experts should communicate and work in collaboration with other effectively to ensure a comprehensive risk management approach to development at local and national levels. Such collaboration could lead to several benefits such as:

- Reduction of climate-related losses through more widespread implementation of DRR measures linked with adaptation
- Efficient utilization of resources – financial, human and natural
- Enhanced effectiveness and sustainability of both CCA and DRR approaches.

² <http://www.unisdr.org/2005/wcdr/intergover/official-doc/L-docs/Hyogo-framework-for-action-english.pdf>

³ UNISDR (2013). Implementation of the Hyogo Framework for Action. Summary of Reports 2007-2013. Geneva

⁴ IPCC (2012). Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change. Field, C. B., Barros, V., Stocker, T.F., Qin, D., Dokken, D.J., Ebi, K.L., Mastrandrea, M.D., Mach, K.J., Plattner, G.-K., Allen, S.K., Tignor, M. and Midgley, P.M. New York: 582.

Rationale

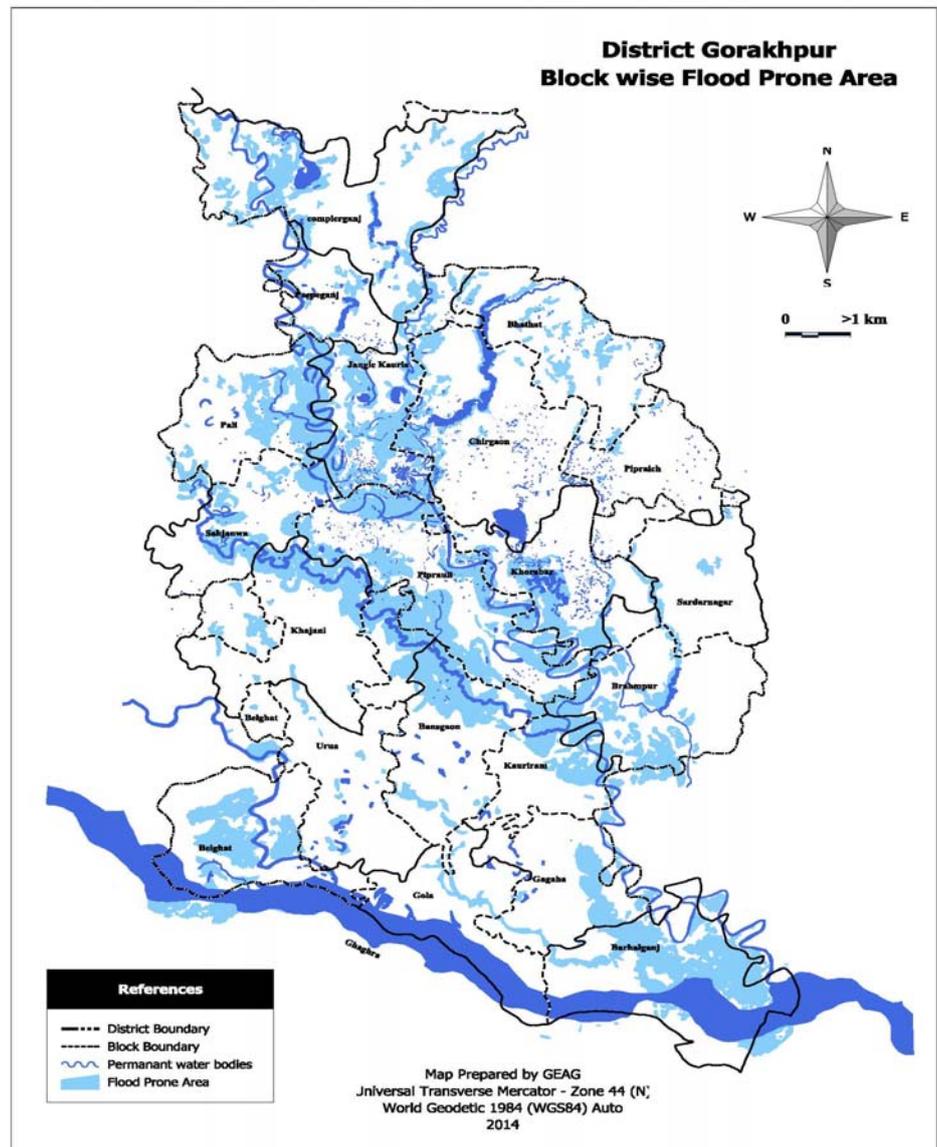
In India, Disaster Risk Reduction and Climate Change Adaptation approaches are integrated at national level through India's commitment to Hyogo Framework for Action (HFA 2005-15), the National Action Plan on Climate Change (NAPCC), the Sustainable Habitat Mission and other programmes. But such programmes are, however, seldom integrated at sub-national or state or district levels due to lack of capacity of the relevant departments or organizations. As a result, agencies such as the District Disaster Management Authority (DDMA) rarely have a forward looking approach in their planning and implementation activities that accounts for range and trends in climate projections. At the same time, those working on climate adaptation rarely learn from experiences in DRR programs. Furthermore, an array of sectoral departments (such as those involved in water supply, health, agriculture, rural development and urban development) undertake activities that influence climate and disaster resilience. However, very little effective horizontal coordination exists between departments, especially on integrating DRR and CCA concerns into their sectoral programmes. These gaps undermine the ability to translate concepts and DRR or CCA policies into action on the ground.

Considering the above mentioned gaps, the intervention was piloted in Gorakhpur to improve the capacity of the DDMA and represents a potential point of entry for addressing the vertical and horizontal gaps in planning and implementation of DRR and CCA approach at local level. The DDMA are district level organizations with a presence across India where all the departments converge. Hence, they offer a unique platform for integration of DRR and CCA approaches

Since Gorakhpur in eastern Uttar Pradesh lies in the lower catchment area of river Rapti which originates from the hills, it is highly prone to natural disasters. A number of rivers like Rapti, Aami, Rohin, Ghaghra intersect and pass through Gorakhpur. At any time, if any of these rivers flow above the danger line, chances of flood in the catchment areas of other rivers increase. This kind of geographical setting of Gorakhpur makes it vulnerable to floods every year. During last 100 years, situation has worsened in the region, specifically due unplanned development, lack of effective preparedness plan, lack of awareness at departmental level and lack of proper enforcement of policies and government orders (Rana, N.K, 2005). The number of recorded significant flooding events in Gorakhpur is listed below

1900's – 1903, 1906, 1910
 1920's – 1922, 1924, 1925, 1927, 1928, 1929
 1930's – 1930, 1932
 1950's – 1953-1960 yearly (Rapti Catchment)
 1960's – 1961, 1967, 1968 (Rapti Catchment)
 1970's – 1970, 1971, 1973, and 1974 (Rapti Catchment)

On the other hand, the analysis of future climate projections has shown that Gorakhpur will be further more affected by the impacts of change in temperature and rainfall patterns. From the analysis of different climate models such as CGCM, CNRM, CSIRO, MIUB, it has been predicted that the maximum temperatures will be most pronounced in winter and summer. This fluctuation in temperature and its potential impact on precipitation could have significant impacts on agriculture and urban water management for Gorakhpur, while the increased temperature can change the pattern of occurrence of water and vector borne diseases.



Goal and objectives

The overall goal of the CDKN-START programme was to incorporate climate change consideration into disaster management planning within Gorakhpur district. The programme was jointly implemented by Gorakhpur environmental action group (GEAG), institute of social and environmental transition (ISET) and National Institute of Disaster Management(NIDM) . To achieve the above mentioned goal, the milestone objectives of the programme were to:

- Understand the systemic factors within a flood prone Gorakhpur district of eastern Uttar Pradesh that contribute to resilience or exacerbate vulnerability;

- Understand specific policy innovations that could help to bridge the vertical gap between the integrated national policy framework and local contexts and the horizontal gap between actions within sectoral development programmes to integrate Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA) practice; and,
- To develop relevant capacities of line departments and researchers on CCA and DRR.

The Methodological Framework

The methodological framework for carrying out the research was developed by GEAG and ISET which involved mapping of key departments, analysis of vulnerabilities under climatic conditions, institutional arrangements and current planning process. To meet out the objectives, specific set of methodologies were developed and adopted. ISET had been involved in resilience planning processes by using self developed tools and methods on CCA in capacity building of various government departments and civil society organizations. Similar set of tools and methods were used in this project as well such as Shared Learning Dialogue, mapping of key systems (departments/themes) and current and future vulnerability by using available and projected climate data. The table below outlines the objectives and the methods adopted to meet out those objectives and the data sources used during the course of the study:

Objectives	Data Sources	Methods adopted
To understand the factors within the flood prone districts of Gorakhpur that contributes to resilience or exacerbates vulnerability	<ul style="list-style-type: none"> • Review of secondary sources exposure and fragility of key systems considering the recent events of floods of 2007 and 2008 • Reports generated on climate change by ISET/GEAG and other local agency • Past records on failures across the systems/ departments 	<ul style="list-style-type: none"> • Mapping of key departments such as water supply, health, power, communication, housing and agriculture etc. at district level. • Analysis of their vulnerability in terms of exposure, fragility or failure rates and risks to flooding under current and projected changes in climate. • Overlaying of the climate change projections on current vulnerability mapping for systematic resilience planning process developed by ISET/ ACCCRN for evaluation of impact of climate change on key systems. • Analysis of climate change impacts which causes failure of key natural or social systems.

<p>To understand specific policy innovations that could help to bridge the vertical gap between the integrated national policy framework and local contexts and the horizontal gap between actions within sectoral development programmes to integrate DRR and CCA practice</p>	<ul style="list-style-type: none"> • Collection of District Disaster Management Plans of the districts of Uttar Pradesh • Collection of byelaws, codes and regulatory framework of various sectors. • Collection of information on various ongoing sectoral Programmes 	<ul style="list-style-type: none"> • Institutional analysis through shared learning dialogue, workshops, policy roundtables and interactive learning sessions with the government organizations (including DDMA, SDMA, NDMA and allied government departments and Ministries) at state and national levels. • Desk review of District Disaster Management Plan of the selected district/s including review of ongoing sectoral schemes, techno-legal framework. • Understanding relationship between departmental programmes and reduction/exacerbation of climate vulnerability by using Causal loop-diagramming tool of GEAG
<p>To build capacity of scientists and engage young researchers from two key academic institutions for promoting DRR and CCA by seeking contributions development and sharing of knowledge.</p>	<ul style="list-style-type: none"> • Identification of academic and research institutes located in the concerned district/s. 	<ul style="list-style-type: none"> • Creating a pool of young scientists and researchers engaged in academic institutes and universities. • Engaging researchers as interns and involving them in regular interactive sessions organized through workshops in universities on the theme of integration of DRR and CCA in development processes.
<p>To document and disseminate the lessons learned from the case study</p>		<ul style="list-style-type: none"> • Documentation and dissemination of knowledge obtained from objectives (1 to 3) through Shared Learning Dialogues (SLDs) as a tool for combining local knowledge with global science on climate change • Workshops at district, state and national levels.

Downscaling Climate Change Projections for Gorakhpur and Extreme Event Analysis

A detail downscaling of Climate Projections was carried out for Gorakhpur's rainfall in 2050's. Subsequently, to capture changes in extreme precipitation events Intensity-Duration-Frequency (IDF) curves were developed for key duration and intensities (Opitz-Stapleton, 2013).

General circulation models (GCMs) project how the climate might change, given changes to these human-controlled factors, which are accounted for as representative concentration pathways (RCPs) in the IPCC 5th Assessment models (van Vuuren et al., 2011). Because no single model can project exact changes to an area's climate, it is necessary to use projections from multiple GCMs, each driven by a couple of RCPs, to capture the possible range and trend of changes. Furthermore, climate is a description of an area's average weather over a period of time, typically 30 years. Therefore, climate change analysis involves comparing the statistics of an area's particular weather as projected for a period in the future that is at least 30 years long, with a period of historical climate of the same length.

With these two caveats, ISET downloaded daily precipitation data (simulated historical and projected future) from the CMIP5 Multi-Model Ensemble Database: <http://pcmdi9.llnl.gov/esgfweb-fe/>. The ensemble set of projected daily rainfall was formed using projections from 9 GCMs, each running the RCP 4.5, for a total of 9 ensemble members against which to compare future rainfall with past rainfall. Simulated historical rainfall by the GCMs covered the period 1961–2005, whereas future projected rainfall spanned 2006–2055. At the time of data access from the CMIP5 Database (November 2012), only projections from RCP 4.5 were available, precluding the use of other RCPs for comparison. A 'super' historical daily rainfall dataset for Gorakhpur was compiled and interpolated from a number of data sources due to the incompleteness of available records. Additional historical data covering the period of 1961–2005 were accessed from the APHRODITE project database (Yatagai et al., 2012) to validate and supplement gaps in the sparse station records. The data were cleaned and underwent several quality control checks that are standard for meteorological and climatological data. Six out of the nine GCMs were able to reasonably replicate the seasonality of Gorakhpur's rainfall, as well as the median and standard deviation (the first and second moments) of monthly rainfall totals. Hence, these 6 models were used for Climate Projections downscaling.

Process adopted for mainstreaming CCA and DRR in development planning

The project team has carried out mainstreaming of DRR and climate change concerns into district level development planning through the following steps. A brief description of activities under each step has been given as following:

Initial Planning

Initial planning was carried out in close consultation with various line departments at district level. The district administration was supported by GEAG and ISET for maintaining coordination and preparation of department-wise plan. This support helped government to establish regular communication and facilitate sharing of information between the research team and district level departments. A database was prepared by collecting data on frequency and history of natural hazards and their impacts for analysis of issues and gaps at various levels.

Project Launch Workshop

After completing initial planning, project launch workshop was organized by GEAG and DDMA at DDMA office to share the project purpose, implementation plan and expected outcomes with the concerned line departments. 54 government officials from various departments participated in the workshop and expressed their viewpoints on the process. On the behalf of District Magistrate, Additional District Magistrate-Finance and Revenue (ADM-FR) chaired the workshop and facilitated the discussion. Representatives from NIDM, ISET and GEAG were present in the workshop. Key outcomes of the workshop were :

- ADM-FR was nominated as the nodal officer for anchoring the research initiative from the district
- GEAG to provide technical support to DDMA to manage the research initiative and coordinate with various line departments.
- A Project Steering Committee was proposed to be constituted at the district level consisting of members and officers from DDMA, Municipality, Gorakhpur Development Authority, and representatives from NIDM and GEAG
- Progress review meeting to be held quarterly. GEAG to be responsible for bearing expenses, record keeping and project related documentation and dissemination.
- Provision of separate meetings at all departments from time to time to make department wise preparedness and response plan for District.

This dialogue was an initial breakthrough where the government welcomed the idea of CCA and DRR integration in district level disaster management plans. On the other hand, it was observed that the departmental capacities were not as strong as expected to take up the preparation of departmental disaster management plans considering specific climate change impacts in their respective departments. Therefore, it was decided to have additional dialogues with each line department would seem helpful in preparing the disaster management plans with the integration of climate change aspects. This process was all about building the capacity of government officials in understanding climate change issues and developing plan accordingly. A series of departmental shared learning dialogues were conducted in Gorakhpur in the form of workshop. Departments such as Flood Control, Panchayati Raj, Nalkup, Jal Nigam, Animal Husbandry, Forest, PWD, minor Irrigation, Agriculture, Education, and Health were separately covered in a series of events.

Department-wise Workshops

The SLDs had shown that the capabilities of coordination and collaboration are essential to save lives and basic infrastructure in times of disasters, which the government bodies lack at different levels. It also highlighted the role that departments play in disaster risk reduction and the capability requirements that have to be in place at each stage to pro

vide enhanced support to the victims, considering the fact that eastern UP is expected to face more natural disasters in the near future due to change in climatic condition.

Therefore, a series of department-wise workshops were organized for creating an understanding of climate change issues in disaster management planning and collection of data for sectoral assessment. Departments such as Panchayati Raj, Irrigation and Flood Control, Nalkup, Jal Nigam, Minor Irrigation, Animal Husbandry, Forest, Public Works, Agriculture, Education, and Health were separately covered in a series of events. A detailed discussion on the roles and responsibilities of line departments during various facets of disasters were discussed. During this process, potential gaps were identified and department wise recommendations were made. (Annexure, 1)

Department-wise Information Collection and Analysis

Information related to occurrence of floods, response, flood damage, relief distribution, planning document and relevant governmental orders were collected for analysis of gaps at departmental level. The department-wise plans were reviewed and it was observed that departmental plans were primarily *response centric*. These documents were not updated nor based on updated records available at the time of developing the document. There was neither document available on flood response/relief or any best practices at departmental level in the district.

Guideline Preparation and planning at department level

Based on the findings of department-wise meetings and collection of information, a guiding document for preparation of departmental plan (along with planning formats) was prepared. A consultation exercise was again organised for the fourteen departments to review the guidelines, formats and contents. Afterwards, a compiled document on department-wise planning for disaster management was introduced by the district authority, which has got overwhelmed response from line departments. A Government Order (GO) was issued by the District Magistrate to all the line departments to mainstream CCA and DRR into developmental plans (Annexure 2), .

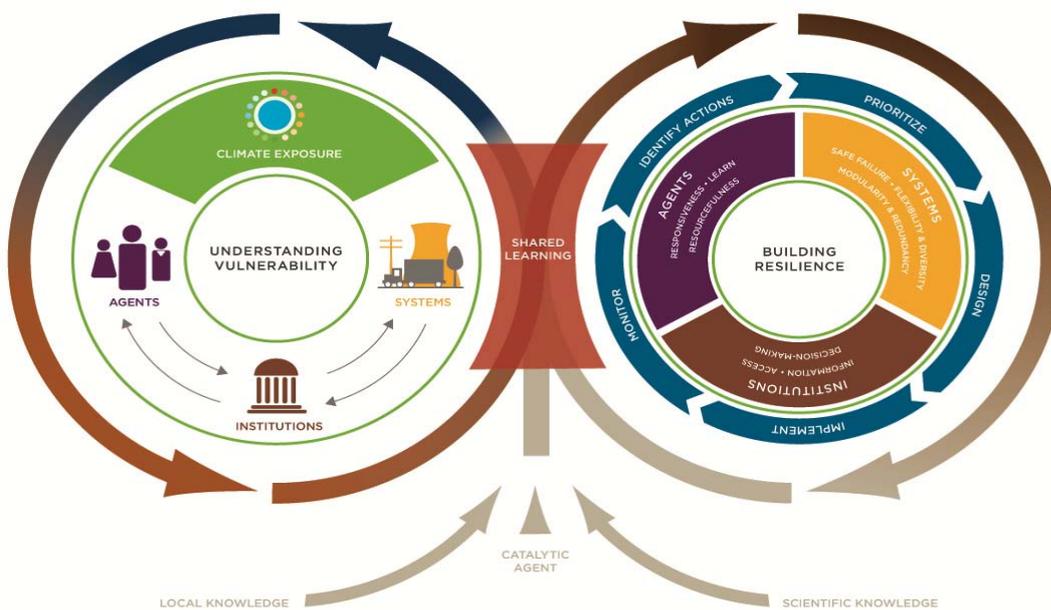
State level sharing workshop

The State Disaster Management Authority (SDMA) is the apex body that regulates and guides the DDMA. The process of preparation of Disaster Management Plan in Gorakhpur district was shared at the state level workshop which was attended by the Honorable Minister of Revenue and Relief Commissioner of Uttar Pradesh in Lucknow. Senior officials from 24 flood prone districts of UP participated in the workshop. The prime objective of sharing this process was not only to educate the district level officials but also to get the process approved at the state level so that it can be implemented through SDMA in other districts as well. As a result, SDMA issued a letter to districts to follow the process undertaken in Gorakhpur in DDMP preparation (Annexure-3).

Second round dialogues with departments

The second round of interaction was organized with all the departments to facilitate planning and documentation of DDMP. Almost 15 dialogues were organised with the departments during April to May 2013 under the guidance of the District Magistrate. In the course of these dialogues, emphasis was laid on climate resilience concepts and the

officials were oriented on Climate Resilience Framework⁵ (figure below) which is developed by ISET International. The framework is a conceptual planning approach to building resilience to climate change. It helped in building a broad understanding of urban resilience by describing the characteristics of urban systems, the agents (people and organisations) that depend on and manage those systems, institutions (laws, policies and cultural norms) that link systems and agents, and patterns of exposure to climate change. As a result of these dialogues, various points related to climate change were integrated in department level plans. Further, these plans were integrated in district plan document.



Training of Young Researchers

Training programme was organized for young researchers and scholars from reputed institutions (Gorakhpur and Ambedkar university) which was aimed at building their capacity on promoting integration of DRR and CCA into developmental planning. The workshop resulted in:

- Building of a common understanding in context of current development scenario
- First-hand experience on understanding of community level assessment of vulnerabilities, sectoral gaps and scope of integration of CCA and DRR
- Creation of a cadre of trained young researchers on CCA & DRR issues

⁵ ISET-International is using this framework with cities across Asia to build local capacity for climate change resilience with funding from The Rockefeller Foundation, USAID and The American Red Cross, and the Climate Development Knowledge Network. The Climate Resilience Framework emerged from the initiation of resilience building activities in the Asian Cities Climate Change Resilience Network (ACCCRN) and the need to put activities into a conceptual context for dissemination and replication. The CRF is informed by years of work in Asia and elsewhere by multiple actors and was refined through the M-BRACE program with support from USAID, and co-funded by The Rockefeller Foundation through the ACCCRN program. The CRF has proven helpful for cities working with numerous multi-stakeholder, cross-sector issues that arise when trying to address issues of climate change, uncertainty, and planning. Ten cities in Asia have produced resilience plans from which over 35 proposals have been written and over 20 of which have been funded. As such the CRF proves itself practical in holistically addressing issues of local need while offering an avenue to reach clear, specific actions.

The training programme was a success in the district and was well received by young researchers.

Dissemination of project achievements

National Level

The project findings was shared at national level conference entitled 'Risk to resilience which was held at NIDM with focus on Mainstreaming climate change and disaster risk reduction in developmental planning . The inaugural function was presided by Hon'ble member of national disaster management authority. In this seminar, member participated stressed on the need of integrating climate change adaptation and disaster risk reduction in developmental process – especially with focus on livelihood and food security. In the conference special policy session was organised to feed in the outcomes of the technical sessions along with the lessons and experiences of the Gorakhpur project (supported by the CDKN) on developing climate sensitive DDMP and its process of improving departmental plans. At the end of the conference a draft version of Delhi declaration (R to R, 2014) as resolution of the conference was passed .

International level

The process of participatory making of climate sensitive district Disaster Management Plan and the vulnerability of Gorakhpur, was shared through poster presentation at International conference ' Resilient cities', 2014, the 5th global forum on urban resilience and adaptation, held at Bonn, Germany. Beside it, the CDKN released its Inside story on climate compatible development- A case of Gorakhpur depicting the integration of CCA and DRR concern into the disaster management planning.

Major Outcomes

The project has demonstrated achievements at various levels, may be as given below:

- Development of District Disaster Management Plan with inclusion of component of climate risks and adaptation strategies.
- Countered horizontal gaps by engaging departments in developing plans on DRR & CCA.
- Understanding of process and gaps at Department level and corrective actions taken in planning process and content of DDMP which will possibly contribute to state and national level planning framework in context of DRR & CCA.
- Understanding the use of Communication, Coordination and Convergence at organizational level, right from the planning to implementation level.
- Recognition of importance of DDMP preparation and need of considering CCA issues in the process at district as well as state level by officials and ministers.
- As it was the unique process of integration of CCA and DRR at ground level, the whole process was documented and shared at state, national and international level

Implementation of DDMP and related outcomes

As mentioned before, the preparation of DDMP involved revision of departmental plans and inclusion of the same in the DDMP. Since the whole process of preparation of DDMP was done in a participatory way, the departments were well aware of its implementation in their respective areas. Therefore, each department took proactive steps and equipped themselves in a better way to deal with the flood situation in 2013-14. Following are a few case examples where the plan was implemented and the related outcomes that were achieved:

- **Municipal Corporation:** The Nagar Nigam (Municipal Corporation) of Gorakhpur had prepared the disaster risk reduction plan of their department. Based on this plan, the Municipal Corporation collected the resources repaired and modified it and prepared a plan on how these resources can be utilized during times of floods. These pre-flood preparations helped in speedy draining out of the waterlogged areas in Gorakhpur.
- **Health department:** The Health department of Gorakhpur had also revised their disaster risk reduction plan which was included in the DDMP. The revised plan included the activities that need to be done before the disaster occurs, during the course of disaster and after the disaster. The officials of the health department admitted that the division of the plan in these three stages helped them sufficiently in responding to the floods. The department completed the investigation of all the public health centers (PHC) and other health centers to ensure that there were sufficient mechanisms to deal with the floods or waterlogging situations. Due to these preparations, there were no waterlogging situations in the PHCs. Also, all the PHCs, CHCs and district headquarters had sufficient storage of medicines which were made available during floods which did not allow spread of diseases.
- **Education department:** The Gorakhpur Basic Education department had also revised their disaster management plan which was included in the DDMP for the first time. Schools are adversely affected during times of disaster as the school buildings are used for relief camps and rehabilitation work and the school does not function during that time. Also, many a times the school premises get waterlogged due to which the schools remain closed during the entire period. In order to overcome this, the education department identified high level safe areas as alternate places for running the school during times of flood. During the 2013-14 flood events, at few places, the schools ran smoothly even though the problem of water logging continued.
- **Animal Husbandry department:** Like the other departments, the animal husbandry department also had divided their disaster management plan into three parts, namely, planning for pre-disaster, during disaster and post disaster. Immunization camps were conducted before the occurrence of floods and all the animals were immunized. This yielded very positive results as the animals did not suffer from diseases and there was also no incidence of spread of chronic diseases among them.

- Dissemination of DDMP: Dissemination of the Gorakhpur DDMP was done by the DDMA by ways of presentations in various workshops and meetings. The State Disaster Management Authority (SDMA), Government of UP has adopted the Gorakhpur DDMP as a model and has circulated it in all the districts of UP with an order to prepare their respective disaster management plans based on the one that has been prepared by Gorakhpur DDMA.

Challenges and strategies adopted to programme implementation

The key enabling factors have been highlighted in the earlier sections that led to the programme achieving more than planned. But the programme faced some challenges too while working at the district level that were also addressed:

1. Lack of comprehensive understanding of vulnerability and its contributing factors. Further no clear and systematic plan exists in departments to collect and synthesise data/ info on vulnerability.

Strategy : The programme worked with various departments (including the lowest officers from village levels) directly through the iterative SLD consultations, facilitating joint understanding of vulnerability issues from the CRF lens, and analysed departmental and inter-departmental issues related to vulnerability. Further, the DDMP/ plans of various departments have been revised to incorporate collecting data on impacts, damages and losses (including reasons thereof) to department's systems (physical infrastructure) in all future flooding and waterlogging in the district.

2. Lack of understanding of departmental staff especially on implications of climate change to their departmental plans and programmes.

Strategy: The programme developed this understanding through the structured iterative SLD process with them. In contrast to stakeholder consultations conducted in piecemeal fashion, the SLD process takes the stakeholders through a process of step-by-step developing understanding of comprehensive vulnerability issues and identification of specific resilience building actions.

3. Lack of effective horizontal coordination among departments.

Strategy: As part of the SLD process, the programme worked with the DDMA and subsequently its members (various departments) individually to develop joint understanding of inter-departmental issues that influence vulnerability.

4. Lack of availability of climate projections, downscaled and interpreted in a meaningful way.

Strategy: The programme overcame this by generating the needed knowledge by using appropriate analysis techniques by ISET (e.g. conducting extreme event analysis using downscaled climate projections).

5. Damages due to floods are assessed just from the viewpoint of assessing compensation needs. No detail analysis is undertaken to understand root causes of vulnerability.

Strategy: The programme used the CRF framework.

Implications of experience for decision-makers and practitioners elsewhere

Climate change is no longer a distant concern even for entities at district level such as government departments and DDMA. There are four key needs to be addressed specifically in the sub-national/ district level context: a) one single department/ authority needs to have a clear mandate to work on climate change manifestations at the local level—one such effective entity that the programme found is the DDMA (Gorakhpur); b) there is need to bring the scientific and complex knowledge of climate change to district level in a way that unpacks the complexity and is translated into a form that aids understanding of implications of climate change for departmental plans and programmes. This can be achieved by conducting relevant additional analysis (such as extreme event analysis for floods) on the data from available GCMs and RCMs; c) there is lack of framework to analyse vulnerability in a comprehensive way that is due to both, departmental and inter-departmental actions (and/or non-actions) at the district level, and the CRF is an effective tool to analyse this; and, d) there is lack of understanding on “how to respond” to Climate Change at district level and hence, there is need for imparting training through developing and delivering training modules.

Conclusion

This research initiative was unique in the way that for the first time in the country, capacity building of government officials from various departments was done on the concepts of CCA and DRR and how to integrate these aspects into developmental planning. Departmental level disaster management plans were prepared which were integrated into the District Disaster Management Plan. Through this process of research, it was concluded that if the capacities of the government officials are built appropriately, they are receptive to new concepts and ideas which can help to bring positive change in overall development. The DDMP has been well recognized by the state and national governments where the state has disseminated the document in all other districts of UP and encouraged them to follow the Gorakhpur DDMP for integration of CCA and DRR into developmental planning. This is obviously not the end but just the beginning. Learning of this research has to go beyond local level. The process of formulating DDMP through an exhaustive consultative process as this one, needs to be upscaled and disseminated at state and national level with policy makers and other relevant stakeholders.

Future Directions

- **Assessment of disasters:** Keeping in view the climatic changes occurring in this region, it is very important to do a detailed assessment of all the departments at various levels and then prepare the disaster management plan. While preparing the DDMP, it is important to analyze and evaluate how a weather event took the shape

of a disaster. This analysis can help in gaining an understanding on the shortcomings of the previous plan, preventive measures that can be taken to overcome these shortcomings, physical and human resources required for the preparation of the new disaster management plan.

Before the disaster occurs, an inventory of resources and information should be documented and kept ready at hand so that it can be readily used to respond to disasters. These resources should be mapped on the district map so that it is easy to understand which resources are available at which places. During the time of disaster, it will be helpful to document the relief work which happens so that it will help in developing future strategy. This documentation will further help in understanding the weaknesses or the limitations of the department and the alternate solutions can be arrived at accordingly. Assessment of damages occurred after the disaster is also equally important and should be done immediately. Usually, this assessment is done after one or two months after the disaster due to which the disaster affected people or communities are not able to get the support that they should. Post disaster assessment should include the analysis of the reasons due to which the assets or infrastructure is damaged – whether it is due to heavy rainfall, rise in the river level, due to waterlogging, lack of adequate culverts or because of the carelessness of people.

- **Documentation:** Keeping in view the frequent changes taking place in the climate and the increasing number of disaster occurrences, it is very important that the DDMA maintains a regular documentation of the physical and human damages being caused by natural disasters such as cyclone, flood, excess rainfall, high temperatures, etc. This kind of a regular documentation will help the DDMA in formulating an effective DDMP.
- **Departmental convergence:** Every department at the district level has an important role to play in the disaster mitigation strategies of the district. The disaster can be mitigated only if the department has the capacity in terms of human resources and other physical resources available with them. The development works get affected due to climatic changes like untimely rainfall, high temperatures, etc. In order to ensure the quality of the developmental work and that that it completes in time, it is important that the departments talk among themselves and support each other's tasks so that they are well informed and can take immediate actions at times of disaster.
- **Capacity building of district officials:** It is important to build capacities of officials from various departments on climate change and disaster risk reduction. As of now, the officials have very limited understanding of these issues due to which they are unable to deal with disaster situations. Usually, the trend has been that the disaster management plans are made on the basis of previous experiences of disaster. But, it is equally essential to keep the future projections and predictions of disaster in mind before formulating the disaster management plan. Therefore, the concerned officials should be trained on these aspects.

- **Formation of a technical committee:** At the district level, there should be a technical committee which can analyse the impacts of climate change and suggest ways of disaster risk reduction. The technical committee should include representatives of various departments, educational institutions, scientists, NGOs, etc. The technical committee should play a crucial role in the formulation of the DDMP.

References

- O'Brien, G., O'Keefe, P., Rose, J. and Wisner, B. (2006). Climate Change and Disaster Management. *Disasters* 30(1): 64-80
- Shaw, R., Pulhin, J. M. and Pereira, J. J. (2010). Chapter I Climate change adaptation and disaster risk reduction: overview of issues and challenges. *Community, Environment and Disaster Risk Management* 4: 1-19.
- Sperling, F. and Szekely, F. (2005). Disaster Risk Management in a Changing Climate. Discussion Paper prepared for the World Conference on Disaster Reduction on behalf of the Vulnerability and Adaptation Resource Group (VARG).
- Kelman, I. and Gaillard, J. C. (2010). Chapter 2 Embedding Climate Change Adaptation within Disaster Risk Reduction. *Community, Environment and Disaster Risk Management* 4(Chapter II): 23-46.
- UNISDR (2013). Implementation of the Hyogo Framework for Action. Summary of Reports 2007-2013. Geneva
- IPCC (2012). Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change. Field, C. B., Barros, V., Stocker, T.F., Qin, D., Dokken, D.J., Ebi, K.L., Mastrandrea, M.D., Mach, K.J., Plattner, G-K., Allen, S.K., Tignor, M. and Midgley, P.M. New York: 582.
- Rana, N.K. (2005), Role of stream dynamics and hydrological modeling in flood mitigation: A case study of rapti river basin, U.P, Unpublished Ph.D thesis, Department of geography, DDU Gorakhpur University, Gorakhpur
- Opitz-Stapleton, S. And Hawley K (2013)., Technical Report – Gorakhpur India: Extreme Rainfall, Climate Change and Flooding. / Policy Brief for the ACCCRN Initiative/ (pp. 6). Boulder, CO: Institute for Social and Environmental Transition.
- van Vuuren, D. P., Edmonds, J., Kainuma, M., Riahi, K., Thomson, A., Hibbard, K., Hurtt, G. C., Kram, T., Krey, V., Lamarque, J., Masui, J., Meinshausen, M. , Nakicenovic, N., Smith, S. J., & Rose, S. K. (2011). The representative concentration pathways: An overview. *Climatic change*, 109: 5–31.
- Yatagai, A., Kamiguchi, K., Arakawa, O., Hamada, A., Yasutomi, N., & Kitoh, A. (2012). APHRODITE: Constructing a Long-term Daily Gridded Precipitation Dataset for Asia based on a Dense Network of Rain Gauges. *Bull. Amer. Meteor. Soc.*, 93, 1401–1415. doi:10.1175/ BAMS-D-11-00122.1.

Annexure 1**Rural Development/ Dist. Administration****Identified gaps**

- Lack of adequate human resources
- Lack of information on fund disbursement to the beneficiaries under the disaster relief fund
- Non utilization of funds due to lack of information on disaster management relief fund

Recommendations given

- Development programs should be designed keeping in mind the local disaster threats and disaster reduction should be an integral part of the development programs
- Coordination between governmental planning and development projects should be established
- MGNREGA scheme should be utilized for cleaning of rivers and removal of silt. Several other developmental works can be done through MNREGA funds in peace time.

Health department**Identified gaps**

- Connecting road to PHCs/CHCs gets damaged during rainy season
- Long duration power cuts creates problems in attending the patients in the PHCs/CHCs
- Women employees feel unsafe working in the late evening hours in the centers because there is no adequate arrangement of lights on the roads
- Caution before floods are not given due to which adequate preparations are not made
- Most of the health centres get water logged due to heavy rain.

Recommendations given

- In the construction of PHCs/CHCs, it is important to include flood resistant techniques along with earthquake resistant techniques.
- Training on Do's and Don't's at times of disaster should be organized for the members of Village Health and Sanitation Committee

Education department**Identified gaps**

- School premise is often used for shelter and relief centers during flood disaster.
- Lack of knowledge in students regarding basic disaster preparedness and safety.
- Many of the schools are not located at elevated land

Recommendations given

- In the construction of schools, it is important to include flood resistant techniques along with earthquake resistant techniques
- Site selection for construction of schools should be done at a safe and elevated place
- Information and awareness on use and management of fire extinguishers installed in the schools should be given not only to the teachers but also to accountants and employees of other departments
- In the school campus, the Mark-II hand pumps should have proper water outlet arrangements
- Mock programs in the schools should be organized on relief and management of disasters
- The schools should not be used as disaster relief camps or for storage of food grains. This adversely affects education.

Agriculture / Agriculture Protection Department

Identified gaps

- Crops get affected due to untimely rains, extreme cold and hot temperatures.
- The situation of agriculture go-downs at the block level are not good due to which flood water enters the go-downs and causes damage to the chemicals stored there.
- Water logging in the crop fields causes problems in controlling pests, insects and diseases. Also, application of pesticides in water logged areas cause water pollution.
- Problems in storage of crops.
- Soil structure gets affected and amount of silt increases
- Floods negatively affect crop cycles

Recommendations given

- Works related to land leveling and construction of farm bunds for the conservation of soil can be done under the MGNREGA program.
- Promotion of vermin compost and Nadep compost structures under MGNREGA program.
- Effective coordination should be established between soil conservation department, agriculture department and agriculture protection department.
- There is a need to bring about awareness among farmers from the flood affected areas to use flood resilient varieties of crops.

Animal husbandry

Identified gaps

- Infertility problem in animals due to extreme temperatures
- Non-availability of fodder because of water logging
- Shelter problem for animals during rains and water logging
- Water logging leads to diseases
- Animals suffer because of unavailability of medicines at veterinary hospitals

Recommendations given

- Pre-flood vaccination of animals
- Shelter and fodder for animals should be the part of relief package
- Ensure availability of medicines at village level

Jal Nigam

Identified gaps

- Most of India Mark-II pumps are not functional during disaster
- Funds for installing hand pumps at elevated lands are not sufficient enough
- The plan for establishing sewerage system for the city of Gorakhpur is ready but due to non-allocation of funds, the work has not yet started
- For every scheme, there should be adequate number of regular staff to carry out the tasks

Recommendations given

- The India Mark-II hand pumps should be installed at a high elevated and safe place. -This can be done with the support of Panchayats.
- While construction of buildings, problem of flood should be kept in mind
- Renovation of water sources to enable access to water for everybody in the village and ward.
- The Panchayat (Local body) should get the defunct hand pumps repaired in time.
- For the implementation of schemes, the funds should be made available before the actual work on the ground starts.
- System of quick communication, decision and implementation should be established in order to manage disasters effectively.

Panchayat Raj department

Identified gaps

- Lack of resources for repairing of destroyed public properties
- Lack of active involvement in planning and implementation process
- Capacity building of Pradhans and other members are not done at local level.
- Lack of infrastructures and other facilities

Recommendations given

- Assessment of flood and other disasters in local areas should be done according to which provision for funds should be made for the maintenance of Panchayat bhawan and other public buildings.
- Awareness should be brought about among villagers to keep their village surroundings clean and usage of individual, school, Anganwadi and community toilets should be promoted.
- Awareness campaigns can be done by using motivation groups, nukkad natak, media, etc. Amount of materials should be also increased.
- For the repair of India Mark hand pumps for drinking water, funds under Panchayat Raj, 13th Finance Commission should be increased.
- Assessment of damage caused to public properties should be done and accordingly the demand for renovation/repair of these properties should be made. This should be implemented at the Gram Panchayat level for which adequate funds should be allocated.

Flood Division and Drainage Division

Identified gaps

- Less number of work supervisors in the departments
- The embankments get cracked in summer season due to high temperatures. Situation becomes even worse if this is immediately followed by heavy rains.
- Pressure on the embankments increase when all of a sudden, water increases in the rivers which are on the way to Nepal
- Lack of support and cooperation from Tehsil and local government

Recommendations given

- As per the SDRF guidelines, the embankments should be re-established within 45 days. It becomes very difficult to get the work completed within this deadline.
- It is important to activate the flood protection committees

Saryu Canal Division

Identified gaps

- Heavy rains rupture the branch-lets of canals which hampers irrigation facilities
- Depletion in the groundwater levels due to which the discharge from tube wells is decreased
- Low electricity voltage because of which the tube wells get defunct
- In the Kharif season, the pipelines are destroyed at some places by the farmers

Recommendations given

- Construction and re-establishment related works are done during a fixed time. Considering the geographical and environmental situation of an area, it is important to place bans and restrictions on cultivation of water-intensive crops such as peppermint, etc.
- Diversity in cropping systems should be strictly implemented
- The structural designs of various infrastructures which are related to canals are done as per the orders of respective departments. These infrastructures should also be made earthquake proof and flood resistant.
- As a mechanism to adapt to drought and flood situations, various rivers should be joined so that they prevent floods and help in increasing the groundwater table levels

It is important to have convergence between various departments and Panchayats in order to prevent encroachment

Annexure 2**DDMP related Government Orders (Issued by District Disaster Management Authority, Gorakhpur)**

वर्ष 2013-14 की आपदा प्रबंधन एवं न्यूनीकरण योजना निर्माण में निम्नांकित शासनादेशों/दिशा-निर्देशों/सुझावों को दृष्टिगत रखते हुए पूर्ण की गयी है

क्र०	शासनादेश संख्या	दिनांक	विषय
1	संख्या-564 / 1-11-2010-22(जी) / 2010	05 अगस्त, 2010	प्रदेश की नदियों में नाव से हो रही दुर्घटना की रोकथाम करने एवं समुचित संचालन कराये जाने के संबंध में।
2	संख्या-509 / नौ.-7-11-27ज / 04	25 अप्रैल, 2011	आगामी ग्रीष्म एवं वर्षा ऋतु को देखते हुए प्रदेश की नगर निकायों द्वारा नागरिक सुविधायें उपलब्ध कराये जाने के संबंध में
3	संख्या-एम-105 / 11-27-सिं.-2-98 बाढ़ / 11	10 जून, 2011	नदियों के बहाव क्षेत्र से अतिक्रमण हटाये जाने के सम्बन्ध में।
4	सं.-2191 / नौ-7-12-27ज. / 04	09 जुलाई, 2012	सम्भावित सूखे की स्थिति से उत्पन्न पेयजल समस्या के समाधान एवं सफाई व्यवस्था के सम्बन्ध में कार्यवाही।
5	संख्या-198 / 1-11-2012-22(जी) / 09	13 मार्च, 2013	वर्ष 2013 में बाढ़/अतिवृष्टि प्रबंध योजना का क्रियान्वयन तथा बाढ़ से प्रभावित व्यक्तियों को तत्काल राहत प्रदान किये जाने के सम्बन्ध में।
6	संख्या-199 / 1-11-2013-रा०-11	13 मार्च 2013	आपदा प्रबंध व जोखिम न्यूनीकरण तत्वों को समस्त विभागों के योजनाओं/कार्यों में सम्मिलित किये जाने के सम्बन्ध में।
7	संख्या-219 / 1-11-2013-18(जी) / 06	04 अप्रैल, 2013	वर्ष 2013 में सूखा हेतु कार्य योजना बनाये जाने के सम्बन्ध में।
8	कार्यवृत्ति	15 जून, 2013	वर्ष 2013 में बाढ़ की तैयारी के बिन्दु पर मुख्य सचिव महोदय की अध्यक्षता में दि० 15.06.2013 को अपरान्ह 06:30 बजे तक आयोजित बैठक की कार्यवृत्ति।
9	मा० राजस्व मंत्री, उ०प्र० शासन की अध्यक्षता में आयोजित समीक्षा बैठक	19 जून, 2013	श्री अम्बिका चौधरी, मा० मंत्री राजस्व, अभाव, सहायता एवं पुर्नवास तथा लोक सेवा प्रबंधन विभाग, उ०प्र० शासन की

Annexure 3**State Government Order regarding mainstreaming DRR in Plans/Activities of all Departments (screenshot)**

संख्या-199/1-11-2013-रा0-11

प्रेषक,

जावेद उस्मानी,
मुख्य सचिव, उ०प्र० शासन/
मुख्य कार्यपालक अधिकारी,
उ०प्र० राज्य आपदा प्रबंध प्राधिकरण।

सेवा में,

1. समस्त प्रमुख सचिव/सचिव,
उ०प्र० शासन।
2. समस्त मण्डलायुक्त
उत्तर प्रदेश।
3. समस्त जिलाधिकारी,
उत्तर प्रदेश।

राजस्व अनुभाग - 11

दिनांक: 13 मार्च, 2013

विषय:- आपदा प्रबंधन व जोखिम न्यूनीकरण तत्वों को समस्त विभागों के योजनाओं/कार्यों में सम्मिलित किये जाने के संबंध में।

महोदय,

उपर्युक्त विषय पर मुझे यह कहने का निदेश हुआ है कि राष्ट्रीय आपदा प्रबंध अधिनियम, 2005 के धारा 39 में किये गये प्राविधानों के अनुसार, राज्य सरकार के विभिन्न विभागों को अपने विभागीय योजनाओं एवं कार्यों में आपदा जोखिम न्यूनीकरण के तत्वों का समावेश किया जाना आवश्यक है। इस अधिनियम की धारा 39 के प्राविधान निम्नवत हैं:-

"39. It shall be the responsibility of every department of the Government of a State to—

(a) take measures necessary for prevention of disasters, mitigation, preparedness and capacity-building in accordance with the guidelines laid down by the National Authority and the State Authority;

(b) integrate into its development plans and projects, the measures for prevention of disaster and mitigation;

(c) allocate funds for prevention of disaster, mitigation, capacity-building and preparedness;

(d) respond effectively and promptly to any threatening disaster situation or disaster in accordance with the State Plan, and in accordance with the guidelines or directions of the National Executive Committee and the State Executive Committee;

(e) review the enactments administered by it, its policies, rules and regulations with a view to incorporate therein the provisions necessary for prevention of disasters, mitigation or preparedness;

(f) provide assistance, as required, by the National Executive Committee, the State Executive Committee and District Authorities, for—

(i) drawing up mitigation, preparedness and response plans, capacity building, data collection and identification and training of personnel in relation to disaster management;

(ii) assessing the damage from any disaster;

List of additional materials developed under the project

1. Climate sensitive District Disaster Management Plan , 2013-14
2. Sectoral workshop Report
3. State level workshop report
4. National level conference report
5. Delhi Declaration on Risk to resilience
6. Mainstreaming climate change adaptation and disaster risk reduction in development planning , Gorakhpur : A Process document , published by GEAG
7. Training Report of young Researcher on Disaster risk reduction and climate change adaption
8. Training Manual : Mainstreaming Climate change adaptation and disaster risk reduction into district level development plan , published in collaboration of National institute of disaster management , NIDM , ISET and GEAG
9. Technical report on extreme Rainfall, climate change and Flooding of Gorakhpur
10. Policy brief on extreme Rainfall, climate change and flooding of Gorakhpur
11. Inside story on climate compatible development entitled Integrating climate change concern into disaster management planning : Case of Gorakhpur , India, published by CDKN and released in Resilient cities conference at Bonn, 2014