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Flood Resilience through Climate-change adaptation: A case of Gorakhpur, Eastern Uttar Pradesh in India

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Abstract

Two third of the disasters the South Asia experiences are climate related and there has been phenomenal increase in their frequency, severity and unpredictability in the recent years. Vulnerabilities are aggravating from stresses on water availability, agriculture and environment. It has been well recognized that developing countries are rather prone to disasters than the developed countries because developed countries have well planed strategies to coping up with disasters. But in recent years the developing countries have also taken initiative to study disaster management vis-a- vis climate change adaptation which seems best way to mitigate the flood problem. In this paper we discussed about the adaptation strategy to mitigate the flood risk.

Keywords: Climate change, adaptation, flood disaster, Gorakhpur.

Introduction

The environment is changing on global, regional and local scales due to the impact of many kinds of anthropogenic activities such as green house gas emission, change in land-use pattern, deforestation, natural resource exploitation, waste disposal, etc. The collective effects of such environmental changes resulted into climate-change, which is one of the most important global challenges of the present times. Many types of impacts are needed to be understood and assessed, vulnerabilities needed to be addressed, while developing adaptation strategies to sustain the altered environmental settings encompassing risks of climate and water related disasters as well. Adaptation to climate change can be based on un-coordinated choices and actions of individuals, firms and organizations or on collective action and choice at local, national, international as well as intermediate and multiple levels.

In recent decades, an increase in the frequency and severity of floods has been observed in many countries including India. The rapid pace of development in almost all the countries has led to the destruction of forest cover, draining of natural wetlands and spread of towns across the countryside, and many other human interventions have reduced infiltration, leading to more frequent and higher floods[1].The Indian sub-continent being located in the heart of the summer monsoon belt, receives in most parts more than 75% of its annual rainfall during the four monsoon months of June to September[2].Among all natural disasters, floods are the most frequent climatic disaster to be faced by India[3]. It is, however, seen that the summer monsoon rainfall is highly variable both in time and space. The occurrence of floods due to climate change and anthropogenic activities seems to be increasing[4]. The modern flood risk management approach acknowledges that floods cannot be stopped from occurring and places emphasis on how to reduce hardship and vulnerability of the risk prone communities. The increased pace of climate change in last 50 years is in occurrence with the significant effect on hydrology and water resources in whole India. It is also known to badly affect the water regime of the Himalayan region. Flood resilience through climate change adaptation therefore, must be with eco-friendly approaches. A resilience approach has adopted for effective decision support system. The concept of resilience in an ecological context, was defined by[5] as the amount of disturbance an ecosystem could withstand without changing self-organized processes and structures.

Resilience Approach in Flood Disaster Management: Resilience is the ability of a system to recover from a response to disturbance. The conceptual definitions of resilience are neither consistent nor ready for operational use, as highlighted, *e.g.* by [6,7,8] for example defines resilience as a non-tangible property describing how a community that is exposed to hazards resists, absorbs, accommodates to and recovers from the effects of a hazard in a timely and efficient manner. Similarly, approach in flood risk reduction requires action to reduce impacts of extreme events before, during and after they occur. Theme includes technical measures of disaster prevention and aspects of socio-economic development designed to reduce human vulnerability to the impact of hazards. Approaches toward the management of climate change impacts also have to consider the reduction of human vulnerability under changing levels of risk. Key challenge and also the opportunity, therefore, lies in building a bridge between current flood disaster risk management efforts aimed at

reducing vulnerabilities to extreme events and efforts to promote climate change adaptation. There is a need to understand better the extent to which current flood disaster management practices reflect future adaptation needs and assess what changes may be required if such practices are to address future risks.

Risk on Rural community: Rural communities and individual farmers face flood disaster risks associated with climate variability and climate change in Gorakhpur. Their livelihoods are exposed to climate risks and the associated impacts. Conventionally, disaster risk is expressed by the notation:

Risk = Hazards x Vulnerability.

Risk identification and assessment are the two important steps that form the basis for successful implementation of adaptation practices. This involves identification and assessment of current (climate variability) and future (climate change) risks and associated societal vulnerabilities. A perception of changing rainfall patterns features prominently. Over the past decade, the rain has become increasingly unpredictable and erratic; the seasonal rains have started earlier and finished uncertain time. This is detrimental to people's key assets, cattle and farmland, which are vulnerable to climate risks. Key trends that affect households' ability to deal with the climate risks include increasingly limiting livelihood choices and reduced solidarity in the times of stress. Before communities can deliberately anticipate against floods they must become aware of the possibility of a flood (awareness) and take measures to protect themselves (preparedness) [9]. Resilience of flood-prone communities can be assessed according to natural, physical, economic, institutional and social criteria[10,11].

Material and Methods

Study Area: For the detailed study we have selected village Jungal Augahi, Campierganj Block, Gorakhpur. This village is situated on the bank of Rohini river and annually affected by flood. It is 35 km. away from the district head quarter. Personal interview method has been applied and 30 families were selected on random basis. Campierganj Block situated in the north corner of Gorakhpur district. It is situated in the eastern part of Uttar Pradesh in India. It lies between Latitude 26º 13' N and 27º 29' N and Longitude 83º 05' E and 83º 56' E. Gorakhpur is one of the most flood affected district of eastern Uttar Pradesh, India. It is located in the Terai belt with cup shaped topography[9]. In term of population growth it is at present the second largest district after Varanasi, in Eastern Uttar Pradesh. In the past few years there has been a rapid alteration and unexpected changes in the climate. Gorakhpur being an agricultural based district, approximately 80% of its population lives in rural area, the prosperity of its agriculture largely depends upon the rainfall received during its summer monsoon. Figure-1

Results and Discussion

It is observed that recurrent floods have significantly reduced harvests and extended livelihood gaps. Communities report an increasing sense of exhaustion in the face of the changes they are experiencing. Communities in this village are already starting to feel the impacts of climate change in the form of more frequent and unpredictable adverse conditions. Therefore, the adaptation strategies to support flood risk reduction are ever more important. Study revealed that 20% people are landless, 40% people having less than 2 hac land and 40% people having 3-5 hac land. Local people are expected to vouch the preparedness, response and recovery cycle almost whole the year, with the major time period division as follows:

Table-1
Showing the time period distribution of villagers

Preparedness	March to May
Response	Mid June to September
Recovery	October to December and beyond

It is observed that in local communities, the activities for preparing to face the flooding start during March-May onwards when they make efforts for identifying and locating safe places in case of required evacuation and storage of flood, fodder and fuel. This is also the time when people make arrangements to protect the houses in case of inundation. Repair of mud walls and roof tops, raising the adjacent areas near habitation *etc*. are the usual practices in this regard. The community also repairs the nearby embankments to protect it from the eventuality of flood and such repairing efforts and protecting it from breaches are generally on a voluntary basis. Communities prepare and make arrangements for lights (kerosene oil lamps) and polythene sheets. During the floods, whole village unites in saving life and property of people and evacuations to safer places along with their cattle. After the floods, communities make efforts in procuring information about the relief packages and relevant schemes and compensations. However, availing compensations (such compensations are provided generally for collapse of houses) is a tedious work and the actual availability is only towards the end of November/December or even later. In the recovery period of post disaster, organizing credits for agricultural inputs, house repair etc. is also a problem. Proper and timely information to communities, related to various activities of disaster management, are required to be ensured. The time of such information and related activities, if matches with the activities cycle of community, becomes highly useful. During our Study it was found that most of the families involve in sowing new variety of rice. Regarding this, interviews with a village farmer Mr. Darmendra Singh for the details have been conducted.

Key findings of study: Mr .Darmendra Singh of Jungal Augahi village has three acres of land, located near Rohini River, which is annually affected by flood. In 2006, on a training organized by GEAG (Gorakhpur Environmental Action Group), he learnt about the water loving variety of paddy called 'Turanta'. It has the ability to tolerate water and faster growing power that impressed Darmendra. He decided to cultivate 'Turanta', the next season in his own land. First of all he sowed that variety,

albeit only on half an acre for want of seeds, then on end of July, the flood came along the river all nearby field were inundated when water recede after 15 days. Darmendra found that there was no negative effect on the 'Turanta' crops. On the contrary, new shoots had emerged from the sides of the plants. The paddy continued to thrive and in time it was harvested. From a mere half an acre, he got a yield seven quintal. Encouraged by this, other farmers from the nearby villages too are now keen to plant this rice variety.

In village people are learning the coping mechanism to resolve the problem with best adaptation practices. These local level adaptation practices should be involve in higher level.

Conclusion

Resilience enhancement provides an added value to operational flood risk management. The resilience concept is seen as a multi-disciplinary approach in which technical measures are integrated with economic, environmental, social and governance measures. The establishment of flood resilient communities promises effective means for adaptive management of disasters in a changing world. Although authorities do not yet completely acknowledge the implementation of this concept, some measures are already partly or fully implemented in recent Flood Risk Management approaches. It remains yet innovative to have resilience measures implemented in an integrated and effective way and many opportunities to enhance resilience still remain. In the three dimensions of resilience-relevant measures (interplay of institutions, flood risk communication and flood modeling tools) described in this paper, participation of all stakeholders and bottom-up involvement is considered important factors. Techniques to increase this participation will increase the ownership of solutions and increase resilience. Increasing the strength of a community is also about increasing the strength and scope of the internal connections between its individuals, organizations and the physical environment that form that community. It is creating stewardship of lay people and consequently hand over responsibility from the authorities to the lay people is considered to be a challenge.

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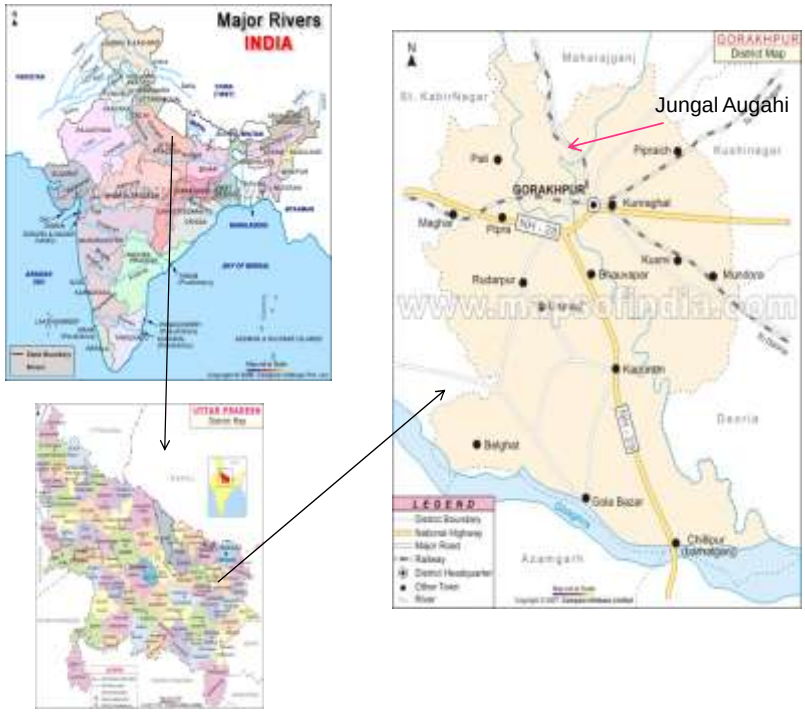

Figure-1
Location of Gorakhpur in India