Recommendations

The second-round of SLDs in each of the project states aided in identifying key areas for mainstreaming DRR-CCA in Development Planning. Similar to the first-round it was iterative in nature to foster shared-learning horizontally across departments at the district level and vertically between the district and state level departments. The findings contributed to revising the District Disaster Management Plans (DDMPs) of the three districts and making recommendations to State Level Departments including the State Disaster Management Authority (SDMA, Odisha; Disaster Management and Mitigation Centre-DMMC, Uttarakhand; and, SDMA, Uttar Pradesh). While department-specific recommendations are detailed in the revised DDMPs of respective districts, we present below the gist of diverse nature of recommendations across key thematic areas found common across the states:

- The Climate Resilience Framework and Shared Learning Dialogues are useful tools for mainstreaming DRR-CCA in Development.
- DDMP of one district in each of three states has been revised. These could be considered as models for replication in other districts in the states. Towards this, Uttar Pradesh has already passed the needed Government Order while State DMMC, Uttarakhand has declared the revised DDMP of Almora as a model DDMP for replication in other districts.
- Technical norms for designing infrastructure in all sectors need to be revised to the standards needed for resilient designs. Equally important is the need for passing needed Guidelines/ Circulars/ Government Orders to promote resilient designs.
- Necessary and dedicated financing channels need to be established for mitigation and capacity building especially by creating pool of funds from various programmes and plans within each government department at the state level. There is a provision of using 10 percent as flexi fund under all the Centrally Supported Schemes (CSS) but such a fund has not been created. Interestingly, OSDMA expressed interest into passing the needed resolution in the consultation held on 24th October 2016.
- All infrastructure projects need to be screened for potential impacts on environment and vulnerabilities. Specific tools need to be developed for granting financial approvals for such screening.
- Higher allocation of funds for investment in new infrastructure across various administrative divisions (districts/ blocks/ villages/ urban areas) is needed in higher disaster-prone areas.
- Coordination sub-committees should be constituted for activities of each department under the aegis of
- DDMA to facilitate coordination amongst relevant departments for planning, implementation and monitoring of infrastructure development.
- There is a need for enhanced investments for diversifying livelihoods in disaster prone areas in sectors that are less vulnerable to disasters viz. manufacturing and services.
- Women, children and the aged, generally become more vulnerable especially due to migration of men from disaster prone areas for employment. Thus, concerns of these groups need to be integrated and articulated well in policies, plans and programmes on development and disaster management.
- Investments need to increase in developing capacities of field level staff of departments in Disaster Management.
- Vacant posts, especially at field level, need to be filled with permanent staff in all departments. This will bridge the lack of capacity for field level assessment of loss, reconstruction and monitoring effectively.
- Maintenance and periodic repairs need to be taken up timely. There is need for increasing such budget of various departments.

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Unpacking Mainstreaming DRR-CCA in the sub-national level Development Planning :

Insights from three states in India

Shashikant Chopde[1], Dilip Singh[2], Anil K Gupta[3], Amit Kumar[4] and Shiraz A. Wajih[5]

Abstract

The District Disaster Management Plans of one district each in three states in India have been revised to demonstrate mainstreaming DRR and CCA in Development Planning at the sub-national levels. Mainstreaming DRR and CCA in Development Plans at the district level will need to consider policy, technical, capacity and financial support requirements from higher-level government departments at the state and national levels. This paper flags key areas of such a support. While it is important to understand factors for direct impacts of disasters, it is equally important to consider the associated invisible drivers of vulnerability, referred to as Indirect Vulnerabilities, while undertaking developmental planning for the spatial and sectoral allocation of resources for mainstreaming. Capacity development, coherent and coordinated department-specific actions based on integrated thinking of resilient development at the district level are central to the process of mainstreaming.

Introduction

There is a greater recognition internationally that the frequencies and intensities of losses due to climate-related disasters are on the rise and likely to further increase due to climate change (IPCC 2012; World Bank 2013). During 1980-2012 weather-related disasters alone accounted for 87 percent (18,200) and 74 percent (US$ 2.6 trillion) of the total number of disasters and losses globally, respectively (Munich Re 2013a,b in World Bank 2013).

Figure 1 : Total number of disasters and losses during 1980-2012

Source : World Bank 2013

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In recognition of this increasing risk, Government of India has made concerted efforts for Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA). The recent National Disaster Management Plan (2016) emphasizes integration of Disaster Risk Reduction (DRR) into development. It specifically defines roles of various central and state agencies, promotes cooperation of the centre and state governments, and coordination among various ministries and departments. This succeeds the Disaster Management Act (2005) and National Policy on Disaster Management (2009) that evidences paradigm shift from reactive and relief-centric to a proactive disaster risk reduction approach covering various aspects of disaster management spectrum. Another significant development in this direction is adoption of the National Action Plan on Climate Change (NAPCC) in 2008 and the recent Paris Agreement at CoP21 in December 2015. While there is greater integration and capacities at the national level, the subnational bodies at the state, the district and local levels often lack the needed capacities for integrating DRR in Development. Further, the underlying factors exacerbating vulnerabilities such as environment, poverty, gender and equity are often not considered in the District Disaster Management Plans (DDMPs).

This paper presents experiences from a project undertaken by Gorakhpur Environmental Action Group (GEAG) and Institute for Social and Environmental Transition-International (ISET-I) in technical collaboration with National Institute of Disaster Management (NIDM) on integrating DRR and Climate Change Adaptation (CCA) in sub-national level Development Planning. The project was implemented in two phases and focused on one district in each of the three project states; Phase-I in Gorakhpur (Uttar Pradesh), and Phase-II in Almora (Uttarakhand) and Puri (Odisha).

Recent work on climate resilience lays emphasis on addressing climate and disaster- risks in urban centres given their significant and increasing contribution to GDP, as also the unprecedented pace of urbanization in India. However, we need to consider the urban-rural landscapes as a continuum, as there are inherent interdependencies between urban and rural areas, especially regarding the (two-way) flow of goods and services across the urban borders. Hence, this aspect is important to consider as it shapes vulnerability of both, rural and urban areas. Given this, one large urban center in each of the three project districts was also considered.

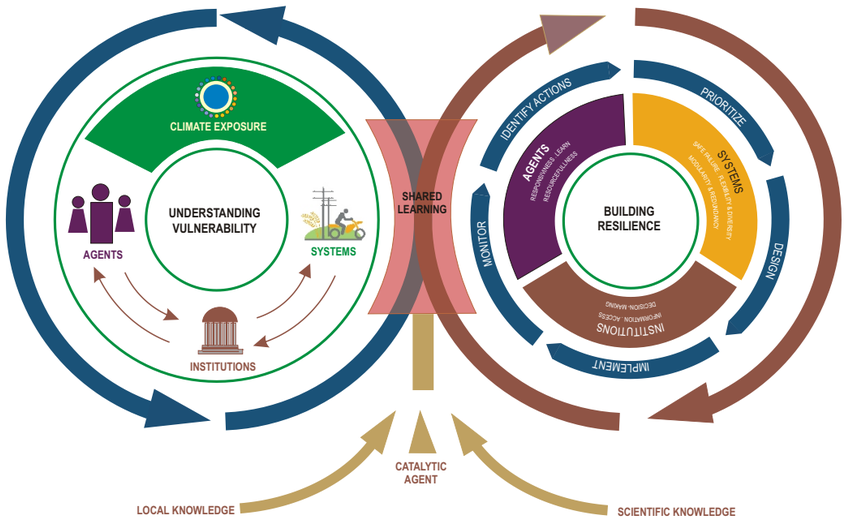
Finally, the paper demonstrates the integration through application of Climate Resilience Framework (Tyler and Moench, 2012) and the Shared Learning Process in each state. We discuss the overall approach and salient features of mainstreaming DRR-CAA in Development Plans at district level and implications for the State and National level development planning.

Overall approach

The approach in each state comprised of the application of Climate Resilience Framework (CRF) as a guidance tool through a process of Shared Learning Dialogues (SLDs) for understanding various components of vulnerability (the left-hand loop) and identifying actions for building resilience (right-hand loop). Vulnerability is characterized by interactions between climate exposure, systems (physical and natural), institutions and capacity of change agents (community/ government agencies/ civil society/ academia/ private). The resilience building interventions are categorized into characteristics of :

- Systems (flexibility, redundancy and safe failure): The characteristics of physical infrastructure and ecosystems such as water supply, irrigation, roads, groundwater and surface water natural systems, that allows maintaining the functionality of systems even during disaster events.
- Institutions (decision-making process, codes, financing norms etc): That foster learning and change for adaptive response capacities of formal and informal structures, for example any department's internal procedures and norms for decision-making, designing, financing, implementation and monitoring. These procedures and norms are stipulated and dependent on policies, programmes and plans layed down by higher level intitutionsat meso (state) and macro (national) levels.
- Change agents (responsiveness, resourcefulness and capacity to learn): Capacity to organise and re-organise as needed to identify, anticipate and plan for disaster events. It also relates to their ability to mobilise resources and assets from within their own departments or if needed from other departments through collaboration. The SLDs, an iterative approach, is central to the process of inquiry. It brings together local expertise (on linkages between rainfall patterns and stream flows, infrastructure, natural resources, technical norms etc.) and external expertise (climate change, concepts of resilience, mainstreaming theories and practices, etc.) to understand vulnerabilities and identify resilience actions. The SLDs in all the three locations followed a similar practical approach. Figure 3 illustrates as an example how it was implemented in practical terms in case of Uttaarakhand.

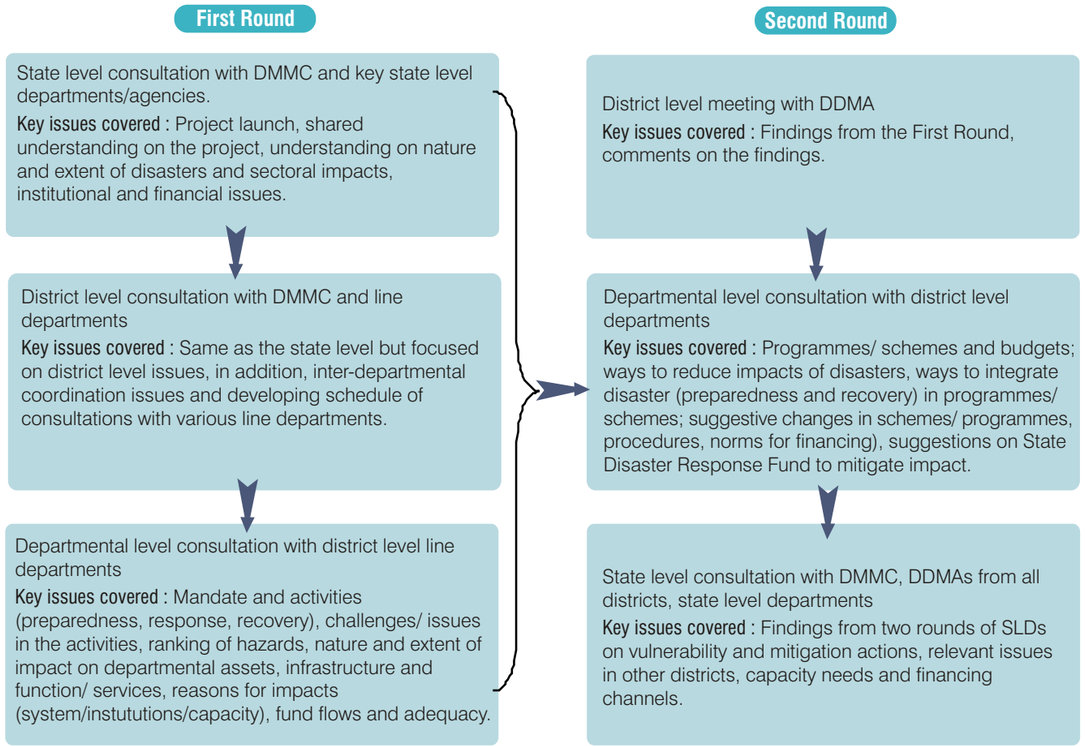
Figure 2 : Climate Resilience Framework



Source : Tyler and Moench, 2012

The SLD process provided qualitative insights into the issues of hazard, vulnerability, impacts, risks and capacities across various departments/ sectors; and aided identifying options for mainstreaming CCA-DRR in Development Plans of various departments. This was combined with quantitative data, as available, on the above aspects to draw a comprehensive picture of hazards, vulnerability, risks and capacities.
The focus of this project was on the conventional Development Planning at the subnational level and hence we focused on understanding the salient features of Development Plans of select key departments and its delivery on the ground; And the resulting impacts on vulnerabilities, risks, impacts, response and recovery.

Figure 3 : SLD process in Uttarakhand



Development and Disaster linkages: Implications for Research Methodology

The District/ State Disaster Management Authority at the District/ State level (DDMAs/ SDMAs) are provided for by the DM Act 2005 as institutions for promoting integrated and holistic response on disaster management at sub-national levels in India. Interestingly, they also serve as platforms for coordination among various departments involved in development and disaster response. Hence, we see DDMAs/ SDMAs as key vehicles to promote mainstreaming DRR-CCA in Development Planning at subnational levels in India. However, we believe that the coordination, capacity and institutional issues of various departments determines the level of effectiveness of the mainstreaming.

The literature on mainstreaming DRR and CCA in Development, highlights specifically the fallouts of conventional development on vulnerabilities and compartmentalized nature of working of agencies on development and disaster management. Also, it flags the importance of considering likely changes in frequencies and intensities of weather-related disasters due to climate change to promote a no-regret options, preparedness and mitigation, holistic assessment of vulnerabilities and need to build-back-better. However, it was quite evident that execution by the agencies/ government departments working at the subnational level, especially on the ground, is driven primarily by parameters such as systems and procedures and organizational capacities, for planning, implementing and monitoring; even as these parameters are defined mostly by higher-level governance structures at the state and national levels. Hence, we focused on the above parameters given that our research focused on development and disaster management at the subnational level.

As mentioned in the foregoing, there is a lack of capacities of agencies/ departments at the subnational levels. The gaps in capacities are more pronounced at the district and lower level agencies/ departments who are actually responsible for execution. Also, it is important to consider the urban-rural continuum. Hence, we specifically investigated systems and procedures that the select departments/ ULBs use to plan, design, implement and monitor various plans and programmes as part of the Conventional Development Plans (DPs); systems and procedures of recording and monitoring disaster impacts in the current Disaster Management (DM) system; system, procedures and financing mechanism for preparedness, response, immediate recovery in current DM system; and long-term recovery and reconstruction as part of DPs and DM systems. To highlight the difference or gap between the current systems and procedures at the district level and what is needed from a comprehensive or ideal development perspective, we flagged the notions of Indirect Vulnerabilities and Direct Impacts. Indirect Vulnerabilities are associated with data not often considered by the DM system in planning, implementing and monitoring required from the comprehensive development perspective. And, Direct Impacts refer to the losses and damages recorded by the DM system. Through this lens, Figure 4 shows key information/ data that was collected as recorded by district level government on rural and urban areas, grouped under the above two notions. It included data recorded by various departments at the district, block/ tehsil for rural areas and by the ULB of and for the largest urban center in each of the three districts. In addition, the Figure 4 illustrates where and how mainstreaming can potentially contribute in the entire interlinked processes of:

- The Conventional Development
- Current but evolving system of Disaster Management (preparedness and mitigation, response and recovery)

We believe that the Indirect Vulnerabilities are compounded by past hazards and (lack of) capacities that are especially driven by department/sector specific institutional and organisational contexts (systems & procedures and capacities). At the same time, the Direct Impacts influence the response capacities of the departments and communities by triggering changes in allocation of budgets and resources and the livelihood base, respectively.

Further, the Indirect Vulnerabilities, Direct Impacts (including reasons thereof) and (inadequate) Capacities make-up for the Overall Vulnerability. When this Overall Vulnerability in the business-as-usual scenario is overlaid on likely future intensities and frequencies of future hazards, we arrive at risk. Potential avenues for mainstreaming CCA-DRR are identified in policies, programmes, plans and landscape of institutions that govern execution by subnational development agencies.

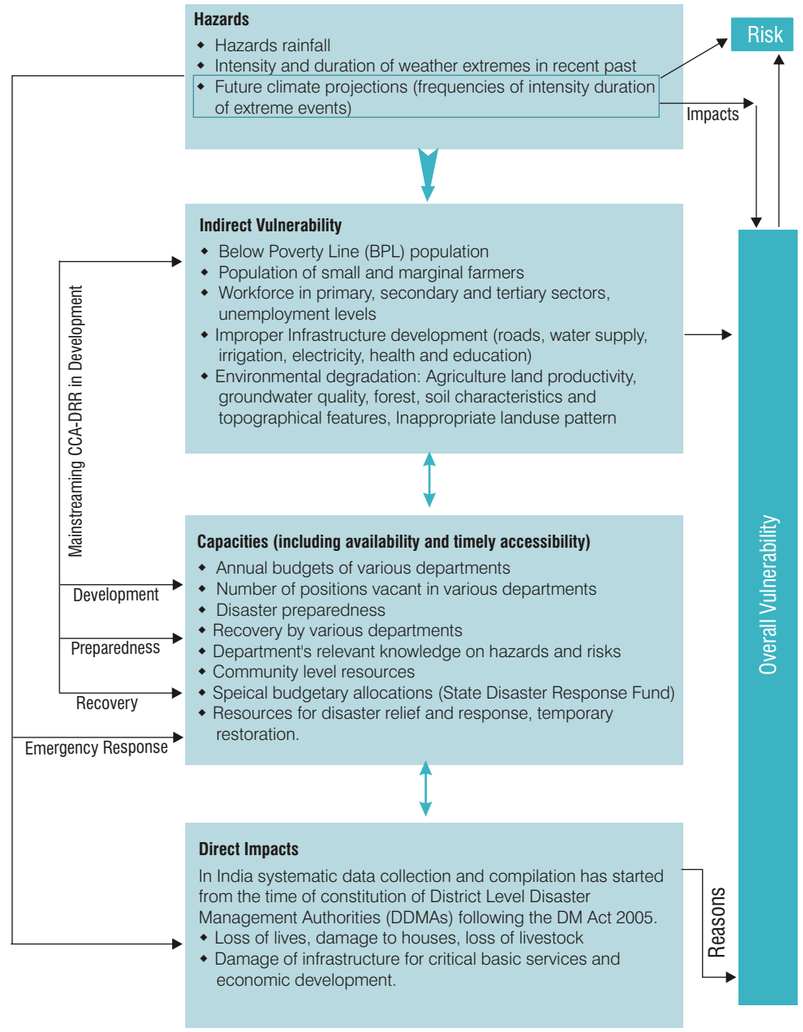
The data/information has been collected and analysed as available, and is listed in various boxes in Figure 4 even at the block/ sub-district administrative level.

Key findings from the three project locations

Context and hazards

The three locations were selected to capture the diversity of weather-related disasters in India. These locations have experienced extreme surplus and deficit rainfall events, intense cyclones, extreme hot and cold days for long durations and hailstorms manifested in flash floods, riverine & deltaic flooding and waterlogging, landslides and droughts impacting all

Figure 4 : Key elements of mainstreaming CCA-DRR in Development Planning



the sectors of the economy. At the national level these disasters affect significant geographical areas. Out of 7500 km of coastline, a huge 5700 km is prone to cyclones and tsunami in India; forty million hectares (12 percent of the land) is prone to floods and river erosion; sixty-eight percent of cultivable area is prone to droughts; and, large tracts of the hilly region is prone to flash floods (NDMP 2016).

Almora (Uttarakhand)

Almora district is centrally located in the multi-hazard prone districts of northern Himalayan State of Uttarakhand, spread over 3139 sq km. The population of Almora is 622506 (Census 2011), of which about 90% is rural, and agriculture is the major occupation of the people in the state. Almora is an important town of the district. The climate of Almora district varies in places depending upon its elevation. In summer, near the river valleys, the temperatures can go as high as 40^{0}C, while the winter temperatures drops to below 0^{0}C at higher altitudes. The average temperature though ranges from 31.2^{0}C in summers to 0.1^{0}C in winters and the average annual rainfall in the district is about 1027 mm.

Hazard profile

Cloudbursts, landslides, flash floods and earthquake are the major hazards in the district. The district has

Type of hazard	Month of occurrence											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Flash floods												
Forest fires												
Cloud bursts												
Cold waves												
Hailstorms												
Landslides												

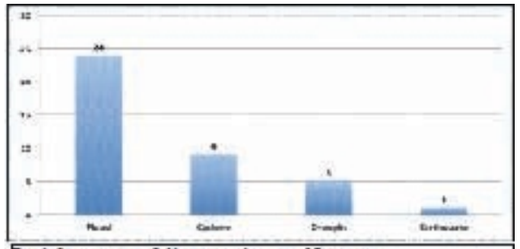
observed some very severe devastation in the year 2010 due to flash floods and landslide caused by cloudbursts. Almora is susceptible to earthquakes and falls under zone IV and V. The district faced a severe flash-flood event in 2010 caused by a cloudburst. Subsequently, heavy rainfall and landslides episodes in 2013 and snowfall in 2014 are some major recent disasters making the district vulnerable to multiple hazards.

Most of the GCMs models project an increase in total rainfall in July, August and September, though very few indicate reduction too. In addition, the winter rainfall is likely to increase.

The maximum and minimum temperatures in summer and winter are likely to increase, as evident from almost all the GCM models.

Puri (Odisha)

Puri is a coastal district in the eastern State of Odisha spread over 3479 sqkm and is a major religious destination for Hindus. The population of Puri district is 16,98,730 (Census 2011). The district comprises of 11 blocks & four Urban Local Bodies (ULBs) including Puri Municipality and agriculture remains the main source of livelihood. Puri district enjoys a tropical climate with an average rainfall of 1424 mm. It experiences hot dry weather (March to early June), hot wet weather (mid June to October), and slight cold dry weather (November to February).



Puri: Instances of disasters in past 60 years

Hazard profile

Multiple natural hazards and new types of vulnerabilities are emerging in the district; floods and cyclones being the most prevalent. Based on the discussions with various departments and local community, the types of hazards and months of their occurrence are shown in the graph.
The total number of cyclones is likely to reduce. However, the high intensity cyclones are observed to rise from pre-warming (before 1950's) to the post-warming era.

Type of hazard	Month of occurrence											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Flood												
Cyclone												
Drought												
Sunstroke												
Fire												

The cumulative two-and three-day extreme rainfall that significantly contributes to flooding/ waterlogging in Mahanadi deltaic areas of Puri district is likely to occur once in two years.

Gorakhpur (Uttar Pradesh)

Gorakhpur district is located in the eastern part of Uttar Pradesh and covers an area of 3484 sqkm. Gorakhpur city itself is an important religious, cultural, commercial, educational and medical center, serving the hinterland of eastern Uttar Pradesh in the Gangetic plains. Gorakhpur is one of the most populated districts of UP with population of 44,36,275 (Census 2011) of which about 80% is rural, and agriculture remains the main source of livelihood. The district comprises 7 tehsils, 19 blocks & 8 ULBs.

The climate of eastern UP varies from semi arid to sub-humid and it experiences all four seasons. The summers are very hot, while the winters are cool and dry. Currently, the summer average maximum temperature soars to as high as 37.5C and winter average minimum is 10.2C. During the later part of summer season and during monsoon, the humidity levels increase significantly. The mean annual rainfall ranges from 80 cm in the south to 140 cm in the northern parts.

Source: Flood Division, Gorakhpur, 2012

Hazard profile

Gorakhpur district is majorly affected by flooding from Rohini, Rapti, Aami, Kuano and Ghaghra rivers, which is almost an annual phenomenon. All the blocks of the district are highly prone to flooding. In addition, dry spells during the monsoon season cause drought like conditions.

Analysis shows increase in intensities of 24 hr rainfall events for all return periods (2, 5, 10, 20 and 50 years) across all GCMs (Stapleton *et al* 2014); and, losses from one in ten years flood is likely to occur once in five years with one in 100 years losses occurring once in 60 years (Kull *et al* 2008). Overall frequencies of high intensity floods are likely to increase.

Key Vulnerabilities, Risks and Capacities

In this section we analyze the data collected and SLD processes with key government departments in all the three locations as illustrated earlier in Figure 4. Firstly, the key observations and findings from the data collected and SLDs are presented in Table 1 (Indirect Vulnerabilities) and Table 2 (Reasons for Direct Impacts) below. In these tables, the vulnerabilities and impacts have been segregated in accordance to the core guiding framework, the Climate Resilience Framework (CRF), across the three project districts. It is noteworthy that the CRF factors of Vulnerability, especially the Institutions and Agents, capture adequately the root causes of Indirect Vulnerabilities and Direct Impacts described earlier.

Table 1 : Indirect Vulnerabilities (CRF factors)

Almora (Flash floods, landslides, water shortages, cold wave, forest fires)	Puri (Floods/cyclones/ drought)	Gorakhpur (flooding/ waterlogging/water scarcity in summers
◆ Almost 50% population below poverty line (BPL) ◆ Significant proportion of Schedule Caste (SC)/ Schedule Tribe (ST) population	◆ Significant proportion of (SC)/ (ST) population	◆ High population density, low literacy rates ◆ 30% population BPL ◆ Significant SC/ST population
◆ 76% farmers are small and marginal ◆ High dependence on agriculture for livelihoods ◆ Less diversified livelihoods ◆ High unemployment levels	◆ High dependence on agriculture for livelihoods ◆ 92% farmers are small and marginal ◆ More than 50% Rabi season cultivated area unirrigated ◆ One third of total workers employed for less than six months in a year ◆ Inadequate trained person-power at field level of agriculture department	◆ High population density, low literacy rates ◆ 30% population BPL ◆ Significant SC/ST population
◆ Some healthcare centres are sited on landslide-prone areas ◆ High turbidity in local streams supplying domestic water supply causes breakdown of pumps and allied equipments ◆ No backup power for rural water supply system so power disruption impacts water supply ◆ Inadequate field staff ◆ Inadequate funds for periodic maintenance and timely repairs of schools including for retrofitting	◆ Some health care infrastructure situated in disaster prone locations ◆ Approach road and the infrastructure do not follow resilient design norms ◆ Inadequate DM trained personnel at field level and boats ◆ Approach road to primary and secondary schools gets inundated ◆ Contamination of drinking water sources	◆ Most healthcare centres are sited on waterlogging prone areas ◆ Approach roads to most Centres get damaged due to flooding/ waterlogging ◆ Power disruptions impede functioning of Centres ◆ Most schools are sited on waterlogging prone areas ◆ High dependency on groundwater for water supply ◆ India Mark II handpumps get submerged ◆ Inadequate funds for elevating pumps
◆ Unsafe cattle keeping locations ◆ Nutritional feed inadequate against required for the cattle during cold wave ◆ Inadequate and trained person-power at field level of Animal Husbandry department	◆ Unsafe cattle keeping locations ◆ Inadequate green fodder storage facilities for supply during flooding ◆ Inadequate and trained person-power at field level of Animal Husbandry department	◆ Unsafe cattle keeping locations ◆ Inadequate water availability for cattle during summers ◆ Inadequate fodder availability during waterlogging ◆ Increase in disease incidence in cattle during floods

Almora (Flash floods, landslides, water shortages, cold wave, forest fires)	Puri (Floods/cyclones/ drought)	Gorakhpur (flooding/ waterlogging/water scarcity in summers
◆ No consultation	◆ Inadequate and trained person-power at field level of Fisheries department ◆ Lack of scientific methodology for assessing fishery production and loss ◆ Conventional fishing boats not of adequate strength	◆ No consultation
	Environmental	
◆ Hilly terrain and difficulty in accessibility owing to inadequate vehicles ◆ Rapid loss in vegetation making the slopes unstable. ◆ Large forest areas of species that catch fire easily ◆ Capacities of local streams inadequate for increasingly intense rainfall events ◆ High turbidity in local streams supplying domestic water supply	◆ Reduction in forest and open land areas for flood buffering due to land conversion ◆ High groundwater salinity	◆ Reduced discharge capacity due to siltation of riverbeds of major streams ◆ Combined with increasing high intensity precipitation events cause floods ◆ High dependency on groundwater for water supply ◆ Improper landuse ◆ Drainage congestion due to obstructions by embankments and roads

Table 2 : Reasons for Direct Impacts (CRS factors)

Almora (Flash floods, landslides, water shortages, cold wave, forest fires)	Puri (Floods/cyclones/ drought)	Gorakhpur (flooding/ waterlogging/water scarcity in summers
◆ High proportion of semi-permanent and temporary houses with more concentration in just two blocks	◆ More than 50% of houses are semi-permanent and temporary	◆ About a third of houses are semi-permanent and temporary
◆ Roads constructed in cutting instead of balancing the cutting and filling, which makes the slopes unstable ◆ At most locations cross-drainage works do not follow resilient norms due to higher cost ◆ Unavailability of required width of land for roads from forests ◆ Inadequate budget for maintenance/ repairs/ renovation ◆ Inadequate and trained field staff	◆ Inadequate funds for maintenance and periodic repairs of roads ◆ At most locations cross-drainage works do not follow resilient norms due to much higher cost	◆ No consultation
◆ Inadequate knowledge of local geology causing subsidence of canals ◆ Need higher norms of financing in hilly areas but now are same as for plains	◆ Lack of fortnightly/ seasonal forecasts on sudden high inflows into (majorly silted up) Hirakud dam during mid-Sept-Oct which caused sudden release of water downstream into Mahanadi delta ◆ Reduced discharge capacity of main rivers and its secondary and tertiary tributaries in delta due to siltation	◆ High temperatures crack embankments ◆ Situation of cracked embankments worsens when exposed to intense rains ◆ Inadequate field staff
◆ Ageing electricity infrastructure	◆ Ageing electricity infrastructure ◆ Most cables over the ground ◆ Corrosion of poles and conductors due to salinity ◆ Lack of funds for maintenance	◆ Ageing electricity infrastructure ◆ Rapidly growing demand

Almora (Flash floods, landslides, water shortages, cold wave, forest fires)	Puri (Floods/cyclones/ drought)	Gorakhpur (flooding/ waterlogging/water scarcity in summers
Almora Municipality ◆ Few slum pockets ◆ Haphazard development ◆ Water supply and drainage infrastructure not resilient ◆ Poor financial resources and high dependency for finances from State and Central Government	***Puri Municipality*** ◆ High slum population ◆ Haphazard development ◆ Road and electricity infrastructure not resilient ◆ Weak coordination between the Municipality and various parastatal agencies on infrastructure development ◆ Poor financial resources and high dependency for finances from State and Central Government	***Gorakhpur Municipal Corporation*** ◆ High slum population ◆ Haphazard development ◆ Road and electricity infrastructure not resilient ◆ Very poor drainage infrastructure ◆ Poor financial resources and high dependency for finances from State and Central Government

Indirect Vulnerabilities : Factors include high population density in disaster prone areas, poverty levels and significant population of socio-economically weaker sections of the society; high dependence of population on agriculture that is vulnerable to weather-related disasters, combined with low levels of irrigation development and limited diversified livelihood opportunities for communities.

High environmental degradation viz. groundwater salinity, soil erosion and unstable hilly slopes, land productivity; improper landuse that reduces flood buffering/ absorption capacity of natural system; and, reduction in capacities of natural drainage/ rivers/ streams due to improper infrastructure development. For example, jacketing of the rivers by embankments has led to increased siltation in the river raising its bed, thereby reducing its discharging capacity; and, cross-drainage works in roads have inadequate capacities to channelize runoff generated from even moderately high rainfall events.

Capacities : Very limited capacity of various departments at the field level for assessing loss, implementation and monitoring infrastructure development and restoration, and disaster response; inadequate maintenance and repair budgets; lack of enabling technical norms, guidelines, procedures and unclear financing channels for developing resilient infrastructure especially at and below the state level; lack of coordination between departments with mandates for planning, constructing, maintenance and repairs, and restoration of sectoral infrastructure. For example, between the Irrigation Drainage Division and Puri Municipality with the former involved in planning and development of sewerage system/drains, the responsibility of maintaining the same is entrusted to the latter. In addition, there is a lack of effective coordination between departments for response, temporary restoration and reconstruction of infrastructure.

There is also a severely constrained capacity of communities for financing restoration of damaged assets/ houses in a resilient way; and, poor knowledge of disaster prevention, mitigation, preparedness and management.

Direct Impacts : Critical infrastructures like roads, schools, health, irrigation and electricity are either situated in disaster-prone areas and do not follow resilient design norms or are very old or underdeveloped. At some locations/ sectors it is the combination of all three. The thrust is on constructing new infrastructure as per existing technical norms and replacing the damaged infrastructure, as against adopting technical norms of resilient designs to build-back-better. This approach increases risks in most cases to future disasters. Some anecdotal evidences indicate that reconstruction of infrastructure has been undertaken adopting higher technical and financing norms, but it is yet to be mainstreamed.

In most cases alternative backup systems, especially at the sub-district/ block levels, are practically absent; hence damage to the main infrastructure causes breakdown of services/ functions to be provided by that system. In addition, significant proportion of housing stock is non-permanent or temporary.
The Government considers damages of only infrastructure while flow-losses (such as reduction in employment, erosion of livelihood base of the communities etc.) are often not accounted for. The ground reality is that there is enough evidence of increased erosion of livelihood assets and financial base of communities due to disasters.
Finally, undue consideration of factors of indirect vulnerability combined with incomplete understanding of losses and damages leads to implementing options that do not address the full range of vulnerabilities.
The disaster risk increases substantially considering the above factors in the light of increasing frequency of weather-related hazards as highlighted by climate analysis in all the locations.