DISASTER
Response & Management

June2014, Volume 2, Number 1
ISSN: 2347-2553




LBSNAA

Published by:

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Subscriptions:

The "Disaster – Response and Management" is published annually.

Subscription orders can be placed with the contact details given below:

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LBS National Academy of Administration,
Mussoorie – 248179, Uttarakhand, INDIA.

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Phone: +91-135-2632545
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Subscription rates are as follows:
(i) Individual - Rs. 200 per copy
(ii) Institution – Rs. 250 per copy

Printed in India at Print Vision, Dehradun - 248 001

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CENTRE FOR DISASTER MANAGEMENT

Lal Bahadur Shastri National Academy of Administration

Mussoorie (Uttarakhand)

PREFACE

India is vulnerable, in varying degrees, to a large number of natural as well as man-made disasters. About 58.6% of the land mass is prone to earthquakes of moderate to very high intensity; over 40 million hectares (12% of total area) is prone to floods and river erosions; of the 7,516 km long coastline, close to 5,700 km is prone to cyclones and tsunamis; 68% of the cultivable area is prone to drought and hilly areas are at risk of landslides and avalanches. Vulnerability, to disasters / emergencies of Chemical, Biological, Radiological and Nuclear (CBRN) origin also exists. Emergencies, especially those that occur in Nature, only become catastrophic events when they combine with vulnerability factors such as human settlements and population density.

The implementation of sound disaster management laws and policies can play an important role in mitigating the negative effects of disasters and can contribute to the development of more resilient societies. Disasters disrupt progress and destroy the hard-earned fruits of painstaking development efforts, often pushing nations, in quest for progress, back by several decades. Thus, efficient management of disasters, rather than mere response to their occurrence has, in recent times, received increased attention, both within the country and abroad. In a caring and civilized society, it is essential to deal effectively with the devastating impact of disasters, looking at the increased frequency and intensity of disasters in recent times.

In continuation to the successful publication of the first issue of the journal "Disaster-Response and Management" from Centre for Disaster Management, it is our pleasure to publish Volume II, Issue 1 of the journal "Disaster-Response and Management" for the year 2014. The journal will provide an insight to the field administrators about the field level disaster management and scientific intervensions towards Disaster Risk Reduction.

Saurabh Jain, IAS
Deputy Director & Director,
CDM, LBSNAA

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Uttarakhand Disaster: A Reminder for Introspection

Brig Narender Kumar*

" Those who live beyond the confines of morality, their end is often by fire and water"

-Anonymous

Abstract

Unprecedented disaster in Uttarakhand is an indication of abnormal change in climatic conditions. Humans cannot ignore the warning of nature for long. If the abuse of natural resources continues to go on unrestricted, disasters will become routine and more devastating. There are no easy solutions to this problem. What is important is to adopt the sustainable development without causing turbulence to avoid climatic catastrophe.

Respect for nature and development of culture to deal with the disaster is need of the hour. It is a shared responsibility and every citizen is accountable to contribute and prevent a calamity to occur. There is a need to change the mind set and a cultural approach is required to prepare present and future generations to, mitigate disaster and rehabilitate the nature.

Every individual, every family will have to act as leader or pioneer to rise above the selfish motives to save the precious environmental wealth for our future generations. This cannot be deferred or delayed till another disaster strike and more lives are lost.

Key Words

Uttarakhand, Disaster management, Nature, Cultured Approach, Human Endeavour, Soldiers.

Introduction

The magnitude and expanse of disaster in Uttarakhand was unprecedented. Disaster struck in approximately 40000 square kilometre area, more than 100 thousand people were stranded and close to one million people were directly or indirectly affected by this mountain furry. The disaster highlighted different shades of commitment, morality and human struggle for survival in hostile environment. Individuals reacted differently, some followed the path of being humans first, some kept self-survival as paramount and some took advantage of helplessness of the victims. On one side, the nation and the people were assured that we have the organisational and national character to stand united to face the

daunting challenges together, but on the other side more disturbing fact was abdication of moral responsibilities by fellow humans. Unfortunately this aspect escaped the media and public scrutiny. Being humans first is indeed affinitive behaviour, which should reflect the national and social character, especially during crisis or human tragedies. In the natural course, the logic suggests that the survivors and the witness of such pervasive act of nature must respond by being humans first and individuals later. Uttarakhand disaster is a testimony of the fact that inherent sufferings come when human beings shun the confines of morality and respect for the laws of the nature.

The Blunt and Uncompromising Nature

Unusual and abnormal change in weather conditions warrants that the development activities in such ecologically fragile zones should be carefully planned and development should be socially and environmentally sustainable. For thousands of years the Western Himalayas were known as the Dev Bhoomi, possibly the logic for declaring it as Dev Bhoomi was to prevent human activities in this eco sensitive zone. But ignoring the signals of nature, rulings of courts and norms of sustainable infrastructure development led to one of the biggest tragedies in the recent times. The losses could have been prevented if the social and moral responsibilities were upheld by the people and the government. Sad part is that often the humans are lulled into complacency (Toddjasper, March 2012) after the calamity and they return back to their usual way of life tempering with nature and disregard to the signals of nature till another tragedy strike. I recollect a lesser known sadhu "Swami Nigamanand" who passed away after indefinite hunger strike on 13 June, 2011, exactly two years before this disaster (the spell of heavy rainfall that triggered the floods began on 14 June, 2013), at the Himalayan Institute of Medical Sciences at Dehradun (Sampath June 2013). He gave his life to save the environment and fight against unregulated mining along the river Ganges. But regrettably how indifferent the society and the government agencies were that no one paid any attention to the cause for which he laid down his life. It is indeed the misfortune of the society and humanity at large that short term gains overshadow the long term losses.

The disaster became unmanageable because of unregulated infrastructure development, lack of respect for geological advice against building roads close to flood prone rivers and riotous human activities in the red zones (An area which is unstable and has a high risk of natural disaster). "Misaligned incentives" overruling the larger interests of the humans is in my point of view a bigger disaster. Normally such acts of greed and recklessness appear innocent and we tend to accept it as part of the development process, but in the long run these acts

against "Mother Nature" make the innocent people pay through their lives. Cloudburst and glacial lake outburst floods, triggered the disaster, but the collateral damage was caused by unregulated development.

In the month of April 2013, Uttarakhand government had strongly opposed the Central government's decision to issue a gazette notification to declare an area about 100 km-long along the River Bhagirathi from Gaumukh to Uttarkashi as ecologically sensitive (23 Times of India April 2013). The disaster in June 2013, justified that not only Bhagirathi eco sensitive zone is a mandatory requirement but the entire Western Himalayas are required to be declared as eco sensitive zones. Will we learn the lesson or not, is a different question, but it is a reminder that nature must be respected and tampering with it will cost irreparable loss.

Age Old Dike Laws Still Relevant

"No land without dike and no dike without land" (German Historical Institute Studies in International Environ)but the limit to the extent to which we can go has to be laid down. Utilisation of water and the need for development is an age old practice but the extent to which it can be exploited must be laid down and respected. Germany introduced a dike law in 1426 which still stands. Pollution of rivers, poor and weak construction of embankments and encroachment of river lines were punishable with seizing of land, imprisonment for life and in certain cases even punishable with the death penalty. The reason was very simple, because any violation could cause havoc and catastrophe which may cause harm to a large population. That was the importance which was attached to the rivers, ponds, embankments, canals and diversion of river lines. Even in India between 300 to 1100 AD, polluting or diverting rivers, canals and destruction of water sources were punishable offences and it could range from financial penalty to imprisonment. There is a need to revisit the old wisdom of enforcing "Dike Laws" and regulation of sustainable development in eco-sensitive zones across the country.

Endeavours beyond Limits

On one side was death and destruction and on the other side of the pendulum were, those, who went "beyond the human endeavour" to bring back every living soul and returned them back to the nation. They crossed mountains, glaciers, violent rivers and cut their path through steep mountains, shooting stones, mud slides and forests to reach those whom no one could have reached and save those who had no hope of survival. It included the uniformed men, local villagers, pony wallas, local guides and the local youths. Woman in some villages cooked food since morning till night fall to feed those who had not taken food for days together. Medicos moving from one place to another to assure the sick and

wounded that they will not be left to die because of lack of medical attention. Special langars were established by people from across the country to feed those who were waiting for evacuation. Young helicopter pilots and soldiers risked their lives day in and out to evacuate and rescue the victims of this tragedy. It was a war for these men, "race against time and aggression against nature".

Managing psychological and physical aspect of dealing with disaster was a big challenge. To convince the parents to leave the mortal remains of their children and vice versa was traumatic and unthinkable. But it had to be done. The disaster relief forces were working in an environment of death, destruction and unbearable stench of rotting mortal remains of humans and animals. Yes, they had to perform their duties without remorse and sympathy. There were more than 2500 soldiers and officers who belonged to Uttarakhand and the welfare of their family members was not known since there was complete information vacuum, yet not even a single soldier asked for leave and went about their task as nothing had happened.

The game changers from absolute hopeless situation to a ray of hope was indeed due to the untiring efforts of the "soldiers of God" who descended from the sky, they came from the ground, used every possible innovation to evacuate and rescue the last living soul. Military and civil officials worked day and night, the flag rank officers from army, NDRF and ITBP moved along the length and breadth of the disaster area to encourage, supervise and modify the operational plans. Command and control organisations were established at ground zero. Men took time to catch up with some rest during night, but these young officers huddled together to chalk out the strategy for the next day. Most important factor which ensured saving of thousands of lives was that these men could inspire the victims to live for another day and push the men and machines beyond limits in the service of mankind.

Uttarakhand Disaster a Mirror to the Society

Disaster in Uttarakhand was a mirror to the society and the nation as a whole. Extraordinary commitment of armed forces, ITBP, NDRF, NGOs and some local citizen who themselves were victims of this tragedies saved the day for the nation. It was undeniably a challenge to the nation whether India can handle the disasters of this magnitude. In a nutshell, the "national power was critically examined globally". Most heartening was the fact that not only the government agencies pitched in with the assistance but even the common man came forward to help the victims in their own capacity by providing water, food, clothes medicines and even shelters. People sitting thousands of kilometres away rushed with the supplies and assistance to

save every fellow human being from this disaster. While providing assistance no one asked the names and the caste of those who needed assistance. Even the animals were helped in whatever capacity one could.

But then unthinkable also happened where tragedy was used as an opportunity to exploit, loot and cause mayhem to the fellow countrymen. The greed was so perverted that these human vultures did not even spare psychologically deranged individuals, sick and injured victims of disasters. Some eye witnesses gave gory accounts of human deceit, lack of empathy and abject surrender to greed which certainly shamed humanity per se. Instead of giving water and last morsel of food to dying and seriously wounded or sick people, hapless victims were robbed and left to die. Dead were searched for the last penny and temples of God were looted in a brazen display of greed beyond imaginations. This all happened in the unprecedented disaster which was huge in magnitude and spread. The paradox is that we are forgetting and not taking note of the disaster which took place in the moral domain.

Disaster in Moral Domain Irrecoverable

Most worrisome aspect for me is in the cognitive or moral domain. What was absolutely absent was "cultured approach" towards dealing with the disaster till the outside help arrived. On 12 and 13 June 2013 weather warnings were given by the administration and pilgrims were asked to avoid moving forward. But then as a part of the national character and perennial habit to disregard the instructions and guidelines, people went about their business as usual. The problem with us is that neither there is "culture of coping with unforeseen eventualities" and nor the citizens are trained for "collective response for survival during disaster".When the disaster struck in Kedarnath valley, people were warned to go to higher reaches and safe places, some unscrupulous anti-social elements started demanding abusive amount in return to guide them out of the disaster prone areas, since the valley was completely choked and bad weather prevented insertion of rescue teams on 17th June and help only arrived on 18th June when there was a small window of two hours when helicopters could fly in with essential services. On one side people were trying to cope up with the loss of their near and dear ones, at the other end there were some who were busy in making money in this hour of crisis by looting the temples, pilgrims and even the dead victims. Those who survived and managed to reach the road heads, another set of vultures were ready to fleece them by selling water bottles at the rate of Rs 100 and a single parantha for Rs 100 and upwards. The agony did not stop here; the last nail in the coffin was when some taxi owners who charged money even when they

were hired by the government to give free transport to the survivors upto the railway station. 'Billy Bragg' had rightly said, that, "War and disaster, what is it good for? The answer is its good for business".

Reluctance to Assume Leadership and Responsibilities

Assumption of leadership under crisis by the victims, survivors' and stranded pilgrims was missing. Large number of sick, wounded and traumatised people would have been saved during the first 24 hours, which is known as the golden period in disaster relief, if some people among the stranded pilgrims had shunned the sense of being victims and assumed leadership. What it needed was to assume leadership, gain control of situation in their area of influence and distribute responsibilities to manage the resources and critically affected people. The concept of the extended family was absent and the concept of me and my family was paramount. There is a need to carry out introspection and instil a sense of responsibility towards self and the extended family. In Badrinath, more than 15000 pilgrims were stranded but most of the white colour and more affluent people refused to walk down a stretch of eight KM accompanied by no less than the flag rank officers of the Indian Army and a 'field army commander of the fourth largest army in the world'. Large number of them preferred to stay in hotels and blame the government for the delay in their evacuation rather than trekking down just about eight kilometres. At Jungle Chatti there were more than 1000 people stranded but even some of the able bodied people did not assist more critically sick and old people to bring them to safe places and makeshift helipads. 1000 people were waiting for first batch of eight paratroopers to save them and give leadership for organising rescue operation, whereas the 1000 strong people could have made an endeavour to prepare makeshift helipads, find routes to an area from where the rescue could have been much easier. But this did not happen. To some extent it was due to lack of knowledge of "collective response for survival during disaster" and to great extent allowing the feeling of being victims to set in.

Integrated Approach for Disaster Relief A Must

There is no denial to the fact that the agencies involved in disaster relief left no stone unturned to put their best foot forward against all odds. But it is a lesson for the nation that more integrated approach is required to deal with the disaster of this magnitude. Command and control set up, distribution of responsibilities and optimum utilisation of resources can only come about if there is integrated approach and the employment of resources is handed over for execution to a lead agency. In the instant case, Army was the lead agency which had communication, command and control and foot prints on the entire red zone. The situation

created by the unprecedented disaster was no less than war, therefore, the response had to be rapid and at war footing. All the resources should have operated under the army since it had the complete picture of the magnitude of disaster. However, this aspect was neglected and at number of places there were duplication of efforts which could have been avoided. It has clearly emerged that dual and joint control in such crisis situation is a bad idea to pursue.

Way Ahead

Deep interaction between humans and the environment is a must. Development should have inbuilt capacity of risk management. If both these aspects are deficient then destruction is assured. Narrow pragmatism for development may be populist in nature, but lack wisdom and in no way will benefit the people, society and the nation. As a nation there is a need to develop complete résistance and unacceptability to the greedy ways of those who wish to get their so called development projects through by way of bribing or manipulation of the system. Nature and ethics have deep relationship and must be nurtured for the coming generations. Failing which we as a nation will have to get used to of bigger disasters as we are getting used to of terror strikes, traffic jams and immune to corruption. In the moral domain it is important for fellow humans to remember what, Aesophad said, that, "No act of kindness, no matter how small, is ever wasted". This sums up the moral responsibility of every citizen of the country. There are lessons which emerge out of this tragedy which should act as cornerstone to put the house in order both in physical and moral domain.

Culture of Preventing and Managing Crisis is Part of Nation Building

Robust organisational structures, skills and rapid response is imperative to deal with the crisis, which may be due to natural or manmade disasters. Following key issues merit attention:-

- **Management of Disaster**
    - **Nomination of task Force Commander.** Concept of nomination of task force commander is most efficient method of execution of a high risk operation where the lives of people and national security are involved. Multiple command and control structures often lead to inefficient execution of task and lack of accountability. Rapid response needs quick and timely decisions and that can best be done when there is a unity of command.
    - **Joint Command and Control Organisation.** Joint command and control organisation under one commander is an inescapable

requirement to monitor and execute operations under volatile and fast changing ground conditions.

- **Essential Services Maintenance Act (ESMA).** To make people accountable and prevent unethical practices, imposition of ESMA is vital. This will ensure that the public servants and people respond to the crisis with speed. No one will be able to abdicate their responsibilities and leave the ground zero till the task is accomplished.

- **Prevention or Mitigation of Disaster**
  - **Realignment of Roads and Tracks.** Careful examination and analysis has highlighted that collateral damage has taken place along the river banks. No collateral damage had taken place in higher reaches or in an area which was even 400 to 500 meters above the river line. It is an age old wisdom, that, in mountains gain height and don't lose it. Mountain streams and rivers are unpredictable and human activities along the river lines are fraught with dangers. Roads and tracks in mountains should be well away and preferably high on the ridge lines to avoid land slide, sudden floods and periodic damage by avalanches. The land mass along the river lines often remain in a state of perennial downward shift and are unstable due to continuous erosion. Most of the roads in hill sector of Uttarakhand and other hill states which are close to the river lines cannot be rehabilitated because of the instability of the land mass. Therefore, it is in the interest of the state and the people to realign these roads and tracks along the higher reaches of the mountains or along the ridge lines for uninterrupted flow of traffic.
  - **Alternative means of Communication.** Uttarakhand disaster became unmanageable initially primarily due to the inaccessibility of the red zones. There were neither alternative roads/ tracks to reach the victims nor the helipads at a regular interval of two to three kilometres along the affected areas. Stranded victims in most critical areas of Kedarnath Valley could only be reached when troops slithered down and thereafter constructed makeshift helipads by use of explosive and working overnight. Therefore, in areas where there is heavy concentration of masses, alternative routes and makeshift helipads are imperative.
  - **Risk Assessment Essential for Infrastructure Development in Eco Sensitive Zones.** Before embarking upon major projects risk assessment in short and long term is must to ensure that such projects do not cause risk to environment, to the population in immediate vicinity or the areas

in lower riparian zones. Development must be sustainable and should not lead to collateral damage which is irrecoverable in nature.

Course Correction Imperative in Moral Domain

There is utmost need to preserve, protect and strengthen the moral domain to stand united during crisis. Following aspects need to be revisited:-

- We are all part of an extended family. There is a need to make our children and fellow countrymen aware that helping another human in distress is indeed helping the family member.
- Assumption of leadership is important to organise and manage disaster relief and not wait for the relief operations to begin. Rather the stranded victims must prepare conditions for speedy rescue and evacuation operations.
- Being moral is being religious. Biggest religion is the religion of humanity. The responsibility of being humans is important.
- Develop a culture of coping with the unforeseen eventualities.
- Nature does not accept bribe human may, what nature accepts is respect of "mother nature".
- Say no and raise voice against misuse of dike laws.
- Education institutes must make this as part of education curriculum to educate and sensitise the youth to deliver at the time of crisis.
- Disaster behaviour is a subject in itself and there is a need for spreading structured awareness in the public domain. Had this awareness been there with the victims, survivors and the witness to this disaster, the magnitude in moral, psychological and physical domain would have been far lesser, which, in turn could have saved a few hundred more lives. It should be part of the education and ethical studies.

Conclusion

Edwin Louis Cole had said, "Visionary people recognise crises as a time for change, from lesser to greater, smaller to bigger". In my opinion there is a need to rethink and put a course correction in place for sustainable development. Roads need to be realigned and moved away from the flood plains of the rivers and human activities close to river lines are required to be restricted. Collateral damage could have been far lesser if the roads were not constructed along the flood plains of the rivers. Present road and track alignment to Gangotri, Kedarnath, Badrinath and Kailash Mansrovar Yatra are running too close to the river lines and are a liability and literally death traps. It is nature's law that rivers

will revisit their original path once in 15 to 20 years and remove obstruction, manmade or natural, once in 25 to 50 years. That is what has happened in Uttarakhand

Trust and morality is bedrock for survival of a society and state. Very existence of nation can be compromised if trust and morality in public and private life is eroded. Being spiritual and morally upright is a key to collective survival in crisis. Confucius had said, "A nation and society can survive without food, prosperity and army, but cannot survive without trust and morality".

Acknowledgement

My sincere gratitude to the soldiers for having gone beyond the call of the duty to bring back every citizen who became victims of this devastating tragedy. My sympathies with the families those who lost their family members. My sincere thanks to LBSNAA for giving me an opportunity to express my views through their publication.

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Community Based Disaster Risk Reduction (CBDRR)

Meena Jagirdhar*, Dr. K. R. Sastry**

Abstract

The government's policy and planning for preparedness and response to disasters could be molded well to suit the local community; if only the community members are actively involved. Since the objective of community based disaster risk reduction (CBDRR) is to reduce the impact of natural disasters on the living conditions of the vulnerable communities, the first step in this course should be to ensure that the community is capable of withstanding the impact of a disaster at least for the first few days until external assistance reaches it followed by long-term sustenance of its safety and livelihoods. The NGOs, CBOs and the PRIs play an important role in making the community self-reliant. People in India comprise the largest and the most readily available work-force. Hence, CBDRR can be achieved by using this massive resource through community preparedness.

Key Words

Community preparedness, Disaster Risk reduction, PRIs and NGOs, Village Disaster committees, Community knowledge

Community Based Disaster Risk Reduction

It has been recognized worldwide that in order to prepare for all kinds of disaster situations and to effectively handle them, it is important to be in a pro-active participatory partnership mode with local communities as they are the first responders as well as the worst sufferers. The Disaster Management Act (2005) envisages a shift in approach to disaster risk reduction (henceforth DRR) and envisions a holistic sequence commencing with prevention, preparation, planning and capacity development for a prompt and effective response to rehabilitate, reconstruct and recover in time; and thereby making it a permanent line of attack. If such a strategy is to be effective, it needs to undergird and seek the participation of local communities in the entire spectrum of DRR efforts. One of the ways is from end-to-end capacity development through Community Based Disaster Risk Reduction (henceforth CBDRR) to make the program sustainable. Also, the self-help groups (SHGs), non-governmental organizations (NGOs), community based organizations (CBOs), Youth Groups and elected representatives (ERs) of Panchayati Raj institutions (PRIs) at the grassroots play a

major role in the process. These groups are to be engaged first as members and later on as trainers and Disaster Task Forces (DTFs) at the grassroots. One or two members of the community should be given training to partake as coordinator(s) to help organize periodic drills after their initial training was completed. Refresher training programs are to be conducted at least once a year to update the community on recent developments. To institutionalize CBDRR training, it is advisable to proposing that the Chief Executive Officer (CEO) of the Zilla Parishad (ZP) to be in-charge at the District Training Center (DTC) with active involvement of the Zilla Parishad Chairperson, Deputy CEO and the District Panchayat Officer (DPO) to identify suitable persons as volunteer(s) from each village, who receive training at the State Training Institute before becoming trainer(s) and member(s) of the Task Forces. Administrative support for conducting training programs will be coordinated by the Block Development Officer (BDO) and Extension Officers (EOs) at the Panchayat Samithi (PS) and Gram Panchayat (GP) levels, in that order.

Definition and Purport

The CBDRR is defined as the concept and practice of reducing disaster risks through systematic efforts to analyze and manage causal disaster factors, with reduced exposure to hazards, lessened people's vulnerability and property; and astute management of land, environment and better preparedness for calamities. It also provides for a comprehensive approach to reduce disaster risks outlined in the UN-sponsored Hyogo Framework for Action (2005) whose likely outcome is: "Substantial reduction of disaster losses, in the lives and social, economic and environmental assets of communities and countries". The UN-International Strategy for Disaster Reduction (UNISDR) endeavors to mainstream DRR within development and provides for cooperation among governments and Civil Society Organizations (CSOs). The term disaster reduction is used occasionally; while "disaster risk reduction" provides for a better recognition of the ongoing risks and the long-term potential to reduce the looming losses.

The CBDRR envisions reduction on the impact of natural calamities on the living conditions of vulnerable communities in disaster–prone areas. This could be achieved by ensuring that people are capable of with standing the impact of any disaster initially for the first few days in the post–disaster phase, until the external assistance reached them and long–term sustenance of their safety and livelihoods was achieved. In a matter-of-fact situation, the community may be delineated as the population of a Gram Panchayat (village/hamlet/habitat) as the basic unit which deals with making the villagers aware of the vulnerability by training the members of the community to become self-resilient in dealing with

disasters. The National Disaster Management Plans, prepared by the High Powered Committee (HPC), headed by J.C. Pant (2001) lay great emphasis on CBDRM to deal effectively with natural calamities in India.

Capacity Development Through UNISDR Program

The Vision of UNISDR is to integrate DRR into sustainable development policies and planning, besides developing and strengthening institutions, mechanisms and capacities to build resilience to hazards by further incorporating risk reduction approaches into emergency preparedness, response, and recovery programs. Also, UNISDR defines 'capacity development in the DRR domain, as the process by which people, organizations and society stimulate and develop their capability over time to achieve social and economic goals, including improvements in knowledge, skills, systems and institutions within a wider social and cultural enabling environment'. Some other definitions of Capacity Development are as follows:

For the Organization for Economic Co-operation and Development / Development Assistance Committee (OECD/DAC), 'capacity development is the process whereby people, organizations and society as a whole unleash, strengthen, create, adapt and maintain capacity over time'. The Canadian International Development Agency (CIDA) defines 'capacity development as the activities, approaches, strategies and methodologies, which help organizations, groups and individuals to improve their performance to generate development benefits and achieve their objectives'. The World Bank (African Region) defines 'capacity as the proven ability of key actors in a society to achieve socio-economic goals on their own. This can be revealed by functional presence of merger of most of the features: doable enterprises and respective organizations; commitment and vision of leadership; financial as well as material and skilled human resources'.

What Comprises A Community?

According to Vinod K. Sharma, et al., (2012) the community has been emerging as an effective instrument of DRR and in the event of a disaster occurring, awareness of preventive actions becomes imperative for the community response, to be able to significantly minimise the disaster damages. In general, the community reflects a feeling that members have a sense of belonging and that the people matter to one another and to the group as a whole through leveraging a shared faith that members will be met through a commitment that they will be together, whether it rains or shines. For the purpose, an objective demarcation of the elements that comprise a community is essential; and in the process, the

following are the features that constitute the community:

- Elected Members of Gram Panchayat, Pnchayat Samiti, and Zilla Parishad.
- People in the Villages/Hamlets
- Men, women, elders, children, various caste groups, etc.
- Students/Teachers,
- Retired personnel of Armed Forces and Police
- NGO's, CBO's, Civil Society Actors, etc.

Distinctive Features of CBDRR

- The most important characteristic of CBDRR is its people-centric nature;
- People's participation is an important element of CBDRR;
- The most vulnerable group is given priority, as it were; and
- Risk reduction measures are community-specific; and, comprise an inclusive process:
    - It is an integrated exercise covering activities of various development sectors and poverty alleviation measures; and
    - Outsiders have only a limited role to play because they support and facilitate in the initial stages following a disaster.

McMillan and Chavis (1985) have noted that CBDRM's achievements are: "small wins that vulnerable communities contribute to grander goals of disaster reduction." From times immemorial, communities have been coping with disasters with some degree of success. Such mechanisms of the community and indigenous resources and responses have been an integral part of the CBDRR. When the local resources and responses contribute jointly with capacity development of the community in dealing with disasters, the final outcome is immense in making the community resilient to disasters. It is a truism that the impact of disaster is less in a prepared community than in an unprepared community. Preparedness, therefore, minimizes the loss of life and property, which can be realized through CBDRR approach to disasters. The priorities of the policy makers and the expectations of the community with respect to disaster mitigation and actual relief administration are widely different. The CBDRR will strive to offset this top down approach and move toward the bottom up planning process. It will have a citizen controlled decision-making approach in place, where the local problems and needs are locally and adequately addressed. This will help lead to redistribution of power to the disadvantaged sections of the population. Since local knowledge, resources and

labor are liberally available and can be made use of and thereby resulting in smaller financial inputs and larger gains.

Scientific Analysis Versus Community Knowledge

Currently, there has been an ongoing dialogue that whether credence to be given to Community's traditional wisdom or bestow added importance to scientific analysis while dealing with DRR. The position which creates a dilemma in implementing projects on DRR is the absence of a proper linkage between these two different but interrelated concerns.

But Patricia Martel (2013) states: "I work in risk assessment and I have a background in the natural sciences however; when I develop a new risk assessment, community knowledge plays an important role. In some cases there may simply not be a long enough scientific record period or research has not been done for a hazard in a particular area; and, community knowledge can fill the gaps, for which scientific knowledge may not be available." This is because, technical experts tend to focus on the scientific procedures without due regard to the accumulated knowledge and skills of the community's unmistakable inventiveness. However, a proper combine of these two approaches would definitely augur well for the success of CBDRR by satisfying the derivative awareness of the local people. It would also enable members of the community to have a superior understanding of the scientific advancements as also the resultant approaches in simple and intelligible language, when applied to their conventional developmental efforts with DRR. This process would mean a proper blend of the two approaches and their progression possibly will empower the community better.

More often than not, rural people have shown an amazing ability to express and analyze their local, complex and diverse realities which are often at odds with the top-down veracity imposed by professionals. According to Agezew Hidaru (2013), structural measures include any physical construction to reduce or avoid possible impacts of hazards, or application of engineering techniques to achieve hazard-resistance and resilience in structures or systems. Common structural measures for DRR are: dams, flood levies embankments, ocean wave barriers, earthquake-resistant construction, and evacuation shelters. It may be noted that in civil and structural engineering, the term "structural" is used in a more restricted sense to mean just the load bearing structures. Whereas for non-structural measures, any measure not involving physical construction that uses knowledge, practice or agreement to reduce risks and impacts, in particular, through policies and laws, public awareness raising, training and education. It may be assumed that

common non-structural measures comprise building codes, land use planning laws and their enforcement, research and assessment, information resources, and public awareness programs. Thus, these two measures would help propel progression of development which in turn, would lead to empowerment of the community to a huge extent.

Role of CSOs and PRIs

These grassroots institutions play an important role in the process of transforming a community self-reliant in dealing with disasters. The NGOs and CBOs have been working actively at the local level, i.e., at the Gram Panchayat and progressively at the next two higher tiers, i.e., Panchayati Samiti and Zilla Parishad too. The CBOs are usually created at the local level to meet with the demand in service of a particular vocation. The CBOs will thus establish a good rapport and identification at the community level; and are therefore instrumental in dealing with pre-, during-, and-post,-disaster emergency phases. The Gram Panchayat, as the lowest rung of the Panchyati Raj set up will provide an appropriate foundation for the NGOs and CBOs. By coming together, all these bodies alongside PRIs become potential partners for a meaningful DRR at the community level.

Participatory Rural Appraisal (PRA)

Participatory Rural Appraisal (PRA), an approach for rural transformation, pioneered by Robert Chambers (1994), forms an important tool in the process of CBDRR. The PRA explains an increasing family of approaches and methods to enable local people to share enhance and analyze their knowledge of life and conditions, to plan and to act. PRA has sources in activist participatory research, agro-ecosystem analysis, applied anthropology, field research on the farming systems and also rapid rural appraisal (RRA). All together, information through RRA is more elicited and extracted by outsiders; whereas in contrast, information gathered during PRA is more shared and owned by local people. Participatory techniques comprise mapping and modeling, transect walks, matrix scoring, seasonal calendars, trend and change analysis, well being and wealth ranking as well as grouping and analytical diagramming. PRA applications include natural resources management like agriculture, poverty and social programs and health and food security. Overriding behavior by outsiders may explain why it has taken until the 1990's for the analytical capabilities of local people to be better identified and for PRA to become known, grow and enlarge rapidly.

In the sphere of CBDRR, adaptation of PRA method would help identify the vulnerability of the community to a specific natural hazard. It helps in facilitating

the community to develop solutions to the problems faced in the aftermath of a disaster. With the help of CSOs (i.e., NGOs and CBOs), the local volunteers, viz., members of the community at the Gram Sabha are trained in disaster preparedness, which in turn, lead to development of a plan, based on the felt needs of the people. Through PRA method, the process leading to the formulation of the community plan to cope with disasters could be documented. Village Disaster Committees (VDCs) are established to implement participatory process with respect to early warning, evacuation, rescue and relief measures. These committees work toward reducing the impact of natural hazards. Funds are mobilized to create infrastructure to mitigate disaster effects. The plan prepared by community needs to be integrated with the Village, Gram Panchayat (GP), Panchayati Samiti (Block), Zilla Parishad (District) and finally in the State Contingency Plan. As can be gleaned, CBDRR will be successful if only the attitude of the community changes from being dependent on the help and relief from outside to becoming independent and self-reliant in coping well in advance with disaster situations. The community's immediate needs in terms of restoration of livelihoods/alternate livelihoods are to be realized. The solutions to the risks should be practical, simple, doable and within the reach of the community. For this to come about, community solidarity is an important aspect for the success of CBDRR. Once solidarity is effectively built, CBDRR will be sustained. Once a community succeeds in managing declivity pertaining to a disaster and its debilitating effects, CBDRR will be successful, and more to the point, its sustenance well accomplished.

In the words of Prakash Tewari (2004), "one of the NGOs working in the eastern region of India has sensitized the local population to make small simple vulnerability and risk sketches of their areas. In fact, these sketches and maps have been made starting from Village level, Anchal Samiti (Block) level and ZP level. These are easy to make and understand as they are made by the people themselves, who face every year the same disaster and are the most vulnerable and at risk. In reality, the developing countries mainly require techniques, technology, information at the grassroots, involving the local population, non-governmental organizations/ voluntary agencies, who can derive maximum benefit from it." Perhaps, in confirmation to what has been averred, Santosh Kumar (2012) emphasizes that funding for DRR measures should be seriously considered and so designed on the basis of probabilistic risk assessment and exposure appraisal on top of likely disaster damages, which alongside other additional options may provide better opportunities to DRR and sustainable development in an inclusive blueprint.

To recapitulate, the CBDRR amounts to: building skills of the community to survive disasters; help vulnerable sections of the society to prepare contingency plans and form task force groups to get set against disasters; build the competence of the community to initiate the rescue, recovery, relief and reconstruction activities as options to looking for external help; reduce vulnerability of community in opposition to natural hazards besides helping build its own asset base; and enlighten the public above and beyond to lend a hand in reconstructing and that the disaster preparedness process put into practice over time. One can even glean from the past performances of the community during disasters, rural people have shown an amazing ability to express and analyze their local, different and complex realities which are often at odds with the top-down realities imposed by professionals, in order to put forth their best efforts to make India, a well prepared homeland for DRR on the World map.

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Transition from Relief to Recovery –Role of Community

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Abstract

Globally, communities are facing a series of new challenges, ranging from climate change to the energy crisis, from food insecurity to citizens' insecurity, from financial and economic crises to growing global inequalities. Local risk landscapes are changing fast with frequent and intense weather events, societal and environmental stresses which are becoming increasingly uncertain and unpredictable. As a result, despite all concerted efforts at development interventions, many current approaches have had only a partial impact. Therefore, more effective approaches and strategies are needed so as to enhance the abilities of vulnerable communities to deal with and counter the uncertain constellation of economic, social and environmental risks that they confront for creating Sustainable Community Resilience.

In the aftermath of any disasters and emergencies, there is often a conflict between the emergency and development which is a transition phases when humanitarian needs must be met. The goal in the transition phase must be to avoid a 'circularity of risk'. All transition situations are unique which require flexible responses adapted to the specific context and circumstances. However, all types of transition processes have common feature of community ownership and partnership. Therefore, it is important to ensure that recovery processes are to be strategically planned in consultation with local community members to bring the focus back to communities, their capacities and local institutions of democratic governance to enhance the abilities of vulnerable communities in view of Sustainability concerns in Disaster Recovery.

Key Words

Community, Resilience, Recovery, Relief, Transition

Community Ownership and Participation in Post Disaster Recovery

Building Community Resilience encompasses a broad range of interventions-from relief to recovery, as well as preparedness and prevention, Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA).Furthermore, resilience activities can take place at various levels – including building capacity and institutional structures at national level to activities such as ensuring access to basic services in the community. Resilience building also promotes better

adaptation, mutual learning and innovation through effective integration of traditional knowledge and advancements in science and technology leading to effective and early recovery.

In post-disaster transitions, recovery tends to be broad in scope, as disasters can affect various sections of society simultaneously. Therefore, the involvement of National decision makers is critical to building a consensus around recovery priorities, roles, responsibilities and resources. But, such ownership must empower local actors and strengthen institutions through the transfer of technology and public education.

The Local community can play a vital role in preparedness, response capabilities and disaster mitigation, including advocacy and awareness campaigns, and further the development of early warning capacities and training exercises. Such an approach should include assistance in mapping hazards, risks and the formulation and/or revision of risk-reduction measures. Effective communication with local population about recovery activities is another means of reducing confusion and distress in post-disaster situation and involving them in the recovery process. One of the guiding Principles for Post-recovery also emphasised upon promoting participatory approaches and decentralise planning and programming for recovery (Box1).

Recovery can be divided into two categories:

- Local Authority Recovery: Reconstruction of critical infrastructure and re-establishment of services by local authorities (utility services, roads, buildings, dams); and

Box 1.1: Guiding Principles for Post- Recovery

- Mainstreaming disaster risk reduction in recovery and development process,
- Improving coordination,
- Promoting participatory approaches and decentralising planning and programming for recovery,
- Enhancing safety standards and integrating risk reduction in reconstruction and development,
- Improving the living conditions of the affected communities and sectors,
- Building local and national capacities for increased resilience, risk management and sustainable development,
- Taking advantage of ongoing initiatives,
- Gender sensibility,
- Demonstrative effects,
- Monitoring, evaluation and learning.

(Source: GFDRR)

- Community Recovery: Community actions to limit losses, reduce suffering, and restore the psycho-social and economic viability of the community.

Therefore, there is a need to strengthen decentralized capacities that promote participatory approach towards better recovery. Local community members are the cornerstone of disaster relief and recovery efforts and set the framework for multi-sectoral response. Community participation has important role being the primary source of information on understanding of local needs for an appropriate response leading to effective relief, coordination, damage & need assessment, and recovery from exiting condition leading to community resilience.

Role of Community in Post Disaster Transition Phase

- **Community Contingency Planning (CCP)**

  CCP is a management process that analyses specific potential events or emerging situations that might threaten society or the environment and establishes arrangements in advance to enable timely, effective and appropriate responses to such events and situations. Contingency plans for recovery and reconstruction in highly disaster prone areas need to be drawn out during the period of normalcy. One key component of an effective community recovery effort is the awareness and coordination of all community recovery activities as they are being carried out. Recovery activities work best when expertise and resources are shared among volunteers, government and community representatives.

  To ensure this, communities leaders needed to coordinate support from all levels of government, various service agencies, and the general public to develop **Community Task Force (CTF)** including trained members of the community, comprising of representatives of contributing organizations dedicated to work together to meet the needs of residents. The CTF constituted at local level support in developing CCP at various levels is given in Figure1.

  Different **Participatory Appraisal tools/methods** like Seasonal calendar, ranking, transect walk and focussed Group Discussion may be used while developing the basic profile of the community with support of Community leaders, Community members and CTF. It supports in developing:

  - The data on occurrence of disasters in last ten years in locality, risk and dangers considered most serious and common problem encountered by the community to reduce the disaster risk.

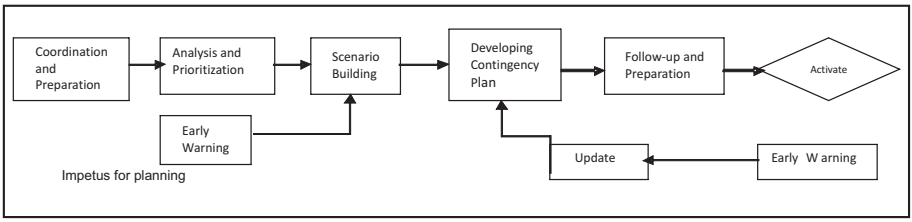

Figure 1: Contingency Planning Process

- Social and resource map of the community indicating Schools, Public building, Sewage system, critical infrastructure etc. found in the community.
- Various government basic services available in the community- health care, education, water &sanitation, relief assistance, livelihood, security and legal assistance.
- Role of community before, during and after a disaster hit a community.

- **Post Disaster Need Assessment (PDNA)**

  It is logical that the community should be the first line of stakeholders in preparing and responding to the event of disaster. The first step after stabilizing the situation by providing sufficient relief is to assess the damage and need. A meticulously executed assessment exercise would provide an ideal base for the rehabilitation efforts. The assessment process should be a consultative process taking into account the views of local community viz. men, women, NGOs, Community Task Force. Local residents and groups are in a position to best identify their immediate needs, coordinate preparations, supplement official response efforts, implement emergency response programs, and contribute to local decision making for future events. This exercise is best carried out through multi-disciplinary teams which go into all aspects of damage (social, economic, psychological) in coordination with the local community. During PDNA, resources should be identified and the roles and responsibilities of all concerned must intent to:

  - Provide the identification and evaluation of existing needs in context of loss of life and livelihood damage to housing, infrastructure and impact on health and environment.
  - Identify the capacities and capabilities of men, women, adolescent girls and boys in post disaster situation.
  - Promote the identification of programmatic gaps and shortfalls.
  - Anticipate the future short-terms needs and potential response gaps.

- Facilitate post disaster, gender aware and context specific roadmap for operational planning across sectors.
- Support in providing the adequacy and efficiency of service provisions in terms of resources that will enable all to improve their well-being and discourage dependency which would facilitate smooth transition from recovery to development.
- Support in designing recovery project that are informed by the articulated needs, priorities and interest of all.

- **Coordination**

  In the immediate aftermath of any disaster, there is a pressing need to ensure the coordination and distribution of the millions of tonnes of relief materials and a number of players who arrive on the scene. Recovery activities are taken up by government agencies, local bodies, international agencies, voluntary organisations and other, through separate, overlapping and uncoordinated interventions. This leads to imbalances in the scale of operations, duplication of efforts in some areas, gaps in other and leakages and misuse of resources. Therefore, establishing framework for coordination is necessary for effective recovery.

  The role of Community leaders, CTF and Voluntary Organisations is extremely useful in post disaster coordination. Local administration is required to set-up a Coordination Centre (CC) from above group to coordinate the relief and rehabilitation activities of the multiple organisations so that they are not just remain concentrated in few pockets. Here, CTF play a multiple role in coordination of relief and rehabilitation work as under:

  - It may provide with details of requirement and need of local community to avoid overlapping in terms of allocation of resources and newly built infrastructure like schools & primary health centres for reconstruction and need based distribution of other relief materials. They facilitate coordination between government agencies and CSOs on the one hand and the village community to ensure a proper flow of benefits.
  - Information Management: The CCs may enable at wo-way flow of information from government agencies to the village cluster and vice-versa. It ranges from logistics and data collection to people's health and psycho-social status. It ensures that information from the district administration on damage assessment, village adoption polices and government resolutions reach the village community.

- Grievance Redressal: The CCs also worked as platform for grievance redressal for the affected people and also support in damage assessment. One such Coordination Centre named "Setu" came up after Gujarat Earthquake investigated several such complaints, their findings and conveyed to government agencies, to warrant a re-assessment of the damage. As a result, several families were granted higher financial assistance to build seismically safe houses.
- Advocacy: The CCs may also identify a range of rehabilitation issues and may voice them at appropriate forums for resolution. For example, after the Gujarat Earthquake, people in Boladi village, were using schoolrooms to store fodder. The teacher no longer came to the school because there were no arrangements for room and school board. While talking to the villagers, the setu team discovered that villagers were keen to send their children to school and willing to provide the teacher with housing and food arrangements. Further enlisting the participation of the villagers and serving as a liaison between them and the teacher, the setu helped to reopen the school.

- **Psycho-Social Support**

  Psycho-social support in the context of disasters refers to comprehensive interventions aimed at addressing a wide range of psycho-social problems arising in the aftermath of any disaster. It is important to consider the different levels of psycho-social support that can be offered to people affected by disasters, depending on their different needs. It is vital that psycho-social support is coordinated and integrated with other recovery efforts. It is also important to recognise the impact that disasters can have on the social cohesion of communities. The health providers need to understand these systemic issues and support the community in helping itself through the recovery process. Normalisation of emotional reaction is an important task in psycho-social care for the survivors of the disaster. Emotional reactions such as guilt, fear, shock, grief, vigilance, numbness, intrusive memories, and despair are responses of people experiencing unforeseen disasters beyond their coping capacity. Emotional reactions are normal responses to an abnormal situation. Nearly 90% of survivors of disaster do undergo these emotional reactions immediately after the disaster. The psycho-social care is essential for all these people.

  The community is the first responder in the event of any disaster and plays an important role in relief, rehabilitation and recovery. The community members understand the local culture and customs better than the outsiders.

Therefore, it is essential to associate them in strengthening awareness, and resilience of the society. A large number of community level workers (CLWs) participate as important team members for providing psycho-social support to the community. These CWLs help the survivors understand and identify local hazards, vulnerability and risks of different communities, changes that they experience in their body and mind due to traumatic experiences and losses, decreasing physical and emotional reactions and minimise the panic, fear and apprehension. They could also rehabilitate and help in recovery by training the survivors for follow-up and referral programmes, designed for psycho-socialsupport interventions by other institutions.

- **Status of Recovery Action in India**

Post disaster response and relief is well institutionalized in India due to well laid out institutional structure and dedicated funds in form of State Disaster Response Fund (SDRF) and National Disaster Response Fund (NDRF) and capacity development over the years. Recovery by far has been stand alone and ad-hoc due to lack of any dedicated fund and institutionalized mechanism though in few mega disasters project based recovery programmes were undertaken with external assistance. The focus so far has been disaster mitigation, preparedness and response/relief. Post disaster recovery has not received as much attention in India.

Recovery extends beyond relief and humanitarian assistance. It is about restoring services and infrastructure, developing resilience through rebuilding shelter and livelihoods, and reducing risks and enhancing the community resilience through Disaster Risk Reduction (DRR) and social protection. While the Government of India has made provisions for relief through National Disaster Response Fund and State Disaster Response Fund, recovery as a policy has not been given adequate attention, except in cases involving large-scale disasters. It is an aspect of disaster risk management, which needs to receive greater attention at the level of policy, financial allocations, and programmes.

A number of large-scale disasters in India happened during the last two decades namely Latur and Bhuj earthquakes, Indian Ocean tsunami, Odisha Super-cyclone, Sikkim Earthquake, Uttarakhand floods and cyclone 'Phailin'. There is a significant amount of learning from their recovery programmes. The details of few of these are provided below:

- **Kutch Earthquake, Gujarat (2001)**

During the immediate aftermath of the earthquake, a holistic comprehensive reconstruction and rehabilitation programme was initiated by Government

of Gujarat with the establishment of Gujarat State Disaster Management Authority and formulation of Reconstruction and Rehabilitation Policy (2001) with the objective of promoting sustainable recovery in disaster affected areas and laying the foundation for creating and developing sustainable community capacities for minimising the impact of future disaster and early recovery. One of the salient features of Gujarat Reconstruction Programme was to promote Owner Driven Construction by providing technical guidance and training to the large number of engineers, architects, masons and local community representatives to ensure that newly built houses are hazard resistance.

- **Reconstruction Scheme with Community participation**

  One such reconstruction scheme was meant for villages with more than 70 per cent of structures damaged. For relocation of such villages, the Gram Sabhas or the Village Councils were required to pass are solution in consent with villagers. Accordingly, different categories of households such as landless labourers, marginal farmers, small farmers and other farmers were got entitlement to plots for reconstruction.

- **Kosi Flood, Bihar (2008)**

  On 18 August 2008, the Kosi River burst through its eastern embankment about 13 km upstream of the Kosi Barrage leading to massive flood in five northern districts of Bihar. At the peak of disaster, 362 relief camps were set up by State Government, about 4.5 lakh flood victims were living in those camps. Distribution of immediate relief items like food and medicines were done by local Self Help Group of Women constituted with support of Anganwadi Centres. The State Government formulated Kosi Recovery and Reconstruction Project for complete restoration on policy of sustained economy and environment. Some of the salient features of project ensuring community resilience and participation were Owner Driven Reconstruction, strengthening flood management capacity with enhanced flood forecasting and community capacity building, developing social and financial capital like Community Institution, Community Investment Fund for expending livelihood opportunity of affected people.

Although, some of the recovery activities are being initiated at State and National level after every large scale disaster in India, but a Comprehensive Disaster Recovery Framework at National Level is yet to be formulated as the window of opportunity to rebuild better. There is an urgent need for putting in place an institutional mechanism for recovery in the country covering

legal, policy, and organizational set up, financial mechanism, approach & scope of recovery planning with sustainable community resilience as the goal.

The framework would not only help in better organising post disaster recovery activities but also strengthen the institutional and community resilience to disaster and ensure sustainable planning. It has been recommended that framework on recovery may encourage the build-back-better concepts clearly. The recovery efforts should be integrated with early recovery/relief phase as well as developmental planning and ongoing programmes / schemes. It may aim at a multi-sectorial, multi-stakeholder community centric, participatory, focused and inclusive approach and have in built flexibility for contextualization to specific needs of states. Recovery may primarily include shelter, livelihoods, infrastructure, social services like health and education, DRR & CCA, urban and regional planning, coordination mechanism, owner-driven and need based recovery. It should facilitate setting up of coordination mechanism at national, state and district levels, provide an enabling environment, define time frames, set benchmarks /Standards/ SOPs for land acquisition, compensation etc. It may also include financial mechanism and protocol for resource mobilization including sources for funding, modalities/protocols for external/international assistance and leveraging/dovetailing with ongoing schemes. It may further prescribe a grievance redressal mechanism and ensure accountability. Thus, National Recovery Framework should be an actionable document and should recommend tools for social impact assessment as well as measuring progress of recovery.

Conclusion

Disasters often wipe out critical infrastructure, government capacity and hard-won development gains, requiring post-disaster transition phases to include sustained support for the immediate restoration of livelihoods and basic social services, as well as preparedness measures that reduce future disaster vulnerability of the community. It should be community driven rather than externally imposed and must emphasis on social, economic and psycho-social recovery as equally important areas as recovery of physical assets & infrastructure. Being the first responder, local communities can provide a sense of connection in times of disaster. Therefore, disaster-recovery programme may be developed together with the affected communities with an awareness of the existing socio-economic situation leading disaster to become a development opportunity. It put community on a path of sustainable development with

inclusion of several cross-cutting issues such as gender, environment and social cohesion to measure the social impact of recovery action in India.

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Vulnerability Assessment of Soil Loss using USELE in Darjeeling District, West Bengal - A Geoinformatic Appraisal

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Abstract

Soil erosion is a growing problem especially in areas of agricultural activity where soil erosion not only leads to decreased agricultural productivity but also reduces water availability. Soil loss is also an important factor for reduction of stability in the hill region and continuous loss leads to land slide. Universal soil loss equation is the most popular empirical model to estimate, predict and management of soil loss. With advancement in remote sensing and geographical information system, it's become a powerful tool due to its ability to accommodate larger area coverage for assessing erosion at small scales. The current study is an effort to predict estimated soil loss of Darjeeling district. For prediction estimated universal soil loss equation has been adopted in Geographical Information System framework. The R- factor has been calculated from existing meterological data of the region. K factor has been estimated from existing soil maps of the region. LS factor has been calculated from 30 metre digital elevation model. Estimation of C-factor based on land cover map prepared from satellite image using supervised classification technique. Based on all these data finally an attempt has been made to assess, and finally to estimate dynamism of universal soil loss equation (USLE) method.

Keywords

Universal soil loss, Remote Sensing, GIS, Landslide, Disaster management

Introduction

Soil from the world's crop lands is being swept and washed away 10–40 times faster than it is being replenished. The United States is losing soil 10 times faster than the natural replenishment rate, while China and India are losing soil 30–40 times faster (Pimentel 2006[1]). Around 60% of eroded soil ends up in rivers, streams and lakes, making waterways more prone to flooding and to contamination from fertilizers and pesticides. Erosion also reduces the ability of the soil to store water and support plant growth, thereby reducing its ability to support biodiversity (Pimentel 2006[1]). Numerous human-induced activities,

such as mining, construction, and agricultural activities, disturb land surfaces, resulting in erosion. Soil erosion from cultivated areas is typically higher than that from uncultivated areas (Brown 1984[2]). Along with climatic activity and environmental impact soil erosion become a larger problem in many region (Julien 1998[3]) and continuously putting stress on cultivation and Surface water. Continuous transportation of sediment enhancing flooding mechanism (Morgan 1995[4]). Continuous soil erosion leads to geological instability of the region and generate frequent and extensive mass movement (Lee 2004[5]). How significantly these mechanisms affect rates of erosion depends on several factors including percentage of ground cover, soil texture, soil structure, soil porosity/ permeability, and topography (i.e. slope gradient) (Rainey, 1991[6]).

Land is a very precious resource in hill areas such as Darjeeling. With development of rapid tourism, a great deal of urbanization has taken place and subsequently there is a lot of pressure on land. This has led to many environmental problems such as deforestation, decimation of water catchments, destruction of endangered fauna and flora, soil erosion, landslides, water pollution, sedimentation and downstream flooding (Ahmad et al. 2006[7]; Pradhan and Lee 2009[8])

The environmental hazard caused by hill land development is that of high rates of soil erosion which has occurred in many parts of the hill slopes. Deforestation is closely related to hill development as hills are usually densely forested before they are developed. All these activities have destroyed the natural forest cover and exposed steep slopes to erosion. Over the last decades, it has led to landslides (Pradhan 2010a, b [9]). Geomorphological processes such as rain splash erosion and surface run-off erosion have been shown to be extremely high in wet hill areas. Given the high intensity of tropical rainfall within short durations, the erosivity of rain and run-off are main causes for loosening the soil, weakening slopes and ultimately leading to mass movements of solid and semi-solid materials such as soil creep, land slips and landslides (Brunsden and Prior 1984 [10]; Lim and Lee 1992 [11]).

Natural Hazards Assessment is primary and necessary step to initiate the land use planning. Various quantitative models have been produced for the assessment of the soil erosion loss, to protect the land used and minimize the erosion. Among them, the Universal Soil Loss Equation (USLE) (Wischmeier and Smith 1978 [12]) is a widely applied empirical model, which is able to assess mean soil loss per hectare per year. On the other hand, Geographical Information Systems (GIS) are a useful tool for mapping and monitoring eroded areas. An integrated application of RUSLE model combined with GIS techniques usually implements the assessment of the soil erosion.

Study Area

Darjeeling is a town in the Indian state of West Bengal. A popular tourist destination, it is located in the Mahabharat Range or Lesser Himalaya at an average elevation of 6,710 ft (2,045.2 m). It's geographically extends to 27 Deg. 13 Min. N to 26 Deg. 27 Min. N Latitude and 88 Deg. 53 Min. E to 87 Deg. 59 Min. E Longitude covering almost 3,149 Square Km. Annual average mean maximum and minimum temperature is respectively 14.9 °C& 8.9 °C with monthly mean temperatures range from 5 to 17 °C. Annual estimated rain fall is well above 3000mm. Darjeeling is a part of the Eastern Himalayan zoo-geographic zone. Flora around Darjeeling comprises sal, oak, semi-evergreen, temperate and alpine forests. Dense evergreen forests of sal and oak lie around the town, where a wide variety of rare orchids are found.

Mainly seven different soil series have been found. Ramman series found in the very deep slope of the Eastern Himalayas 2100 m above mean sea level. There land is covered by the bushy type forest or barren land. Chhota Mangwa series consist of coarse-loamy, mixed, thermic types of soil and mainly found in 1500 m above mean sea level, very deep slope of eastern Himalaya. It is covered by natural forest vegetation. Parent material of this series soil is granite gneiss. Bijanbari series contain fine-loamy, mixed, thermic soils mainly observed in 850 meter above mean sea level in the eastern Himalayas. Top soil is covered by cultivated crops like maize, paddy, ginger, pulses etc. quartzite rocks is a parent material in the Bijanbari series. Next, Barbung series where loamy-skeletal, mixed, thermic, typic haplumbrepts types of soils are found. It is found above 1700 meter from mean sea level, very steep slope of eastern Himalayas, top soil of this series is covered by natural and planted forest. Gneiss and schist are the parent material of this series. Coarse- loamy, mixed, hyperthermic soils are found in the Kharaibari series. It is found in 120 m above mean sea level in the Indo- Gangetic Alluvial plain (Tista plane), in this series soil is covered by Paddy, Tal and Sishu. Parent material is alluvium. Kumargram series is found in the 80 m above mean sea level in the Indo- Gangetic alluvial plain. The parent material of this series is old alluvium. And this type of soil is covered by tea garden. At last Daraboy joy series which is characterized by coarse-loamy, mixed, hyperthermic, aquicudifluvents soils. It is found in the Indo- gangetic alluvium plain, 130m above mean sea level. This serirssoilis covered by paddy, bamboo and grass. Parent material of this series is alluvium.

Materials & Methodology

Data Used

- LANDSAT TM satellite data used for landuse / landcover.
- ASTER GDEM data used for slope

Soil erosion assessment by USLE model

In this study, the USLE model was used to estimate the average annual soil loss, which is expressed as mass per unit area per year (tons/ ha/year). USLE is an index method and interplay of how climate, soil, topography, and land use affect soil erosion caused by raindrop impact and surface runoff (Arnoldus 1981[13]; Lee 2004[5]). In general, erosion depends on the amount and intensity of rainfall and runoff, the protection provided to the soil by land use against the direct forces of raindrop impact and surface runoff.

The USLE was applied in a GIS medium to determine the average annual soil loss and its distribution in the study area. The USLE (Eq. 1) predicts soil loss for a given site as a product of six major factors whose values at a particular location can be expressed numerically.

In USLE model, soil loss rate is calculated as:

$$A = R \times K \times LS \times C \times P(1) \qquad \text{[Eq. 1]}$$

A is Annual soil loss (tons/acre) resulting from sheet and rill erosion. This is the predicted value resulting from the execution of the equation above

R Rainfall runoff erosive factor

Rainfall-runoff erosivity factor. This factor measures the effect of rainfall on erosion. The R factor is a summation of the various properties of rainfall including intensity, duration, size etc. It is computed using the rainfall energy and the maximum 30 minutes intensity.

$$R = 79 + 0.363x \qquad \text{[Eq.2]}$$

Where, x = rainfall in mm.

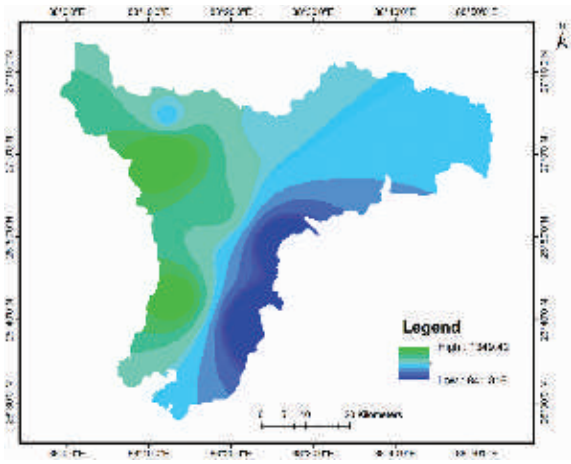

Figure 1: R factor layer of Study Area

K soil erodibility factor

It is a function of percentage of silt and coarse sand, soil structure, permeability of soil and the percentage of organic matter. K factor is based on the soil types and calculated from existing soil map of Darjeeling district.

Table 1: Soil Type and K Factor

Soil Series	Silt	Organic Carbon
Ramman	6393628.00	4.94
Chhoto Mangwa	619342.00	4.15
Bijanbari	619100.00	2.38
Barbug	630104.00	2.27
Kharaibari	642506.00	0.75
Darabojoy	637688.00	0.30
Kumargram	621155.00	1.15

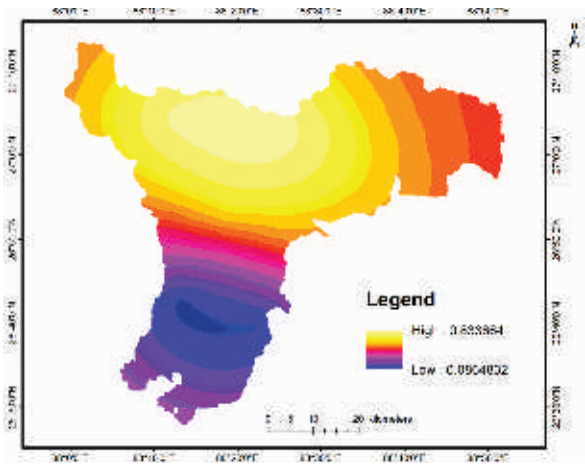

Figure 2: K factor layer of the Study Area

L and S Terrain factors

L is the Slope length factor. This factor accounts for the effects of slope length on the rate of erosion and S is Slope steepness factor. This factor accounts for the effects of slope angle on erosion rates. All things being equal, higher slope values have greater erosion rates. USLE represents the combined effects of rill and inter-rill erosion. Rill erosion is primarily caused by surface runoff and increases in a downslope direction because the runoff increases in this direction. Inter-rill erosion is caused primarily by raindrop impact and is uniform along a slope. These factors are typically calculated together for input into the equation as:

$$L \times S = (/22.1m)\,(0.065+0.045S+0.0065S2) \qquad [Eq.3]$$

Where, "/" = slope length; "S" =slope steepness; and "m" depends on slope

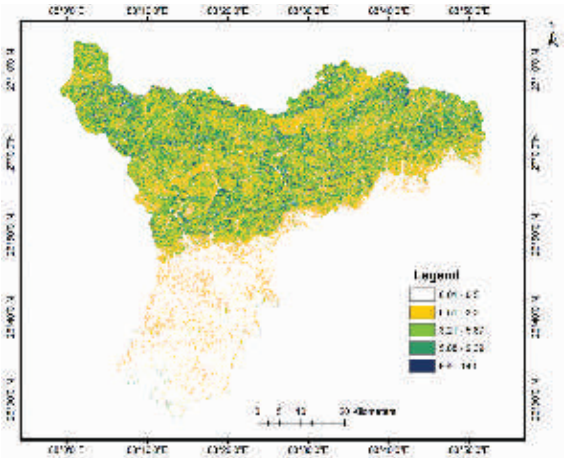

Figure 3: LS factor layer of the Study area

C factor Land cover and management factor

Cover management factor accounts for the influence of soil and cover management, such as tillage practices, cropping types, crop rotation, fallow, etc, on soil erosion rates. It was derived from a land use/cover classification from the satellite data.

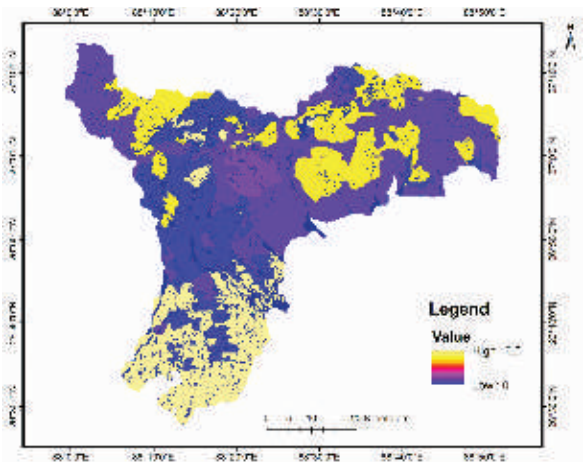

Figure 4: C factor layer of the Study Area

P factor Conservation practices factor

P is Erosion control factor. Accounts for the influence of support practices such as contouring, strip cropping, terracing, etc...

In the absence of conservation practices data in this study area, P factor was assumed as 1.

Soil erosion mapping

Based on the factors describe earlier the annual soil loss has been calculated and incorporated in maps with the help GIS frame work. Later it classified into different zones based on the amount of loss calculated through the empirical equation [Eq.1].

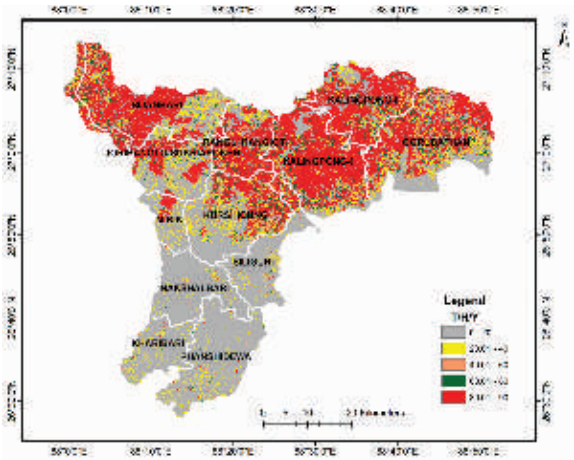

Figure 5: Soil Erosion Map

Results and Discussion

Due to heavy deforestation and excessive cultivation of root crops like ginger, potatoes, onions, cardamoms etc. the extent of soil erosion has increased considerably in the recent times. It is a fact that the entire Darjeeling hill areas do not get any soil deposition. Deposition of soil is only found in the river valleys. Thus, the prevention of soil erosion and conservation of soil is very necessary in the hills. It has been clearly observed mostly in the hilly terrain of Darjeeling district is under severe soil loss problem. Kalimgpong I and II, Bijanbari, Jorbanglo and portion of Gorubathan and Mirik block is very much endanger.

Vulnerability been analysed correlating previous land slide occurrences location and soil erosion map and based on that analysis the Darjeeling district been divided into different risk zones. Based on the above figure we can conclude that the Kalimpong I, Kalimpong II and Rangli – Rangliotare possess sever risk. Rate of risk is also high in Kushioung and part of Bijonbari area. Although as a whole the condition in Kalimgpong sub division is very high where frequent land slide can be observed.

Soil erosion and its conservation play an important role in the hilly areas. Replantation of trees and adapt a sustainable deforestation policy at management

level which can be very useful to control severe damage and to promulgate newer growth. Strict conservation policy should be applied also into infrastructural sectors and conservation policy should be based on different scenarios generated with changes in landuse /landcover for better conservation and protection.

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Fodder Minikit as a Drought Mitigation Measure – A Case Study of Chitradurga District

Dr. Amita Prasad*, Dr. Ashok Sanganal**

Abstract

Almost every year, over 50 of the talukas in Karnataka are affected by drought leaving principally the farming community and their live stock at severe distress. The fodder deficiency during drought results in reduced animal productivity, livestock death or distress sale livestock. To mitigate the risk, the Government of India and the State Government are supplying the fodder mini-kit containing fodder seeds to farmers to grow improved variety of fodder. A case study of Chitradurga district in Karnataka is carried out to assess the impact of fodder mini-kit distribution on the production of fodder, benefits to farmers and livestock, prevention of distress sale of livestock, as a drought mitigation measure, strengths & weaknesses of the scheme and implication on the policy are some of points highlighted in the article.

Key Words

Fodder, drought, Farmers, Livestock, Minikits

Introduction

Drought is common in Karnataka and on an average more than 50% of the talukas are affected by drought every year. In the year 2012-13, the GoK had declared 57 taluks out of 177 as drought affected. Leave apart the drought years, in normal years also there is 21% dry fodder and 46% of green fodder deficiency. Unfortunately, in our country, the problem of fodder shortage is realized only in scarcity conditions and drought periods instead of having a long-term policy. Karnataka is experiencing scanty rains and drought for the last three years. Central funds have come in the big way to mitigate the drought. During drought years the deficiency comes to 60% in case of dry fodder and 85% in case green fodder. Under such situation, animals are not fed adequately by the farmers due to scarcity of fodder during drought. Fodder is important for keeping the animals in good health. This helps our rural community to use these animals for agriculture operations, livelihood and milk production. Unfortunately our livestock is not in better condition on account of fodder scarcity. Livestock provides livelihood support to millions of people both in rural and urban areas who having little access to land. This includes both men and women. Animals provide milk, egg, meat, wool, hides and skins. Livestock plays an important role

in improving food and nutritional security by providing nutritious food. It is also a major supplier of manure for crop production. In totality, this sector helps in augmenting and stabilizing farm income. This sector having strong forward and backward linkages with other sectors in the economy has vast employment potential. In Karnataka, the value of output from livestock accounted for more than one fifth of the value of output from agriculture sector.

There is a need to study how the drought minikit scheme has benefitted the farmers in keeping the health and productivity of cattle and other animals.

Objectives of the Study

- To study the procedure and implementation of the drought minikit scheme.
- To Assess the impact of the drought minikit scheme in the district of Chitradurga .
- To study the strengths and weakness of the drought minikit scheme in the district of Chitradurga .

Drought Minikit

The Department of Animal Husbandry supplies small quantities of seeds of improved fodder variety to selected farmers free of cost. This is aimed at encouraging the farmers to grow improved fodder varieties on their farms to meet their fodder needs. Adequate availability of fodder is essential for sustained production of milk, maintaining animal healthcare and productivity. It is necessary to accelerate the production of fodder through intensive promotion of technologies to ensure its availability throughout the year.

Minikit Programme

This programme is in existence for a long time in the State. The state as well as Central government provide financial assistance for the programme. The Government of India procures certified seeds of high yielding fodder crops/grasses/legumes produced at Regional Stations and by other agencies and distributes freely to various states. The state department of animal husbandry prepares small kits called minikits and distribute these among districts and finally to the farms both in the kharif and rabi seasons. The objective of this scheme is to educate farmers through field demonstrations about the latest high yielding varieties of fodder crops and improved agronomic package of practices for increased production of green fodder.

The minikits containing fodder seeds are distributed to those farmers who have irrigation facilities and own cross-breed cows and/or buffaloes. Those who do not have access to irrigation facilities are provided minikits with seeds suitable for

rain-fed conditions. Each veterinary centre receives about 4 to 5 minikits. In such situations, the doctor of the concerned centre identifies the ideal farmers and distributes minikits without much publicity. Doctors distribute the minikits to farmers whoever approach them without strict verification when sufficient number of minikits is supplied under the scheme like the central calamity scheme. The beneficiaries are approved in Gram Shabha meetings so as to minimize misuse or pilferage of minikits.

All categories of farmers are eligible to get the minikits under the scheme There are of course, stipulations about covering women and SC/ST beneficiaries. The coverage of recipients belonging to women and SC/ST categories as per the guidelines was not strictly followed in the implementation of the schemes. The reason attributed was that beneficiaries belonging to these groups did not own any land. Similarly, the women beneficiaries covered, actually did not own any land, bur their family members owned it. However, that does not satisfy the stipulations. Hardly any effort was made to publicize the utility of the fodder trees, perennial and seasonal exotic grasses. Many farmers are not aware of these. Unfortunately, the problem of fodder shortage is realized only in scarcity conditions and drought periods instead of having a long-term policy.

Karnataka has the distinction of having the second largest share of the drought-prone areas of the country. Weather has not been very kind and dependable in the state and drought like conditions occur without any previous warning throwing the entire administrative structure only on one mission and that is to ameliorate the conditions of the drought-affected population. Recent three consecutive years' failure of monsoon bears testimony for this. Agriculture is the most significant vocation that is affected by drought. In a situation of drought the fodder availability gets altered differentially across seasons and regions. The impact of an early kharif season drought on fodder production is likely to be different than a drought spell during crop growth period and followed by a rabi season drought. Hence, one can visualise the impact on two axes namely the 'Climate and Season' on one axis and 'Land Condition' on the other.

Strategies

- Development of Quality Seeds
- Enhancing Production of Fodder
- Adoption of appropriate technologies for Post Harvest Management

Encouragement of farmers to grow green Fodder

Majority of farmers traditionally dependent on rainfall for raising the bulk of its

crops. The failure of rain causes the drought. The livestock are the main victims of the drought. Karnataka has faced many droughts in previous years. Drought in the context of livestock may be defined as a severe water shortage which leads to an unusual deficiency in fodder supply to the livestock and results in reduced productivity or death. Karnataka is having 1.6 crores of cattle and buffaloes and 1.4 crores of sheep and goats. The total fodder dependent livestock is 3.28 crores (2007 Census) to cater the fodder needs of the livestock.

Establishment of Animal Fodder unit

In Karnataka, Rs 700.00 lakhs has been proposed for 2012-13 for establishment of New cattle feed plant in Sandra village of Shikaripur taluk, Shimoga district with a project cost of Rs.45.00 crore for which Rs.28.00 crores is provided during the last two years .

In the state 56.17 lakh tonnes of feed is required every year. Permission has been given for production of 13.00 MT out of which only 5.00 lakh MT from KMF and 1.50 lakh MT from private manufacturers is being supplied. In order to produce and supply the cattle feed required to the farmers, it is planned to establish the new cattle feed plant in the above said place as the main feed ingredient such as maize, Ground nut Cake etc. which are abundantly available around the district. In order to encourage the farmers to grow fodder crops, the GoK has initiated the subsidy of Rs. 3.0 Lakhs with beneficiary contribution of Rs. 3.0 Lakhs to cover a total of 7500 farmers having irrigation facility to grow fodder crops in 10 Guntas of land by each farmer. A financial target of Rs. 2.00 Crores has been earmarked during 2012-13.

Fodder Development in the State

Rs. 300.00 lakh are proposed for this scheme for Annual plan 2012-13. Under this scheme, funds will be utilised to take up Fodder development activity in 114 backward Taluks where the farmers rearing the animals and having irrigation facilities to encourage the perinial fodder, cultivation in 10 guntas per farmer at a cost of Rs.6000/-. Where in the farmer has to contribute himself Rs. 3000/- and subsidy of Rs. 3000/- will be provided to each farmer and also for purchase and distribution of chaff cutters to the farmers to minimise the forage waste and to manual enhance the desirability of the fodder in animals.

As seen from the table above, there has been sudden increase in the distribution of fodder minikits during the years 2007, 2010 and 2012. The reasons could be attributed to more demand by the farmers and severity of drought and scarcity of fodder. There was also proportionate increase in production of green fodder during these years.

Green Fodder Production Through Minikit Distribution in Karnataka

Sl.No	Year Wise	Distribution of Minikits	Sown area (Hectares)	Production of Green Fodder (MT)
1	2006	114251	11425.10	571255
2	2007	310937	31093.70	1554685
3	2008	123900	12390.00	619500
4	2009	82663	8266.30	413315
5	2010	297447	29744.70	1487235
6	2011	142860	14286.00	714300
7	2012	361973	36197.30	1809865
8	2013	574111	57411.10	2720555

Availability of Fodder

Leave apart the drought years in normal years also there is 21% dry fodder and 46% of green fodder deficiency. During drought years the deficiency comes to 60% in case of dry fodder and 85% in case green fodder. The national commission of agriculture has recommended 8% of the total cultivable land required to be brought under fodder crops. Whereas the national average at present is 3.99% and that too in Karnataka it is only 0.7%. per year.

By supplying the fodder seed minikits free of cost to the farmers who have got irrigation facility to their land is one of the successful way of mitigating the fodder scarcity. The seeds of fast growing and nutritious fodder crop verities like African tal maize, sorghum , multicut varieties of sorghum and sudan sorghum were distributed to the formers of drought hit area. Each minikit containing fodder seeds sufficient for sowing 0.10 hectare were supplied with a note on package of practices. The green fodder grown was mainly used to feed the lactating animals, hence the milk production in the Karnataka was not affected during drought period.

Karnataka State Live Stock Development Policy

Karnataka has 307 lakh livestock, 424 lakh domestic poultry and produces 45 lakh MT of milk,1.14 Lakh MT of meat and 18600 lakh eggs annually (2008-09).The state ranks 10th and 3rd in the country in milk and egg production respectively. 38 rural households have livestock and ,or poultry. The annual growth is 5% and livestock sector contributes 2.96% to State GDP

Main focus of the livestock development policy is to augment farmers income through accelerated growth of livestock sector.

Need for Fodder Production

Karnataka has the second largest share of the drought-prone areas of the country.

Weather has not been very kind and dependable in the state and drought like conditions occur without any previous warning throwing the entire administrative structure only on one mission and that is to ameliorate the conditions of the drought-affected population. Every year on an average, half of the area in the state is experiencing the failure of monsoon. Agriculture is the most significant vocation that is affected by drought. In a situation of drought the fodder availability gets altered differentially across seasons and regions. The impact of an early kharif season drought on fodder production is likely to be different than a drought spell during crop growth period and followed by a rabi season drought. Hence, one can visualise the impact on two axes namely the Climate and season' on one axis and `Land Condition' on the other.

Case Study of Chitradurga District

	Chitradurga District						
1	**Name of the taluks**	**Challakere**	**Chitradurga**	**Hiriyur**	**Holalkere**	**Hosadurga**	**Molakalmuru**
2	**District Profile**	Area:8394.25Sq.km		Avge Rainfall:565mm		Population:533744	
3	**Taluk Profile**						
4	**Population**	332718	376506	264712	197766	219445	126742
5	**Animals**	111566	91906	71630	900500	120920	45376
6	**Food grains [Hect]**	15573	50945	18310	39979	27415	4189
7	**Average Rainfall [mm]**	402.4	590.2	443.8	602.8	463.4	417.4
8	**Minikit Distribution**						
		2009-10	2010-11	2011-12	2012-13		
		Nil	Nil	9200	29140		
9	**Value in Rs term**	-	-	210000	7178000		
10	**Value in Physical term**	-	-	36800M. Tonnes	116560M. Tonnes		
11	**Loss**	-	-	-	-		
12	**Gain in Rupees**	-	-	36590000	109382000		

Minikit distribution includes all the six taluks

Animals in Chitradurga (2007 Census)

Cattle	Baffaloes	Sheep	Goats	Horses	Ponies	Mules	Donkeys	Camels	Poultry	Rabbits
341011	193260	931885	368730	48	2	33	8155	00	1774227	37

Progress achieved in drought mitigation by supplying fodder mini kits in Chitradurga District

In 2011-12 and 2012-13 the number of minikits distributed were 9200 and 29140 respectively with an expenditure of 2.1 Lakhs and 71.78 Lakhs. The green fodder

produced during 2011-12 and 2012-13 was 36800 MT and 116560 MT which could cater to 61333 animals in 2011-12 and 194266 animals during 2012-13. The animals were fed for one month in each year. The coverage of animals only to the extend of 11.42% and 36.17% which implies that a major portion of the animals were left out of the scheme. Hence, there is a need for encouraging the farmers to grow more and more fodder every year in order to meet the fodder shortage during drought conditions.

The progress of fodder mini kit distribution in Chitradurga district covering all 6 taluks during 2013-14 (up to July) is given in the table below;

Sl. No.	Name of the Taluk	No. of Fodder Mini-kits distributed to farmers	Fodder Seed variety	Green Fodder Generation(MT)
1	Chitradurga	1000	African Tall Maize Sorghum	50
2	Chellekere	800	African Tall Maize	40
3	Hiriyur	2820	Sorghum	141
4	Holalkere	2700	African Tall Maize	135
5	Hosadurga	3200	Sorghum	160
6	Molakalmur	1450	African Tall Maize	75
	Total	**11970**		**601 MT**

The farmers of Chitradurga and Holalkere taluks have expressed the need for more number of mini kits than supplied. The farmers grow on an average about 50 tons per hectare and each minikit covers an area of 0.1 hectare of land. It was noted that the beneficiaries covered included small and marginalized farmers and scheduled caste and tribe farmers. Under minikits scheme, so far only 10% of the farmers have been covered. There is a need to expand the scheme of minikit distribution remaining farmers. It is also observed that one minikit per farmer is not sufficient as many such farmers have more number of cattles to be fed. The cost of each kit priced at rupees 260.

Year	Mini kits distributed	Expenditure	Area brought under cultivation in hectares	Total green fodder yield (M.T)	Number of animals fed for a period of one month	% of animals covered
2011-12	9200	210000	920	36800	61,333	11.42
2012-13	29140	7178000	2914	116560	194266	36.17

As seen from the table, the average rainfall in all six taluks of chitradurga district is in the range of 400mm to 600mm which indicates drought situation in all the taluks of chitradurga. The fodder minikits were distributed to the farmers during 2011-12 and 2012-13. Rs .2.1Lakhs and Rs .71.78 Lakhs was spend during these

Ravi S/O Dasappa S.Neralekere
Hosadurga Tq

Shanthanaik S/O Kuberanaik
Bharamasagara Chitradurga Tq

two years for a production of 36800 MT and Rs 1.16 lack MT. By encouraging the farmers to grow fodder through the minikit distribution, an estimated gain of Rs. 3.65 crores and 10.93 crores was achieved in the years 2011-12 and 2012-13 respectively. This gain in terms of monetary value as provided by the department animal husbandry of chirtadurga district is a significant development. Therefore, fodder minikit distribution needs to be enhanced to cover more land. It may be noted that the quantity of fodder produced by the farmers is valued at Rs. 3,65,90,000/- in 2011-12 and Rs. 10,93,82,000/- in 2012-13. As discussed with the officers of the animal husbandry department, the fodder produced has been consumed by the farmers to cater to their own animals. It means farmers have not sold the fodder for financial gains. Those having irrigation facilities got good yield and on rainfed farms the yield was less than the 20 per cent of the average yield due to the shortage of rainfall. The Beneficiaries who had milk animals preferred South African Tall Maize (SATM) seeds and other beneficiaries preferred Sorghum etc. The SATM yielded less fodder compared to other fodder varieties as it offered only one cutting. However, it is more nutritious and when fed to milking cows, the milk yield is enhanced significantly.

Field Observations

In Chitradurga district, the minikits containing seed verities of Sorghum, M.P Cheri, African Tall Maize are distributed predominantly in all six taluks of Chitradurga. Occasionally Lucerne minikit is also supplied to the farmers. These kits are given to the farmers who are having irrigation facilities. Each farmer is given a minimum one kit for cultivation of 0.1 hectares or 10 guntas of land. A minimum of 20MT per acre of green fodder is estimated to be grown. The Survey indicated that there is an increase in the production of milk to the extent of about 40,000 ltrs per month as compared to only 5 to 6 thousand ltrs per month when there was no supply of minikits. Farmers have stopped the distress sale of their

animals during drought due to the availability of adequate fodder. The veterinary hospitals in the Chitradurga district have reported that there has been significant improvement in the health of the animals. There is improvement in the birth of animals and also increased use of animals (Ox, buffalos) for farming work because of better physical ability of the animals. Number of animals keepers is also growing year by year. It is observed that a few farmers about 20-30% do not sow the fodder seeds in their lands and just ignore the kits. This points to the fact that the farmers are not given adequate awareness and education about the benefits of the kits. Suitable measures are required at the local level to encourage and educate the farmers about the improved variety of seeds and technology for fodder growth and preservation of fodder for longer time.

Strengths and Weakness of Drought Minikit as observed in Chitradurga District

Strengths

- Wherever good variety of seeds are used, there is significant growth in the fodder
- Fodder growth of approximately 5-15 MT per minikit per 0.1 hectare has been noticed
- Wherever awareness is created among the farmers about the importance of fodder seeds, farmers have taken serious steps for fodder growth
- High Nutritional value of the green fodder has reduced the mortality rate of animals e.g., in one of the dairy farms, the deaths of 5-6 cattles has been prevented annually by feeding with the green fodder
- The milk production has increased by 15-20% an on average annually in the dairy farms due to the Green fodder feeding

Weakness

- The delay in the distribution and supply of minikits has resulted in little or no use of kits by the farmers due to delayed cultivation of fodder minikits.
- Due to unawareness of farmers about the minikits and their varieties, farmers have not fully utilized the seeds for fodder growth in their lands
- Many times farmers prefer cash crops over the fodder crops
- Mismanagement by the officials and farmers also laid to poor growth of fodder.
- Non availability or unawareness of technology for preserving the fodder has resulted in wastage of fodder.

- Salige pits used for preserving the fodder will help storage of fodder upto 15 years which will cater during drought situation
- The distress sale of animals has been prevented by the farmers.
- Mortality rate of animals is reduced by 50%
- No starvation death reported
- Milk production increase, as per the KMF,
- Health hazards/diseases due to deficiency in fodder supply have been reduced

Advantages Fodder Minikit

- Encourages the farmers to grow fodder
- Farmers gets readily available input to grow fodder
- The cultivated fodder supports the minimum fodder requirement of livestock.
- It helps to sustain livestock productivity
- It also to motivates neighborhood to reserve some part of land for cultivation

Disadvantages of Fodder Minikit

- Inputs supplied are very meager and meets out the fodder requirement of hardly 2-3 animals
- It requires irrigation facility which creates a bias while selecting the beneficiaries
- At the time of drought, supplied mini kits may not come to rescue of overcoming the fodder shortage.
- It requires man power which is not addressed for identification of beneficiaries and supply of kits.
- Inputs supplied may not create big impact to increase the overall fodder crop shortage.

Policy Implications and Options

Chitradurga District is a drought prone area receiving an average annual rainfall of about 400 to 600mm. The farmers have been benefited by the scheme of fodder minikit distribution. The farmers could grow fodder with improved variety of fodder seeds distributed by the Government. Farmers could not only save their animals during drought but also derive benefits such as increased production of milk(10-20%), improved health of animals, increased farming work by the

animals, reduced distress sale animals, increased birth of animals(10-15%) etc. This scheme will help feeding the animals throughout the year irrespective drought situation if adequate encouragement and sufficient number of minikits are distributed to the farmers comprising both irrigated and non-irrigated, marginalized and rich farmers. In Chitradurga, a few farmers have expressed that the seeds are good and have grown more fodder but could not store and preserve the fodder for a longer time leading to wastage and decay of fodder. Therefore, there is a need to take steps to provide the education on simple and cost effective technology to the farmers to preserve the fodder. Livestock wealth is deemed as the oldest wealth resource for mankind and was once a symbol of economic status in the society. Livestock sector plays a crucial role in rural economy and livelihood. This is one sector where poor contributes to the growth directly instead of getting benefit from growth generated elsewhere.

Draught animal power is making a significant contribution to agricultural production and thus to the rural economy. Draught animal power is still relevant and useful due to the fact that it is suitable to the needs of the farmers with small land holding and the areas where mechanized implements can not be brought to use. There is a need for greater awareness among the farmers to grow fodder by using improved variety of seeds and technology so that maximum fodder is grown at lesser effort and cost. The increased production of milk in dairy farms, reduced starvation death of animals, better nutrition, prevention of distress sale of animals, enhanced labour output of animals, increased quantity of organic manure and maintenance of health care of cattle and other animals are some of the benefits of fodder minikits and other methods of fodder development in Chitradurga. Whatever could be the efforts of the Departments and its Officers in distributing the fodder minikits, the sole responsibility and commitment remains with the farmers. It is necessary that the concerned Officers take all steps to make farmers grow fodder by sowing the seeds. This has to become one of the regular and a natural way of mitigating the effect of drought and deficiency of fodder. Necessary funds for silage pit technology or any other preservation methods need to be extended to farmers in order ensure continuity of interest among the farming community.

The GoI had also envisaged that adequate availability of quality fodder is essential for enhancing livestock productivity. For this, at least ten percent of the cultivable land for growing fodder crops was needed. Since major limitation to increasing fodder production is insufficient availability of fodder seeds it was proposed to start a programme on fodder seed production through registered growers in collaboration with State Agricultural Universities and State Seed Corporations. It was also proposed to set up fodder banks through public private

partnership initiative (PPP). The grazing policy for livestock in forest including joint forest management with particular reference to high attitude forest needs to be developed and jointly implemented by Animal Husbandry and Forest Departments.

Animal Welfare during natural calamities and disaster will require attention since such calamities can drive the poor into destitution. A disaster management fund for livestock needs to be created to support livestock owners during calamities. PRIs, NGOs working for livestock welfare need to be involved and strengthened. The National Agriculture Policy, announced by the Government in 2000, which aims to attain a growth rate in excess of 4 per cent per annum in the agriculture sector, stresses the importance of food and nutritional security issues and the importance of animal husbandry and fisheries sectors in generating wealth and employment. Since the present growth rate in crop production is around 2%, higher growth rates of 6 to 8% in Animal Husbandry sector, would help in achieving the targeted growth rate of 4% for the Agriculture sector as a whole. The Policy proposes to accord high priority to diversification of production, increasing protein availability in the food basket, Health care, fodder production, and freedom from animal diseases are some of the other areas of importance, as envisaged in the Policy document.

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Flood Management in Assam: A Case of Bongaigaon Floods 2012

Abhinav Walia*, Indrajit Pal**

Introduction

As we all are aware of the fact that water is vital to life, but the same water is capable of causing mass destruction in the form of floods. In India it has been observed that the northern and the north eastern parts of the country suffer most due to recurrent floods. Kosi and Gandak in Bihar, Ganga, Jamuna and Gomti in Uttar Pradesh and Brahmaputra in Assam bring curse to people residing by their sides almost every year. Continuous rainfall during the monsoon season for months results in over-flowing of the rivers and leading to floods. Aftermath of such a disaster is enormous. Suffering the massive brunt of 2012 flood in the district of Bongaigaon which is still trying to restore things back to normal. Local people and authorities work together to apply flood control measures to achieve stability in this region.

Bongaigaon District Profile

Bongaigaon District is one of the western-most districts of Assam, having an area of 1725.29 sq. km. created in the year 1989, carving out erstwhile Goalpara and Kokrajhar district, while later some areas of Bongaigaon Sadar and Bijni Subdivision were to become part of Chirang District as well. The Bongaigaon district is bounded by Goalpara to the South, Dhubri to the West, Chirang to the North and Barpeta to the East. It extends from 26º 28´ N lat. to 26º 54´ N lat. and 89º E log. to 90º 90´ E longitude. In spite of its small size, Bongaigaon district is fast becoming one of the leading districts of Assam. This district has sufficient potentialities of its own which remain mostly hidden and untapped. Different valuable natural endowments are within the possession of this district. Like other districts of Assam, Bongaigaon district is also frequently hit by different types of natural and man-made hazards/disasters e.g. flood, bank erosion, earthquake, storm, fire, pollution, accidents, etc. Below Figure 1 depicts the geographic location of Bongaigaon.

Density, distribution and growth of population, sex ratio, educational level etc. and a host of other factors affect largely the totality of the social characteristics of population in a region. The district has a population of 621,136 persons equivalent to 2.33% of Assam's total population of 26,655,528 as per the 2001 census. The sex ratio in the district is 945 female per 1000 male and the population density in the

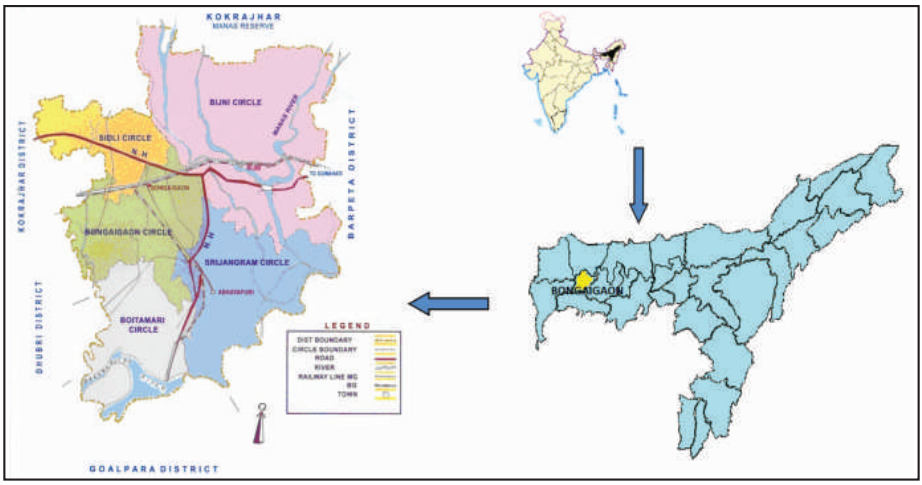

Figure1: Geographic location of District Bongaigaon, Assam, India

district is 360 persons per sq. km. Most of the people in the district (84.35%) live in rural areas.

In view to this, Hazard, Risk, Vulnerability and Capacity Analysis exercises have been carried out by the District Disaster Management Authority. As far as Flood hazard vulnerability in Bongaigaon is concern its period of occurrence ranged between March to August, and it impacts to Loss of life, livestock, crop and infrastructure etc.

Flood is the recurring phenomenon of the district. The general reason of occurrence of flood in Bongaigaon District is the overflow of river Brahmaputra and its tributaries, namely Aie, Manas, Beki and Champa. The annual rainfall ranges between 1847 mm to 5168 mm. Flood occurs generally in the low lying areas of the district during May to August every year. Late flood during the later part of September & October also occurs.

Administrative Setup

Bongaigaon district has three Sub- Divisions including the Sadar Sub- Division and there are five Revenue Circles as shown below with number of Revenue villages:

Bongaigaon (Sadar)	37 Revenue villages.
North Salmara	1) Boitamari Revenue Circle =146 Revenue villages. 2) Srijangram Revenue Circle = 212 Revenue villages. 3) Bongaigaon Revenue Circle = 85 Revenue villages. Total = 443 Nos. of Revenue villages.
Bijni (Civil)	1) Bijni Revenue Circle = 83 Revenue villages.

There are five (5) Development Blocks in the district namely Dangtol, Boitamari, Srijangram, Manikpur, Tapattary.

Causes of Flood & Losses in this Region

Heavy rainfall during the monsoon season contributes to the overflow of the river Brahmaputra and its tributaries, namely Aie, Manas, Beki and Champa, leading to the occurrence of flood in Bongaigaon District. Along with these primary causes, there are some other contributing factors to the floods in the district:

- Excessive water in the channel due to excessive precipitation in the catchment areas.
- Breaching of embankments
- Tributaries are within the close range
- Aggravation of river bed.
- Encroachment in the flood plains.
- Degradation of catchment area in forms of deforestation and loss of soil mantle in Himalayan friable watershed.
- Lack of proper control on landuse
- Negligence and underestimating the flood risk
- Lack of awareness among the communities
- Settlements in vulnerable areas

A brief description of the pattern of rainfall of Bongaigaon

The rainfall in the district usually starts from the month of April in a scattered manner but the monsoon usually starts in the district from the month of June and continues to concentrate till the month of August. The rainfall in the southeastern part of the district is comparatively heavier than that of other parts

of the district in general. During the first three monthly periods, i.e. from March to May, the rainfall, mostly in the form of thundershowers, amounts to nearby 23 percent of the total annual rainfall. The south west monsoon normally arrives over the district towards the end of May and it usually lasts until the October. The rainfall during the four months i.e. from June to September constitute nearby 69 percent of total rainfall.

Rivers and Water Bodies in and around the District

The Brahmaputra River flows through the southern part of the district carving out the alluvial flood of that region. The Aie, Manas, Champa, etc are the important tributaries originating from the Shiwaliks and Bhutan Himalayas and after flowing in southward they merge into the Brahmaputra river. Other tributaries and sub-tributaries that flow through the district are Kujia, Tunia, etc. The district has various wetlands such as the Tamrangabil, Konorabil, Doloanibil, Kochudolabil, Kothaibil, etc. Below Figures 2 and 3 depicts the administrative boundary, water bodies of Bongaigaon and Figure 4 Flood Hazard map of Assam.

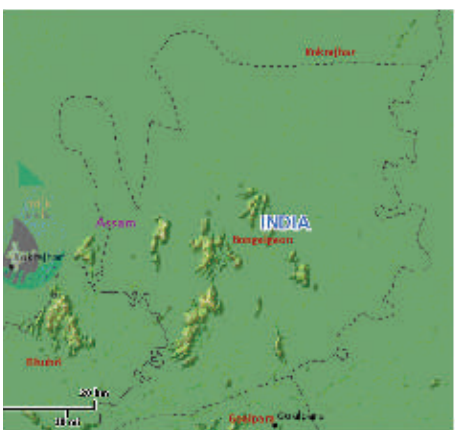

Fig. 2: Digital Elevation Modelof Bongaigaon

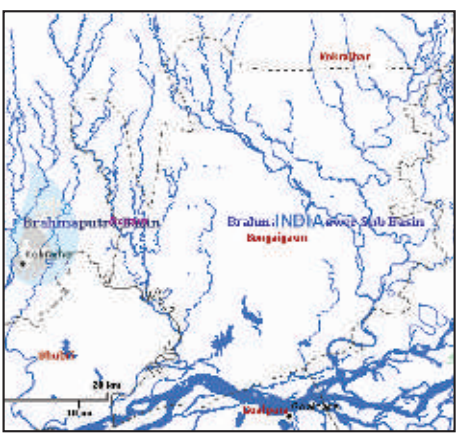

Fig. 3: Water bodies of Bongaigaon

Satellite data was acquired during the floods of 1998-2007 by NRSA and flood Inundation was extracted from these satellite datasets. These layers were integrated to generate a flood hazard layer, which provides the details on how frequently a given area is subjected to floods. About 90 satellite datasets were used for creating this layer. The frequency of inundation observed is further classified into different categories based on the frequency of flood inundation for a particular area:

- **Very low - for 1-2 times**
- **Low - for 3-4 times**

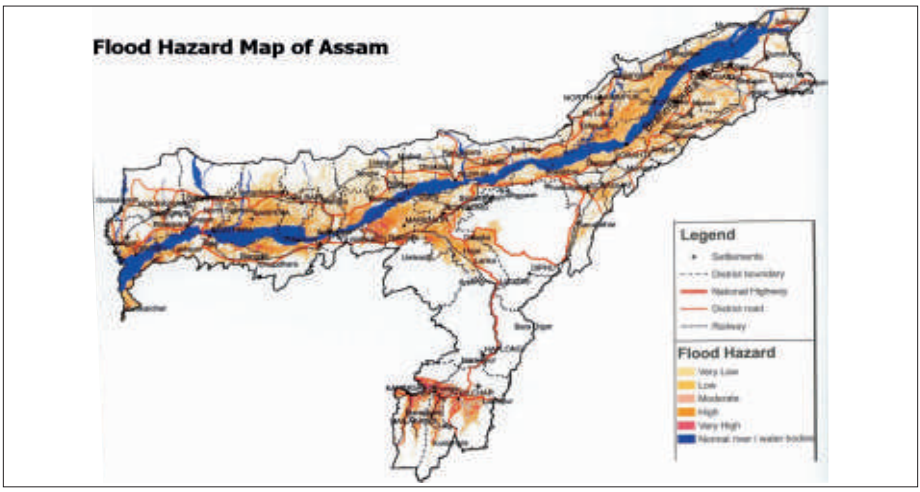

Figure 4: Flood Hazard map of Assam (Source: Modified after Flood Hazard Atlas for Assam State – A geospatial approach, NRSC)

- **Moderate - for 5-6 times**
- **High - for 7-8 times**
- **Very high - for 9-10 times**

As per the analysis, very high category of floods, are the highest consisting 9-10 numbers during the period 1998-2007 (Figure 5).

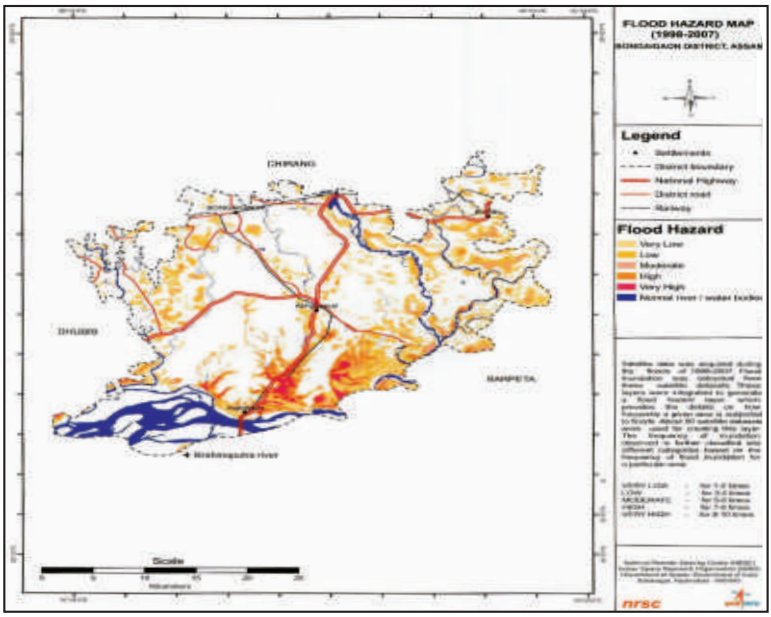

Figure 5: Flood Hazard Map of Bongaigaon

(Source: Modified after Flood Hazard Atlas for Assam State – A geospatial approach, NRSC)

The Aftermath: Consequences of the flood-2012

Floods on 2012 because of heavy rains and breaches in embankments of the Brahmaputra and tributaries have caused immense loss of life and property across the district. A total of four waves of devastating floods hit the Bongaigaon and affected 388,614 persons in 520 villages. These are the worst floods faced by the entire northeastern states since 1998. However, causalities were not very high in number, a total of 6 person died and 1 was missing in the entire district during the whole flood period. As a consequence, there has been a serious impact in Bongaigaon district, almost all revenue circles were hit badly. Out of the five circles, the Srijangram revenue circle and Boitamari revenue circle, which fall under North Salmara Sub-division, were the worst affected. Figure 6 provide a glimpse on flood situation in Bongaigaon.

Figure 6: Flood situation in Bongaigaon

First wave of flood started its chaos on June 13, 2012 by affecting about 41,102 people in the four revenue circles, i.e. Srijangram, Boitamari, Bijni and Sidli. About 83 villages were submerged by the flood water of the rivers Brahmaputra, Aie, Manas, Champa, Kujia, Tunia etc. There was no report of loss of human lives or livestock by this wave. Nine houses were fully damaged in the Srijangram and Boitamari revenue circles. A total of 2024 ha. of crops were affected. During the first wave of floods one relief camp was set up and there were 350 inhabitants, while Gratuity Relief provided for them as per norms. There was no reporting of roads damaged and submerged but a total of 430 water supply sources destroyed. Below Figures 7 and 8 depict the circles affected and villages affected by all the four waves. (W=flood wave)

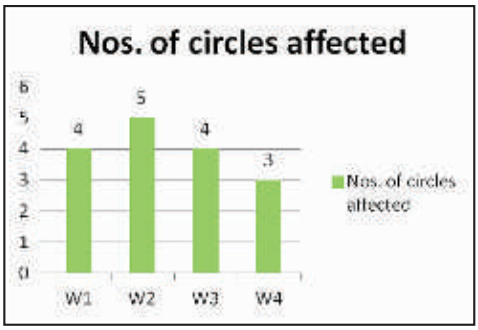

Figure 7: Circles affected

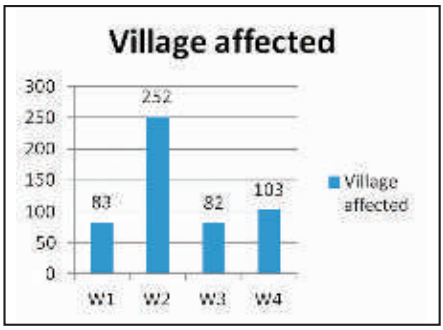

Figure 8: Village affected

Second wave hit the district on 25th of June, 2012, affecting all the revenue circles. About 2,19,203 people were affected in a total of 252 submerged villages. This wave took the life of 5 people out of which two were children of 2 to 3 years of age. Moreover, 141 houses were fully destroyed or washed away by the flood water and 53 were partially damaged. There were also damages to 12 roads and some bridges and submergence of 844 water supply sources. Figure 9 depicts the wave wise population affected.

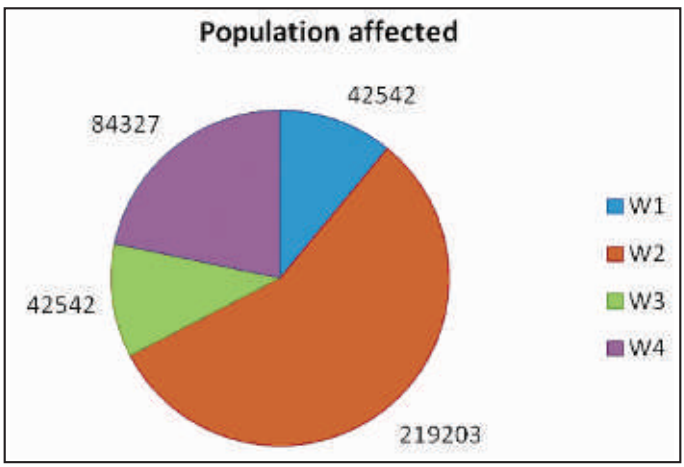

Figure 9: Population affected

The first two waves were followed by the third and fourth one. A total of 4 circles affected by the wave three and 3 circles were affected by the wave 4. District Administration estimated a total of 42, 542 nos. of persons were affected by the third wave and 84, 327 by the fourth one including the loss of 63, 063 Nos. of cattle's. Overall impact of all the four waves was very severe on the entire district. Below Table 3 will give a detailed idea about the damages occurred:

Table 3: Detail about the damages

Sl. No.	Items	Unit	Total Damages
1	Nos. of circles affected	Nos.	16
2	Village affected	Nos.	520
3	Population affected	Nos.	388614
4	No. of relief camps setup	Nos.	97
5	No. of persons in the relief camps	Nos.	43785
6	Houses damaged		
	Fully	*Nos.*	*150*
	Partially	*Nos.*	*53*
7	Human deaths	Nos.	6
8	No. of persons missing	Nos.	1
9	Cattle affected	Nos.	126126
10	Roads damaged	Nos.	28
11	Water supply sources damaged	Nos.	1274
12	Crop area damaged	Ha.	7731
13	Nos. of farm families affected		47793
14	Medical team	Nos.	34

Major sectors/ Areas affected

The floods have a significant impact on people, commodities, crops and property. The main areas that were affected due the floods in the Bongaigaon district:

Water and Sanitation

Tubewells are being used by the people of Bongaigaon for drinking water. Even though these tube wells were not completely submerged, but there was a high risk of contamination as they are placed at a depth of 20 to 50 feet. Because of the recent flood in this district most of these tube wells were submerged except for those that were installed on high ground. Despite of the contamination people collected water from these tubewells and used to drink after boiling.

As far as the sanitation is concerned, usage of kacha toilets and open defecation is preferred by the locals. Sanitation has been affected majorly by the flood, most of them submerged not suitable for utilization. Women in particular have to cope up with this situation and for them the sanitary practices are done either early in the morning or after dusk using boats for transportation purpose. This practice is quite unsafe and needs immediate attention.

Health

Whenever a disaster strikes a region, both mental and physical health of people gets affected alarmingly. After the flood the people of Bongaigaon consumed the contaminated water from the tubewells. High probability of outbreak of malaria was observed. Many children suffered from diarrhea, skin and water borne

diseases but fortunately no big outbreak reported.

Shelter

During flood high number of houses was approximately 2 feet under water and people were forced to take shelter on road, high raised area, schools and community places. Normally, the houses are made of bamboo and mud in the region and there is high possibility that the houses will collapse soon, since water will take as long as 15 days to one month to recede.

Food security

Threat of a severe food shortage is one of the problems that Bongaigaon faces after the flood. People have to survive on the existing stock of rice which is their staple food, as Paddy fields were submerged in flood water and people made all effort to salvage whatever they can from the agricultural field. Children used to eat their meal rice with salt and water. The post monsoon was challenging as the affected people have not able to harvest their Rabi crop and they will also miss their kharif crop if the water remain for longer period.

Impacts on people and communities

Flooding caused physical injury, illness and loss of life. Deep, fast flowing or rapidly rising flood waters was dangerous. Flood water impact on people and communities as a result of the stress and trauma of being flooded, or even of being under the threat of flooding, was immense.

Impacts on property

Flooding caused severe damage to properties. Flood water also damaged electrical and other services and possibly caused structural damage.

Impacts on Infrastructure

The flooding caused damages to businesses and infrastructure, such as transport or utilities like electricity and water supply, and have significant detrimental impacts on local and regional economies. Flooding of primary roads denied access to large areas beyond those directly affected by the flooding for the duration of the flood event, as well as caused damage to the roads.

Impact on the Environment

Significant detrimental environmental effects of flooding included soil erosion, bank erosion and damage to vegetation as well as the impacts on water quality, habitats and flora and fauna caused by bacteria and other pollutants carried by flood water.

Impact on the Agriculture

A large number of agricultural lands has been inundated in the district and remained inundated even after 2-3 months of the flooding, sometime till the next flood season. This caused severe impact on the agriculture and livelihood of the local communities.

Impact on Livestock

Floods in Bongaigaon caused massive devastation to the livestock and is one of the sources of income of the local community of Bongaigaon.

Despite of the fact that the district administration has set up a number of camps for cattle, still people have been found living along with their respective cattle on high places or on beside the roads.

Measures taken by the District Administration/local authorities to control the flood:

Immediate response by the District Administration

- On receipt of warning of the impending flood, early warning has been disseminated in each village to warn the people and communities.
- After getting the pre signals of warning, Emergency Operation Centre (EOC) has been activated in the District.
- For tackling the rescue and for relief and rehabilitation aspects, the entire district is divided into 6 zones and they are further sub-divided into sectors. There were more than 53 boats engaged in the rescue operation. 16 medical teams were also deployed to the flood affected areas.
- Second step of the District Administration was to reach to all the people in the likely affected areas especially to those who have no access to mass media modes. Early warning has been disseminated personally in such areas on time.
- After flood water has been inundated almost in all the 5 revenue circles, evacuation activities has been started from the worst affected circles of Srijangram and Boitamari revenue circles.
- Adequate number of Disaster Management staff, rescue swimmers, boats, equipments has been deployed to the various villages but a shortage of boat man and rescue swimmers has been faced by the Administration which needs to be sort out on the priority basis before the next flood season.
- Safe places at higher elevations i.e., schools, Panchayat Ghar and other

buildings have been identified in advance and a number of flood affected people were shifted to these places.

- As a key responsibility to distribute the food, safe drinking water, hygiene and sanitation facilities etc have been provided by the District Administration to all the affected peoples.
- Parallel to the relief work, search and rescue operations were also carried out.
- People needing medical attention were catered.
- Sufficient quantity of relief have been distributed to all the affected population.

Difficulties faced by the Administration

It is essential to mention that, during the rescue planning and operations the administration faced number of challenges. Below are some of the major difficulties faced by the District Administration:

- **Shortfall of resources**

  Rescue operations require skillful boatmen and other additional manpower. During the 2012 flood rescue operations the administration faced a major difficulty in finding adequate number of such resources. Most of the registered boatmen refused to provide assistance, stating that their own families were living in the flood-affected areas therefore could not contribute to the rescue work. A huge gap in the work force has been observed to deal with such type of flood situation.

- **Embankments Management**

  Since the embankments are on higher elevation than flood plains, people have taken immediate shelter during the floods. The flood affected victims, who have lost their homes stayed back on the embankment for a long time, some stay back permanently. Though the people on the embankment are protected physically but on the other side there was high vulnerability of erosion and in case of breaches there was a greater chance of loss of life and property.

- **Coordination**

  Coordination among the various stakeholders observed as one of another challenges for the administration. DDMP has been structured and developed in a good manner covering all the hazards and their management but it has been observed that execution of the plan seems difficult on the practical ground.

- **Connectivity**

  During the flood a high number of roads either submerged into the water or broken -which creates a delay and hindrance in the rescue and relief activities.

- **Robust Early Warning System**

  There is no early warning system available for flash floods as it is very tough to predict. A number of small hilly rivers are present in the district which creates flash floods very often in the monsoon season. Wave four of the flood season was the example of such type of flood. Emergency communication is also tough during bad weather and it often happen. There is high probability of total breakdown in communication system as because there is no satellite phone, "HAM Radio" etc. available in the DDMA.

- **Distribution of Ration**

  To deal and identify the people who have the actual need of Gratuity Relief was a major challenge for the Administration. People who were least affected during the flood were also found at the distribution camps taking ration. This made it even more difficult for the authorities to fully make sure that the ration was distributed to those who genuinely were in need of it.

- **Inundated water in agricultural land**

  Inundation of farm land is a critical problem for the administration and more for the farmers.

  Temporary embankments, which have been built to stop the small breaches and high flow of water to enter the town, are now acting as a barrier, not allowing the collected water out of the agricultural fields.

  Therefore, the administration has engaged manpower to remove such embankments, to release the water from the fields to the river. This will lead to drying up of the agricultural land, suitable for farming.

Conclusion and Lesson Learnt

The recurring floods in Bongaigaon impose a heavy degree of economic losses, and although the loss of lives is not very high, an interruption of community development processes due to evacuation and rehabilitation takes place. This creates overall disturbance in the regular functioning of the society. District Administration is working sincerely towards a more effective Flood Management in the district. Due to the sincere efforts and good planning by the District Administration, flood situation is drastically improving in the district. Nevertheless, there is still a long way ahead for the robust flood management in

the district. Flood occurs generally in the low lying areas of the district during Mar to August every year. Late flood during the later part of September & October also occurs. The occurrence of flood in the district is due to the river Brahmaputra and its Tributaries. Pre planning for flood management is highly essential considering the lesson learnt from the past floods. Adequate number of resources needs to be arranged in advance with the commitment.

The flood hazard of the district need to be assessed comprehensively by analysis of flood return periods, topographic mapping and height contouring around river systems together with estimates of capacities of hydrology systems and catchment areas, analysis of precipitation records to estimate probability of overload and other scientific methods.

Flooding has been identified as one of the major disasters in Bongaigaon, exposing the communities to a very high degree of risk. However, it has often been seen that the measures undertaken needs to be strengthened as sometime they fail and give way to flood hazards. Floods have occurred in the protected areas due to overtopping, breaching or in some cases, failure of the protection structures. Land use practices need to be projected with foresight keeping in mind the future areas of concentrated growth and their proximity to flood risk zones.

The preparedness for combating incidences of flash floods in the vulnerable areas is also inadequate as has been proved during the devastating floods of 2012. It has been recognized that there is a need of awareness generation and capacity building of the local communities on priority basis. Community is the first responder in most of the disasters but in case of flash floods community awareness and response is very important. In district Bongaigaon some small rivers that come from the north, often create flash floods, and there is no early warning system established yet for these rivers and it is also very difficult. The wave four of the 2012 floods was the flash flood that lacked an adequate warning, so it is essential to address the issue of community awareness and preparedness on priority basis.

The flood affected areas in Bongaigaon are poverty pockets and are most vulnerable to disaster risks. District is annually affected due to floods, the recent floods are reported to be the worst in the last 10 years. Lessons suggest that structural and nonstructural measures for flood risk reduction should be integral parts of both the overall development process and relief and recovery activities in response to floods or other disaster events that occur along the way.

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Preparing Delhi for the Worst: Success Story of India's First Ever Mega Exercise on Seismic Safety

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Abstract

Delhi Disaster Management Authority (DDMA) in collaboration with National Disaster Management Authority (NDMA) conducted a major Earthquake Preparedness Exercise in Delhi from December, 2011 to mid February, 2012, which is first such state wide programme in India. This seismic safety exercise comprised of activities like workshops, awareness programmes, mock drills, public lectures and media campaign on various platforms. The exercise culminated with a National Capital territory (NCT) wide mega mock drill on 15th February, 2012 at 11:30 AM having participation of various stake holders and thereby setting a golden example to be followed by other states of India, for years to come.

Key Words

DDMA, ESF, EOC, Mock Drill, Seismic Safety

Introduction

National Capital Territory (NCT) of Delhi falls in seismic zone IV as per seismic zone map of Indian Standard IS 1893 (BIS, 2002) and is considered as High Earthquake Risk Zone.[1] The entire region of Delhi is liable to earthquake of MSK intensity VIII, which may cause severe damages to structures of different types. As per the Vulnerability Atlas of India (2007), out of 33.8 lakh buildings in Delhi, over 31 lakh are at medium risk of being affected by an earthquake, while 1.46 lakh are at high risk.[2] Apart from being one of the most densely populated conurbations of the World, NCT of Delhi is also the economic and political hub of India. Delhi needs to be well prepared in terms of seismic safety in the absence of any Earthquake Early Warning Mechanism which is necessary to be developed urgently for Delhi centric northern India.[3] Seismic safety advocates attempt to reduce all earthquake losses in various ways.[4] The National Disaster Management Guidelines (2007) on Management of Earthquakes, with a vision of zero tolerance to avoidable deaths to earthquakes, enumerates six pillars of seismic safety such as earthquake resistant construction, retrofitting of lifeline structures, regulation & enforcement, awareness & preparedness, capacity

development and emergency response.[5] The mega seismic safety exercise of Delhi involved the last three pillars of seismic safety.

Figure 1
Administrative Divisions of NCT of Delhi (Source: Census of India, 2011)
(NB: The Revenue Districts of Delhi have been reorganised and 11 Revenue Districts have been created and notified since September, 2012)

The mega seismic safety exercise was conducted from December, 2011 to mid February, 2012 by DDMA in collaboration with NDMA. The exercise comprised of activities like a) Workshops, b) Awareness programmes, c) Mock Drills, d) Public Lectures and e) Media Campaign on various platforms. The exercise culminated with NCT wide mega mock drill on 15th February, 2012 at 11:30 AM. having participation of various stake holders – govt. sector, private sector, Resident Welfare Associations (RWAs), schools, colleges, universities, market associations, courts and judiciary and public representatives.

Specific Objectives of the Exercise

- Creating awareness and coordination among government functionaries, technology personnel, schools, NGOs, CBOs and communities about earthquake disaster and possible preventive actions.

- Preparing the Emergency Support Functionaries (ESFs) to effectively respond to large scale earthquake disaster at state level.
- Development and strengthening of earthquake preparedness, response and recovery plans and practice these through mock drills.
- Capacity building of ESFs and practice of standard operating procedures.
- Knowledge networking on best practices and tools for effective risk management.
- Developing mitigation strategies for the city with the help of the lessons learnt

Components of the Exercise

Review Meetings

Several meetings were organised by DDMA to formulate the action plan of the exercise and review the status of preparedness, beginning from April, 2011. The meetings were attended by Hon'ble Members of NDMA, Jt. Secretary (NDMA), Pr. Secretary (Revenue) and other high level officials of different departments of Govt. of NCT of Delhi. Several review meetings chaired by Pr. Secretary (Revenue) were also held with the Deputy Commissioners (Revenue) of the districts to assess the preparedness of the districts for the mega exercise.

Orientation Workshops

Workshop on earthquake preparedness followed by mock drill on CBRN emergency was organized in the last week of December 2011, with Members of Legislative Assemblies (MLAs) and Councilors of Municipal Corporation at Delhi Vidhan Sabha (Legislative Assembly). Orientation workshops with selected government departments were also organized. A half day orientation

Photo 1: Mock Drill on CBRN emergency Safety at Delhi High Court

Photo 2: Workshop on Earthquake at Delhi Vidhan Sabha

workshop on earthquake safety was organized for the Judges of the Delhi High Court on 8th February, 2012. Additionally, each district organized orientation workshops with Judges and Bar Associations of the District Courts.

Awareness Programmes

Awareness programmes on seismic safety were organised by the districts for the emergency responders and general public. For responders such as private security guards, lift operators, RWAs and traders associations, training programmes were held on disaster preparedness. Personnel from NGOs and hotels were also given training. In addition, at least three hospitals in each district were selected for awareness generation and mock drill programmes.

Various awareness generation programmes conducted for different sections of public are as follows;

- Flyers Distribution at bus stops, metro stations, railway stations, shopping malls, milk booths, airports, etc.
- Torch rallies in nine districts with participation of school children, college students, RWAs, market associations, non-governmental organizations, etc.
- Civil Defence and Nehru Yuva Kendra Sangathan volunteers who were named as 'Apada Mitra' organized local awareness generation campaign. The purpose was to visit selected vulnerable colonies in Delhi and educate the residents on seismic safety by distributing IEC materials.
- At least three Nukkad Nataks (Street Plays) per district were performed in residential and commercial places.
- Public lectures on disaster management were organized involving senior citizens, academicians and women at crowded places such as malls, markets and gardens.

Photo 3: Rally on Earthquake Preparedness

Photo 4: Nukkad Natak on Disaster Preparedness

In addition to the above, training programmes on fire and earthquake safety, debates, quiz & drawing competitions were organized at various colleges and schools. At least ten schools and five colleges in each district were selected for mandatory mock drill on seismic safety.

Drop Cover Hold Exercise

Drop Cover Hold exercise covering almost all the Government/public/private schools simultaneously was conducted on 8th December, 2011. The drill was conducted twice in the districts; at 1100 hrs for morning shift schools and at 1500 hrs for evening shift schools. In order to prepare for this exercise, district disaster management authorities organized two days of training for the teachers and principals of the schools ahead of the exercise. As many as 3992 schools took part in the exercise.

Photo 5 : Drop Cover Hold Exercise in School

Media Campaigns

Massive media campaign was carried out involving different types of media, starting from 25th January, 2012 onwards for spreading public awareness about the exercise. Kapil Dev, India's former cricket captain was the brand ambassador. The cost of media campaign was equally shared by NDMA and DDMA. The details of media campaign conducted are:-

- **Outdoor Media Campaign:** Through hoardings, bridge panel, designer bus queue shelter, advertisement panels in colleges, railway stations, hospitals, government buildings, public utility and Metro stations.

Photo 6: Designer Bus Queue Shelter

- **Print Media:** Print media campaigns were launched in English, Hindi, Urdu and Punjabi dailies in the city ahead of the mega mock drill and on the day of drill itself. Traffic advisory was issued in news papers before the drill to avoid public inconvenience. Thank you advertisements were also published in various dailies of the city on 18th March, 2012.

Photo 7: News Paper Advertisement

- **Radio Campaign:** Radio spots and jingles for public awareness were relayed in 45 seconds and 60 seconds spots for 90 days on six FM channels including Radio Mirchi, Radio City, Red FM, Oye FM, Radio Fever and AIR FM Gold.
- **Bulk Message Campaign:** Bulk Short Messaging Service (SMS) were sent four times ahead of the mega mock drill on 15th February, 2012 and a thank you SMS was sent after the event. The total number of SMS sent was approximately 3 crores.
- **Below The Line Media (BTL):** T-shirts, caps, pens, flyers, mouse pad, bags and notepads displaying themes on earthquake preparedness exercise were distributed.

Preparatory Mock Drill

Preparatory mock drills covering three districts at one time were carried out few days before the mega mock drill. The first drill was conducted on the 31st January, 2012 in New Delhi, South and South West districts; while the second preparatory mock drill was conducted on 2nd February, 2012 for the group of East and the North-east districts. The last drill was conducted on the 6 February, 2012 for north, north-west and west districts. Various scenarios on earthquake and resultant disasters were simulated at multiple numbers of places and installations in the preparatory mock drills.

NCT wide Mega Mock Drill

Mock drills help in evaluating response and improving coordination within

various government departments, non-government agencies and communities.[6] The resources of every Department/agency were stretched to the maximum limit in the NCT wide mega mock drill to test their limitations, response time and requirement of men and material in a major disaster.

The NCT wide mega mock drill was conducted on 15th February, 2012 at more than 1000 locations. In total, 210 awareness programmes, 25 training programmes and 43 mock drills for different sections of society and preparatory mock drills at district level for the Revenue Districts were conducted before the NCT wide mega mock drill. The total expenditure for the mega mock drill was approximately 73 lakh rupees and the cost of media campaign was approximately 5 crore rupees.

Before carrying out the event, all the nine Revenue districts under the leadership of the Deputy Commissioners/Chairmen along with the Additional District Magistrates/Chief Executive Officers of District Management Authorities conducted table top exercises and finalized their district wise plans in coordination with the ESFs at the district level.

Scenario

- An earthquake of magnitude 7.9 on Richter scale occurred on Delhi-Moradabad fault line, at 11:30 hrs on 15 February, 2012.
- The epicenter of the earthquake was 275 km east of Delhi, near Moradabad
- Tremor lasted for 48 seconds
- The potential intensity of the earthquake is between MSK VIII-IX.
- It is simulated to be freezing cold and has been raining for the last two days and weather is predicted to remain as such for the next 24 hours.
- As a result of the above there has been,
- Massive collapse of infrastructures
- A significant number of medical casualties
- The walled city, East, North East and West Delhi, having congested areas have suffered the maximum
- Fire and Gas leaks have occurred at number of places

The simulated and actual numbers of casualties are summarized in the following table:

Table 1: Simulated and Actual Number of Casualties

S. No.	District	Killed		Injured	
		Simulated	Actual	Simulated	Actual
1.	North East	500	21	6000	494
2.	East	470	20	5500	130
3.	South	450	56	4500	174
4.	South West	485	22	5000	140
5.	West	500	24	5500	177
6.	New Delhi	100	10	1500	90
7.	Central	500	30	5700	155
8.	North West	350	20	3000	115
9.	North	400	24	2500	110
	Total	3755	227	39200	1585

The scenarios of mock drill in the districts were of different nature like building collapse, fire incident, road accident, CNG leak, etc. resulting from severe earthquake.

Incident Sites

Details of the sites/installations where drills were conducted are:-

Table 2: Summary of Incident Sites in Mega Mock Drill

Place Affected	Number	Place Affected	Number
School (Government)	1771	Metro Stations	7
School (Private)	24	DC Office	5
Colleges	34	Flyovers	6
Hospitals	24	CNG/LPG Stations	11
Cinema Hall	5	Road Accident	1
RWA	9	Hotel	1
Government Building	14	Industry	1
Market Association	7	Foot Over Bridge	1
Petrol Pump	9	Slum/JJ Colony	4
High Rise Building	3	Airport	1
Malls	7	Parking Area	2

Incident Response

The major agencies which participated in the mock drill were, Delhi Fire Service (DFS), Municipal Corporation of Delhi (MCD), Civil Defence Organization, New Delhi Municipal Corporation (NDMC), Directorate of Health Services (DHS), Delhi Police (PCR), CATS & St. Johns Ambulance Services, Delhi Jal Board (DJB), Food & Civil Supplies Department (F&CS), Delhi Transport Corporation (DTC), Mahanagar Telephone Nigam Ltd. (MTNL), DISCOMs such as BSES & NDPL and National Disaster Response Force.

Incident commanders were appointed for each incident. Deputy Commissioners (Revenue) of the districts were the responsible officers appointed for the concerned districts as per the Incident Response System guidelines. Incident command posts and health posts were established at the incident sites. Minor injured were taken to pre identified relief centres and were discharged after first aid and basic care. Help desks were set up in the hospitals. More than 3500 volunteers from Civil Defence, NCC and NYKS were engaged officially along with many more volunteers from NGOs and general public. The average time taken for completion of drill was 2 hours and 50 minutes. The drill helped in streamlining of standard operating procedures of ESFs and making them infallible.

Photo 8: Delhi Fire Service in action

Photo 9: Health Post at Incident Site

Photo 10: Students Learning First Aid

Photo 11: Runway checking at IGI Airport

Photo 12: Civil Defence in action

Photo 13: NDRF personnel in action

The average response time of ESFs of Delhi is represented in the following diagram:

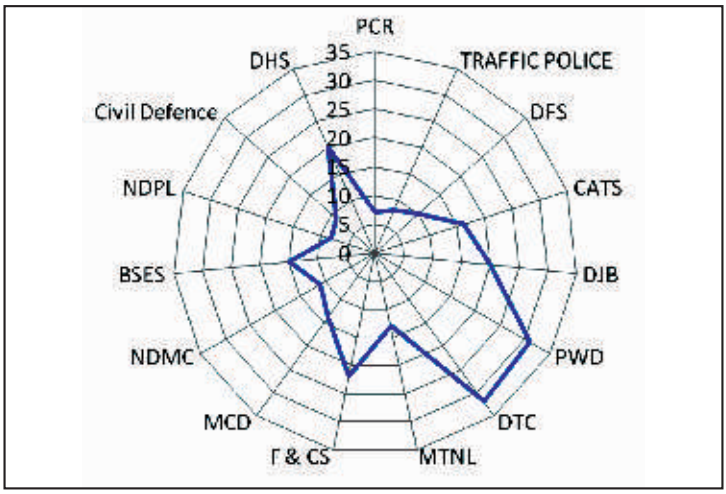

Figure 2: Radar Chart showing the average response time of ESFs

Communication and Emergency Operation Centre

Communication through land line and mobile phones was avoided for building a real life scenario. The entire exercise was coordinated by an effective communication system using TETRA wireless sets. TETRA Groups were formed at state level and district level. This helped across channel communication. The major ESFs were shared with TETRA sets for establishing effective communication system. The State Emergency Operation Centre coordinated with all the District level EOCs for smooth conduct of the exercise.

The trigger mechanism prescribes the manner in which the disaster response system shall be automatically activated after receiving early warning signals of a disaster happening or likely to happen or on receipt of information of an incident.[7] As the mega mock drill was not of surprise nature, first information on each incident was either initiated from the EOC or the incident spot. Upon activation of an incident, the State EOC forwarded the message to relevant nodal officers/control rooms of ESFs and also to the District EOC of the concerned district. Simultaneously confirmation of the incident was also done from the caller and the related line departments. The State and District EOCs remained in constant touch with the emergency management officials at the incident site and various ESF control rooms throughout the incident and coordinated the requirement of extra human resource, equipment or machinery needed at the

incident site. Time and Resource log for responders were maintained at the incident command posts. All the call details were recorded and final report for each incident was prepared by EOC.

Hon'ble Vice Chairman, NDMA was present in the State EOC during the entire exercise along with the members of NDMA to make the coordination effective. From DDMA (HQ) the exercise was coordinated by the Pr. Secretary (Revenue/Disaster Management) and Addl. Secretary (Revenue/Disaster Management). The mock drill culminated without any mishap and inconvenience to the public. After the completion of drill, hot WASH sessions with the representatives of ESFs were held in all the districts by the concerned Deputy Commissioners, in order to assess the management of incidents and incident response at district level.

Audit of Mega Mock Drill

The mega mock drill was audited separately by a team from NDMA and also an independent team of Indian Army from the Headquarter Delhi Area under the leadership of the Colonel (GS) Headquarter, Delhi Area. The Army Audit Teams participated in this long exercise beginning from preliminary conferences, table top exercise, awareness activities, preparatory mock drills and the mega mock drill. The Headquarter Delhi Area provided 09 Observer Teams comprising of officers, JCOs and ORs for each of the 09 districts of Delhi. One team was also deployed at the DDMA Headquarter. Nearly 350 Army personnel from Headquarter Delhi Area participated in the exercise. The Army Audit Teams assessed, inter alia, medical, logistic, engineering, traffic management and communication aspects at nearly 125 locations of the drill.

The independent audit report of Army has observed regular conduct of mock drills as indispensable preparedness measure and also has been able to streamline the future strategies for developing a robust disaster management system for Delhi. The report categorically describes the positive practices and lessons learnt on the basis of observed lacunas in the mega mock drill. Recommendations suggested by the Indian Army include conducting frequent mock drill exercises, better coordination among ESFs, training of stake holders, procurement of state-of-the-art equipment for response, modernization of EOC, sensitizing local people about disaster management, etc. These recommendations would help in preparing for better disaster response in the face of severe disasters.

Recognition of the Mega Exercise on Seismic Safety

The mega exercise on seismic safety was appreciated by the Vice-Chairman, National Disaster Management Authority and Chief Minister of Government of

NCT of Delhi. People of Delhi and various Media Organizations have also appreciated the efforts made. The exercise was a remarkable step towards preparing Delhi for any probable appalling situation arising aftermath of a severe seismic disturbance.

The mega mock drill has been appreciated by Sh. P. Chidambaram, the Hon'ble Union Home Minister on the floor of the parliament on 20th March, 2012. The then Union Home Minister said in the parliament that "I have clearly requested the National Disaster Management Authority that in all future mock drills conducted anywhere in the country, they should apply the lessons of the elaborate Delhi mock drill and run through a programme of preparedness before the mock drill is conducted. In fact, the preparedness stage runs for about two months before the mock drill is conducted. In future, all mock drills will follow the protocol that was followed in Delhi". Thus Delhi has become a role model for the country for conducting such exercises in future.

DDMA mock drills have become benchmark to be followed by other states and territories in the country. To begin with a mega mock drill was organised on 13th February, 2013, simultaneously in Punjab, Haryana and Himachal Pradesh and the protocol carried out in mega mock drill of Delhi was replicated there. On request of NDMA, senior officers from DDMA addressed and helped the officers from Haryana, Punjab, Himachal Pradesh and U.T. of Chandigarh for successful conduct of this mega mock drill. DDMA has also been selected by the Governance Knowledge Centre of Government of India for best practices in governance. Herein, it would not be hyperbolic to conclude that the mega seismic safety exercise of Delhi has set a golden example to be followed by other states of India for years to come.

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Submission of an article to journal "Disaster: Response and Management" (ISSN: 2347-2553)implies that it has not been previously published and is not under consideration for publication elsewhere; and further, that if accepted, it will not be published elsewhere. Manuscripts are to be submitted through email to **cdm.lbsnaa@nic.in** with a copy to:

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Manuscripts should be in Times New Roman, 12 points font with double line spacing, and should not exceed 3000-4000 words. The pages should be numbered consecutively, starting with the title page and through the text, reference list, tables and figure legends.

Manuscript Sequence

Tables, figure, photo, sketch should be labeled, numbered and placed with the text.

The title page should contain Title, Authors, Affiliations, and Corresponding author and address. Not more than five keywords should be indicated separately. Abstract and summary should be limited to 100 words and convey the main points of the paper, outline the results and conclusions, and explain the significance of the results.

Text: The text should be intelligible to readers in different disciplines and technical terms should be defined.

Figures: Drawing, figures, photographs, line drawings should be in high resolution.

References should be placed with relevant text as serial number of the reference list placed at the end (example [2]). Format for the list of References at the end of the text is as follows,

1. Ghosh, M. A. (2012), Hazard Assessment of Jaipur city, Current Research, 2012, Vol.1 Issue 3, pp.112- 118.
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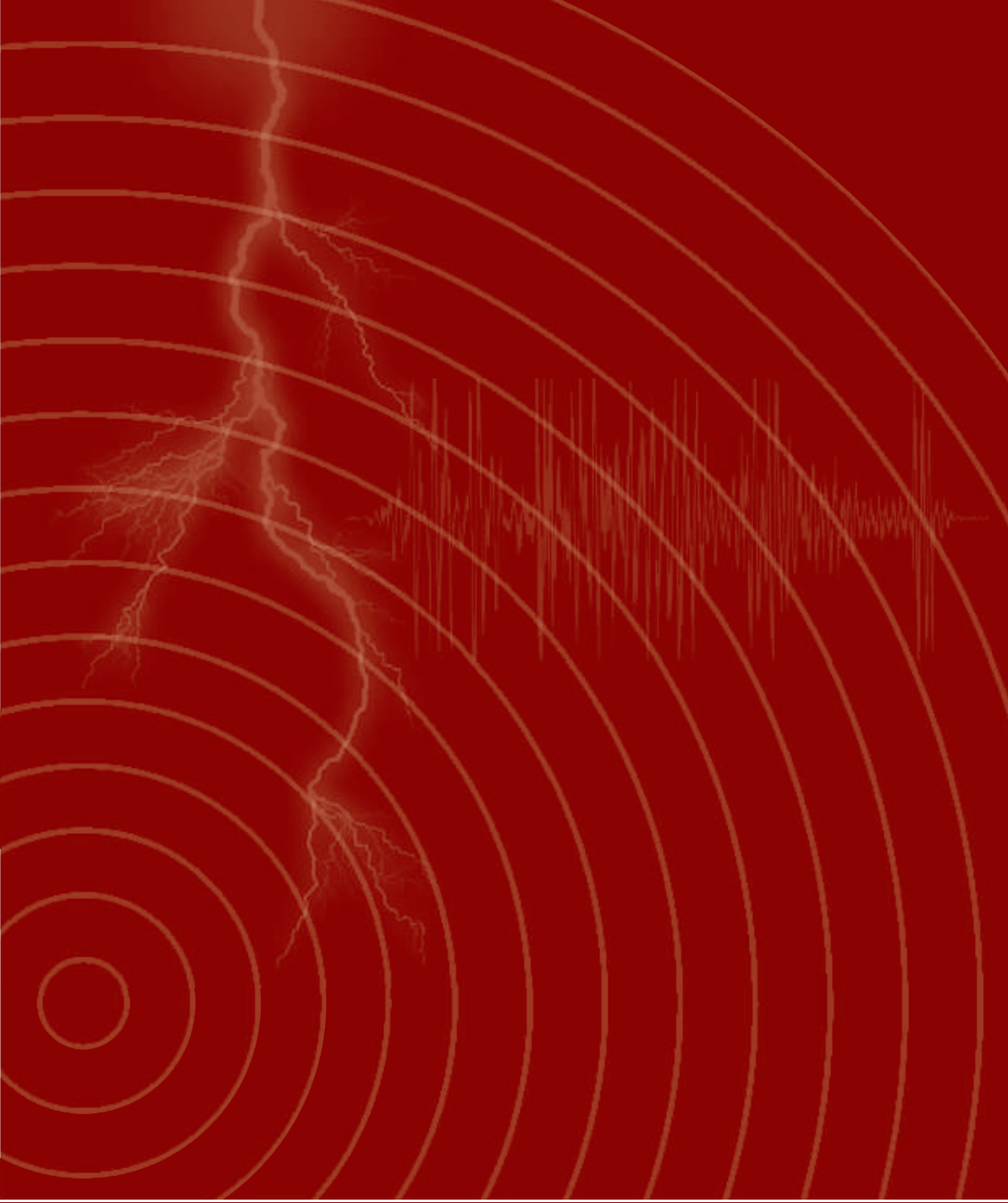

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