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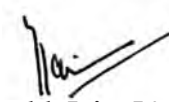
PREFACE

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 II issue of the journal Disaster-Response and Management" from Centre for Disaster Management, it is our pleasure to publish Volume 3, Issue 1 of the journal "Disaster-Response and Management" for the year 2015. The journal will provide an insight to the field administrators about the field level disaster management and scientific interventions towards Disaster Risk Reduction.

I would like to place on record the contribution made by faculty and staff of CDM who have contributed in various capacities for bringing out this Journal.



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CONTENTS

Assessment of Coastal Vulnerability Index (CVI) around Bangladesh Coast using geospatial techniques

D. Mitra[*] & M. Ashraful[#]

Introduction:

Climate change signifies a statistically substantial deviation in either the mean state of the climate or in its variability, persevering for a prolonged period, typically decades or longer. IPCC (2013) states that,the climate change may be due to natural internal processes or external forcing, or to persistent anthropogenic changes in the composition of the atmosphere or in land use. In this context, Global warming the eventual impact of climatic change is the much debated concern among the geoscientist in the current world. The ultimate effect of global warming is the rising of the eustatic sea level (Allen and Kumar 2006) due to the melting of ice sheet as well as the thermal expansion of sea water (Meehl et al., 2005) being evident in various research work . According to the successive IPCC reports, global warming and its consequence would earnestly affect the environment as well civilizations living at the close proximity of the coastal zones. The global average temperature has increased during the past century, while the global warming that has occurred in the past three decades alone has been estimated to be 0.6°C at the rate of 0.2°C per decade (Nageswara Rao et al., 2008;Hansen et al., 2006; IPCC, 2007; Rosenzweig et al., 2008; Wood, 2008). The coastal zones, in spite of being highly resourceful and densely populated, as low lying are directly exposed to the impact of the sea-level rise and therefore would be subjected to accelerated erosion and shoreline retreat (Pirazzoli, 1996; Pye and Blott 2006). There are also evidences of intrusion of saltwater into coastal groundwater aquifers, inundation of wetlands and estuaries, and threatening historic and cultural resources as well as infrastructure (Pendleton et al., 2004).

Potential impact of global warming refers to all impacts that exacerbate the vulnerability of the elements exposed to the natural calamities and eventually escalates the risk of that element. When risk is realized, vulnerability and exposure are considered as the prime key determinants of disaster .Vulnerability is defined as the set of conditions and processes driven by physical, social and environmental factors which ultimately accelerate the proneness of a community or society or nation to the impact of natural calamities. However in other sense vulnerability could be defined as the degree to which a system is susceptible to and unable to cope with adverse effects of climate change. According to IPCC (2007) vulnerability is a function of element, rate of climate change, magnitude and the variation to which a system is exposed, its sensitivity and its adaptive

capacity. Recently IPCC (2012) defines vulnerability as the propensity or predisposition to be adversely affected. Whereas the term exposure, very much interlinked with vulnerability, could be defined as the existence of human being, infrastructures, and environmental resources, social, economic and cultural assets in any place that could be harmed due to hazardous event (IPCC 2012).

The concept of coastal vulnerability was developed by IPCC definition of vulnerability incorporating the idea of coastal environment. A frame work illustrates the coastal vulnerability introduced by Klein and Nicholls (1999) having both natural and socio-economic systems found in coastal environment (Figure 1). The key element of this framework depicts a sharp demarcation

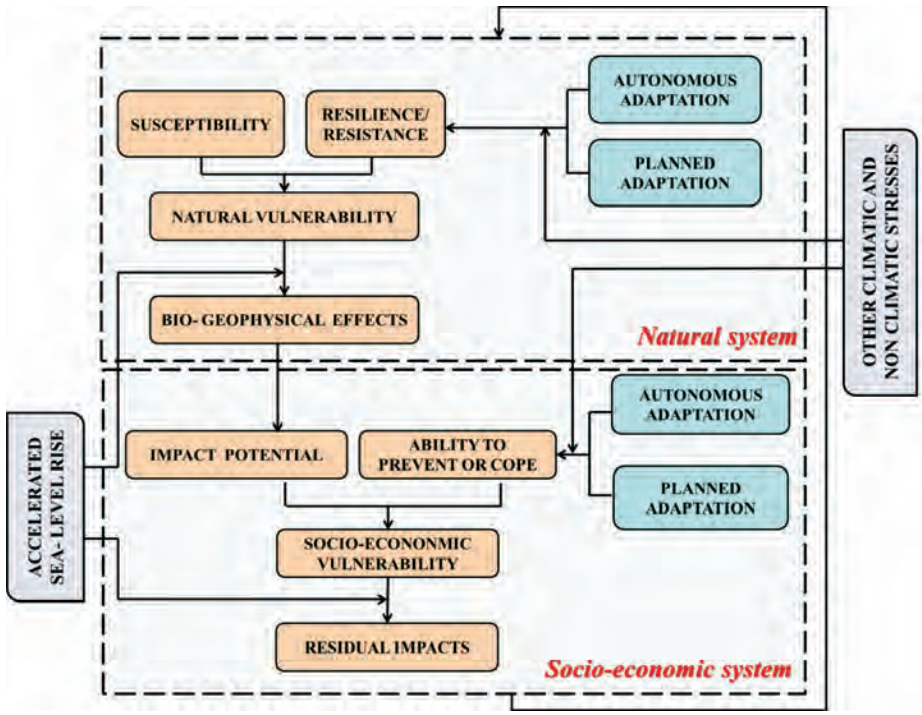

Figure 1: Coastal vulnerability frameworks (modified from Klein and Nicholls, 1999).

between planned adaptation and autonomous adaptation. Moreover the framework also described the influence of socio-economic system over the natural system.

2 Sea level rise (SLR)

Sea level, the height of the sea surface is measured with respect to the any reference location of the surface of the earth termed as relative sea level.

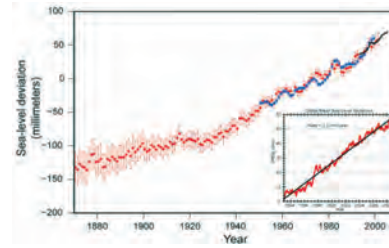

Figure 2: Past & Projected Global AverageSea Level (1800-2100)

When the measured reference is based on an ellipsoid (geocentric), it is geocentric seal level or global sea level. Comparing the both relative sea level might give more relevant estimation regarding sea level rise in a given location. Generally sea level change rate is estimated by tide gauge data. Tide gauge data are available from the mid of 18th century and from this instrumental data current sea level rise is estimated about 3mm/year globally. It is believed that this rate is significantly larger than the sea level rise averaged over the last several thousand years (Figure 2).The rate of SLR since the mid-19th century has been larger than the mean rate during the previous two millennia due to increased ocean warming and increased loss of mass from glaciers and ice sheets. Global mean sea level will continue to rise during the 21st century. Rate of relative sea level changes varies from place to place due to localized processes, terrain subsidence and other tectonic phenomena (IPCC, 2013).The most evident aftermath of sea level rise (SLR) is storms, the permanent inundation of coastal areas and salt water intrusion. Successively it would have a severe impact upon the natural environment and socio-economic conditions in the coastal region (Figure 3)

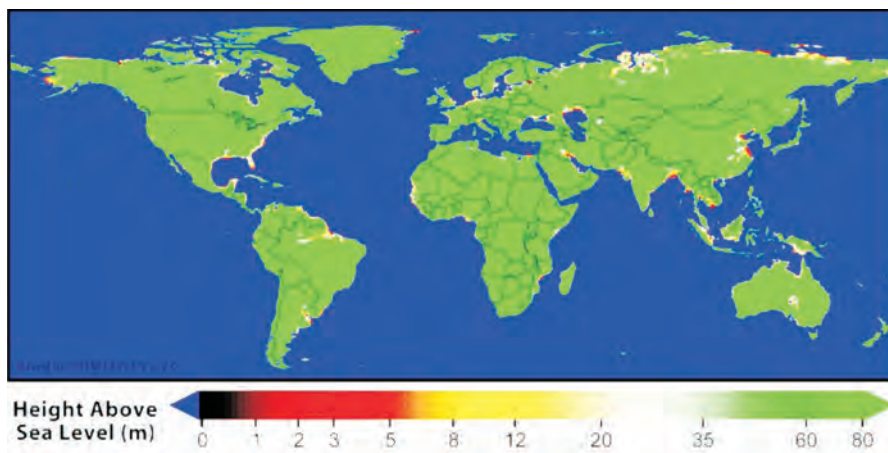

Figure 3: Map showing the regions vulnerable to present sea level rise due to global warming (source: http://www.globalwarmingart.com/wiki/)

3. Coastal vulnerability index (CVI)

The principal drive of coastal vulnerability assessment in the form of coastal vulnerability index (CVI) is to develop a foundation of information to assist community members, decision makers, coastal managers and all

other stakeholders and most importantly the government, to augment their understanding on where along the coastline the impacts of RSLR, climate change and other non-climate drivers would be most acutely felt. Vulnerability assessment is the basic approach before any sort of sustainable development work and hence useful to the reduction of disaster risk. CVI is a numerical approach to rank the segments of coastlines in terms of their potential harm which could impose adverse effect on coastal zone. Results of CVI can be presented on maps to focus regions where the factors are responsible for shoreline changes (Gutierrez et al., 2009).

To compute the index, first methodological step was to ascertain the key parameters which eventually represent the significant driving force influencing the vulnerability in a coastal environment (Gornitzet al., 1991). Initially it was verified with 6 to 7 parameters, however many researchers have modified the key variables according to their specific needs. The next steps was to assigning the rank of key variables with a semi-quantitative manner according to a scale 1-5 (Gornitz, 1990; Hammer-Klose and Thieler, 2001) where 1 indicates the less vulnerability and 5 indicates the high vulnerability. Afterward the third important step was to integrate the ranked variables in a single index. In this regard Gornitz and White (1992) and Gornitzet al. (1997) suggested and verified (in terms of vulnerability analysis) different formulas (considering 7 key variables) for the derivation of the final CVI (Figure 4).

(a) Product mean: $CVI_1 = \frac{X_1 * X_2 * X_3 * X_4 \ldots\ldots Xn}{n}$

(b) Modified Product mean: $CVI_2 = \frac{[X_1 * X_2 * \frac{1}{2}(X_3 + X_4) * X_5 * \frac{1}{2}(X_6 + X_7)]}{n-2}$

(c) Average Sum of squares: $CVI_3 = \frac{(X^2_1 * X^2_2 * X^2_3 * X^2_4 \ldots\ldots X^2_n)}{n}$

(d) Modified Product mean (2) : $CVI_4 = \frac{X_1 * X_2 * X_3 * X_4 \ldots\ldots Xn}{5^{(n-1)}}$

(e) Square Root of Product mean: $CVI_5 = [CVI_1]^{1/2}$

(f) Sum of Products: $CVI_6 = 4X_1 + 4X_2 + 2(X_3 + X_4) + 4X_5 + 2(X_6 + X_7)$

Where: n = Variables utilized

X_1= Mean elevation, X_2= Local subsidence trend, X_3= Geology, X_4=Geomorphology

X_5= Mean shoreline displacement, X_6=Maximum wave height, X_7= Mean tide range

Figure 4: Different formulas tested by Gornitzet al. (1992; 1997) to compute final CVI using seven parameters.

Later on, another CVI was developed by Özyurt (2007) and Özyurtet al. (2008) to specifically compute the vulnerability due to sea level rise through the integration of 5 sub-indices. Each sub-indices used in this particular CVI

corresponds to a specific sea level rise related impact. In this context, the authors have used five variable which are related to sea level rise impact named coastal erosion, flooding due to storm surges, permanent inundation, salt water intrusion to groundwater resources and rivers or estuaries.

$$CVI_{impact} = \frac{(0{,}5 \times \sum_{1}^{n} PP_n) + (0{,}5 \times \sum_{1}^{m} HP_m)}{CVI_{least\ vulnerable}}$$

Where: PP = Physical Parameters; HP = Human Influence Parameters; n and m = the number of physical and human influence parameters, respectively, considered for a particular impact; CVI_{least} vulnerable = the value of the sub-index for the least vulnerable theoretical case, meaning all parameters equal

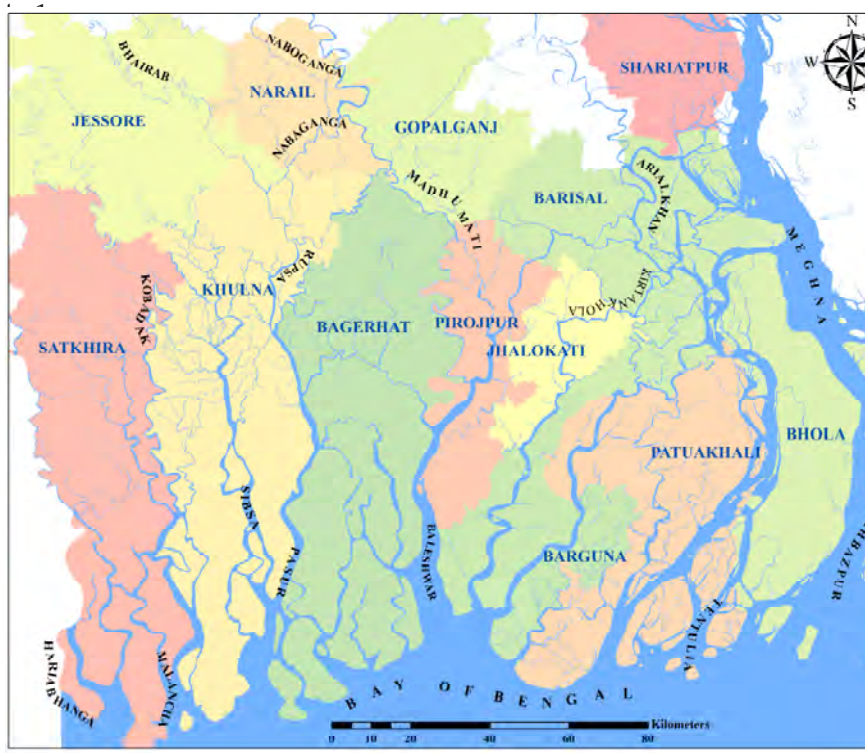

Figure 5: Study area in Bangladesh showing major rivers

5. Methodology

5.1 *Coastal vulnerability index (CVI) computation*

In this study seven parameters were considered for a semi quantitative assessment to achieve the final coastal vulnerability index (CVI) of Ganges deltaic

coast. The parameters are (1)geomorphology, (2)coastal slope, (3)shoreline change rate, (4) rate of sea level change (5) mean tide range, (6) bathymetry and (7)storm surge height. Every parameter having their own vulnerability potential, according to that, entire shoreline of the study area was divided and assigned the vulnerability rank ranging from 1 to 5, where 1 represents very low vulnerability and 5 represents very high vulnerability. Detail ranking for each parameter is given in Table 1.

Table 1: Vulnerability classification based on the seven physical and geological parameters.

COASTAL VULNERABILITY INDEX (CVI)						
ID	Variables	Very low (1)	Low (2)	Moderate (3)	High (4)	Very high (5)
a)	Geomorphology	Nantural levee	Beach-dune complex	Fluvio-tidal	Supratidal	Intertidal
b)	Coastal slope (degree)	3.25-5.14	2.30 - 3.24	1.63 - 2.29	0.88 - 1.62	< 0.87
c)	Shoreline change rate	>-4 to 61 m/y	- 10 to - 4 m/y	-19 to - 10m/y	-52 to - 19m/y	< -52 m/y
d)	Rate of Sea level change	<3 mm/y	-	-	>3 mm/y	-
e)	Mean tide range	>4m	2-4m	1 - 2 m	0.5-1m	<0.5m
f)	Bathymetry	<-6.59 m	-6.58 to -2.81m	-2.81 to -1.48 m	-1.481to -0.76 m	> -0.76 m
g)	Storm surge height	>50%	49% to 25%	25% to 15%	15% to 5%	<5%

Most of the CVI users have taken the square root of the product mean algorithm for final integration. It means that all the parameters have got same importance in final CVI calculation. For instance Gornitz (1991), Thieler and Hammer-Klose (1999), Doukakis (2005) and Diez et al. (2007) used the square root of the product mean algorithm.

When the present study is concern, all the parameters were given same importance in final CVI integration, because of being same vulnerable potential, the present analysis was incorporated the square root of the variables (ranked with factor 1 to 5) divided by the total number of variable considered. The equation is given below:

$$CVI = \frac{\sqrt{a*b*c*d*e*f*g*h}}{7}$$

where, a = geomorphology, b = coastal slope, c =shoreline change rate, d = rate of sea-level change, e = mean tide range, f = bathymetry and h= storm surge height

6. Results and Discussions

The total shoreline of the current study area considering the main land, however, excluding the estuaries was found to be ~ 286 km. For the representation of the entire shoreline accurate, vulnerability was established as a line feature which would portray the risk level at any point along the coast. Hence entire girds were converted to line feature using suitable geospatial techniques. The calculated

CVI values for Ganges deltaic coast range from 1.5 to 16.6 whereas the mean value is 7.13; the mode and the median both are 6.63; however the calculated standard deviation is 3.16. The 25th, 50th, and 75th percentiles are 4.69, 6.63 and 9.38 respectively (Figure 6)

Figure 6: Coastal vulnerability index for the study area.

A total of 286 km of the shoreline in the study area is ranked as per multi-hazard vulnerability. From the analysis, it is revealed that 57.9 km of shoreline representing 20.1% of the total marked as very high vulnerable class, whereas 50.1 km of shoreline comparable to 17.5% of total found as high vulnerable class due to various coastal hazards, hence is under very high and high risk category respectively. Low elevated intertidal as well as supratidal flats, having moderate erosion rate, shallower near shore bathymetry, consuming maximum coverage of the area, being inundated due to strom surge are responsible for the tagging of higher risk factor.Whereas 21.47% of the shoreline covering 61.23 km are being marked as moderate vulnerable because of moderate slope, presence of dominant supratidal flats and moderate erosion rate.Due to relatively resistive geomorphic units i.e., fluviotidal, coasts of accretionary phase together with higher slope and presence of less areal coverage prone to inundation due to storm surge height, approximately 56.57 km and 60.21 km of shorelines are being marked as low and very low vulnerable respectively which comprises of 19.8% and 21.2% of total shorelines respectively.

Acknowledgement:

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A need for Dead Body Management in India

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(Research Scholar)

"We should treat the dead with respect. In death, money doesn't matter, material possessions don't matter; dignity is what we should care about"

– Gung Tresna,

Lifeguard at Kuta Beach following terrorist attack in Bali, Indonesia.

Mass fatality or causality is described as a situation where the management of the dead bodies becomes difficult due to the rising fatality which exceeds the ability of local resources. Mass Casualty is a situation in which there is a disparity between patient load and locally available resources (Dauphinee).

During mass causality the dead are often ignored, overlooked and mishandled in many developing countries. In a disaster situation, the corpses should be recovered, transported, examined, identified, stored and dispatched. At the time of emergency, responders/authority should take an appropriate action that will save lives, assure the safety at site and ensure quick notification of various agencies. This situation with a sudden increase in the need require an effective medical, social and psychological intervention. The involvement of various agencies needs to require proper planning, co-ordination, preparedness and training (Hooft, Noji, & Voorde, 1989). The authority response in the site should be controlled by law enforcement according to the mass death plan.

The management of dead bodies involves a series of activities that begins with search of corpses, in situ identification of the body, transfer to mortuary, delivery of body to family members and final disposal of the body according to religious and cultural norms. Dead Body Management (DBM) in recent years has become an important hospital response towards mass casualties. Dead body management is directly related to the technological environment where we live in, to natural phenomena, as well as related to domestic violence and conflict.

The dead body management requires the organisation to be responsible for the medical response to the citizen, better training and preparedness of the responders, as well as to equip them with appropriate protective tools. Ensuring an effective medical response regardless of its nature (manmade or natural, involving explosive chemical, radiological or biological), is one of the most basic elements that should be in place in each and every society.

Massacres resulting from bombing are historically among the most common forms of terrorist violence and present with a unique epidemiology. They cause specific lesions, such as those due to the primary effect of blast. Terrorist bombings around the world during the past 35 years have occurred primarily in urban areas; they frequently generated multiple casualties, but local medical resources were adequate to provide care for victims. True mass casualty events are a very different situation, and by definition they involve such large numbers of victims, or such severe or unique injuries that local medical resources cannot fully cope with them. The most important way to prepare for the large casualty loads caused by bombing disasters is to understand the patterns of injuries and logistical problems that result. A retrospective analysis of implemented organization and clinical management can identify helpful decisions and errors.

Need for Dead Body Management

Immediately following the onset of a disaster, it is essential for authorities to concentrate their actions and resources on the activities for dead body identification and recovery, handling and management of bodies.

Controversy has always surrounded the handling of mass fatalities. Myths about treatment of the dead are strongly rooted in culture. Contemplating massive measles vaccination campaigns after an earthquake because of the fear that corpses could transmit this disease, or burying or incinerating corpses without completing required identification processes because of the supposed contamination risk they pose, are just two examples of the myths that form part of the popular culture.

Despite efforts by experts to dispel these and other beliefs, certain fallacies have led and continue to lead to unacceptable practices in managing dead bodies. For example, after the earthquake in India in 2001, in which the number of fatalities approached 100,000, the bodies recovered were cremated. The wood supply was quickly exhausted, leaving the survivors without enough fuel for cooking or heating. Considering these factors, it is very important to have a separate unit under the hospital response which can deal with dead body management during disaster situations.

Problems Related Dead Body Management

Management of dead body is a difficult aspect during disaster response. Technical guideline is missing that will provide the guidelines to deal with large number of dead bodies after disaster. Chaotic and uncoordinated situation affect during the recovery phase. Mass casualty management should be done in collaboration with forensic institute and department otherwise it'll be a difficult task.

In all the cultural and religious aspects dead are dually respected and cared in dignified manner. Natural or manmade disaster causes large numbers of deaths at short period of time. It creates huge challenge for the health officials for handling the deceased. Lack of ability to deal with the mass fatality plans also adds on to the difficulty in dealing with dead.

In Indian scenario, dead body management pose a lot of challenges since it is difficult to declare the death on the event site as well as triage on site is impossible because of social and cultural constraints. After the event, lack of proper handling of bodies may leads to improper identification problem. Transferring of the dead body form the site to the hospital as well as to the mortuary is another problem that because lack of proper transportation facilities. The bodies used to be brought to the casualty department by available mode of transportation.

Identification is another serious problem which increase challenges due to the impact of the event. Lack of proper evidence from the sight and identification mark it becomes an issue to deal without any forensic expert. Triangulation doesn't work at all the emergency situation to know the person's identity after any disaster.

Examination includes the cause of death and extent of damage on the body is another problem that arises after a disaster situation. The autopsy done for the large number is also an issue that whether post-mortem have to be done for each and every individual body. Space is required to conduct post-mortem and the duration for which body is kept also creates anxiousness and restlessness among the relatives.

Proper storage facility and the capacity of storage room is also an issue during the mass casualty situation. Adequate morgue space and conditions with all the primary facilities is a big challenge in Indian context.

The disposal of the unidentified body also leads to further problem if the relatives come in later days. Sometimes, public and political pressure leads to mass burial, incineration and collective disposal of cadavers. Management of dead affects the psychology of the people who are dealing with it. Mass burial will cause increased psychological distress and legal problems for compensation, insurance. Even handing over the body for last rituals to the relatives after few days also create some negative impact on the family members.

The difficulty on dealing with dead body is the myth that dead body poses public health risk or epidemics. The dead or decayed bodies of human beings do not create health hazards unless they are not polluting the drinking water through infected plague.

Principles of Dead Body Management

Dead body management deals with the following principles:

1. Dead body should be dealt with respect and dignity.
2. Dead bodies do not pose any health risk.
3. Dead body should not be buried in common graves.
4. Mass cremation should be avoided.
5. Effort should be made to identify the body.

The management of dead bodies requires the involvement of a diverse team of people, including rescue personnel, forensic medicine experts, police, administrative personnel, psychologists, support teams for the personnel who are directly handing the bodies.

In disaster situation, the State and its authorities are responsible not only for being prepared to effectively provide immediate assistance to disaster victims and to maintain basic services following an event. In many cases, management of human remains has not been given the attention it deserves, and has even been disregarded. It is important to clarify that the priority is to assist disaster survivors and to maintain basic services, but we cannot overlook the recovery of dead bodies. There should be adequate coordination among all of the actors to avoid misuse of resources or duplicated efforts. To that end, one of the tasks of the Emergency Operation Committee of a country should be the management of dead bodies in disaster situation.

Dead body management is done with two main perspectives one includes medico-legal while other includes humanitarian. Medico-legal perspective broadly deals with documentation of the information related to the victim. These medico-legal records will help in the further process of investigation and compensations. On the other hand, humanitarian perspective includes treating the body with respect and dignity. It does not involve any personal interest or any order from the top it only depends on the humanity.

There are various steps involved to deal with the dead body. It should be always done in co-ordination with other agencies.

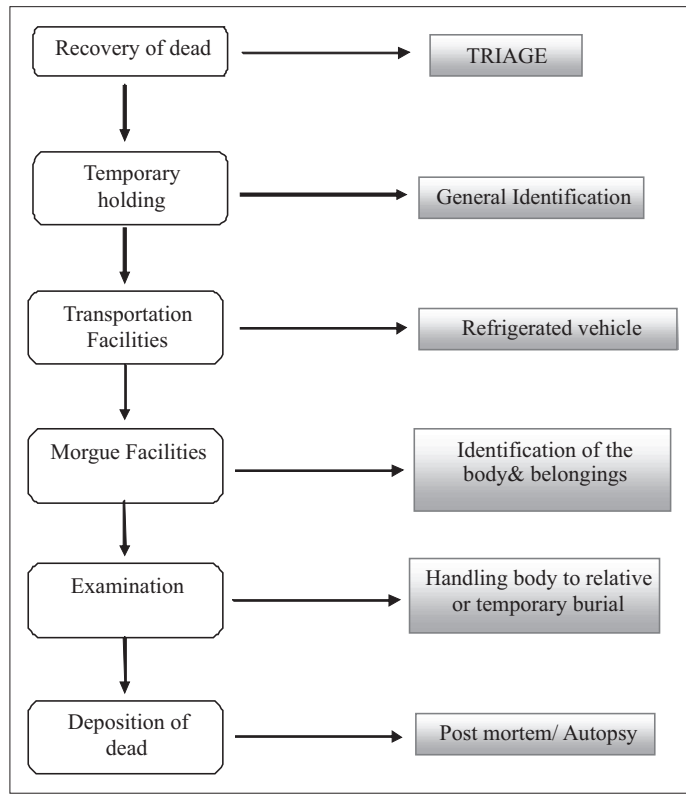

Figure 1: Process for Dead body management.

During mass casualty situation, triage should be done at the site of incident, triage at the hospital by professionals including well trained doctors and forensic experts, management of available resources, integration with law enforcement, identification and release of information regarding victims is done at the earliest (Crabtree, 2006).

Declaration of death is based on the absence of circulation and respiration. The determination of death is sufficiently supported by the absence of mechanical asystole (arterial pulsation). Sometime, echocardiography is also done to know the blood flow through aortic valve and even cardiac electrical rhythm (ECG) is monitored (Bernat, et al., 2010). X-ray should be performed on the living and dead gunshot victims to provide valuable information. In autopsies on gunshot fatalities X-rays enables to identify the projectile that is present in the location or even can identify the projectiles fragments of exited bullet. The path can help to determine the type of ammunition or weapons used and the distance from where it was shot. The presence of pellet indicated that shotgun is used. Bullet

embolisation can be determined by the help of X-rays (Pounder). Computer tomography (CT) scan after death can be used in autopsies to reduce the number of post-mortems to be performed because it provides more information, detect the injuries and defines the mechanism of death in trauma fatalities (Donchin, et al., 1994). 3-dimensional CT is used to find the evidence on the range of the shot and type of bullet used, it is useful in forensic assessment of patients (Stein, et al., 2000).

The bodies will then be taken to morgue to be examined by pathologists, odontologists (forensic dentists) and fingerprint specialists (Scanlon, 1998). The body and fragmented parts along with the belongings should be tagged with unique recovery number. These steps are done for better record keeping. Body should be handled with respect and dignity. In case of further danger the body should be move to some safer place known as temporary morgue or safe fatality collection point secured from public view. It should have adequate space to receive body and proper ventilated. The legal investigation of the dead body involving the identification and establishment of cause of death is done.

After all the general investigations being completed the body should be carried in organized manner in an ambulance or closed van, refrigerated vehicle to the mortuary. The morgue must have proper lighting facility, running water, appropriate furniture for identification with adequate space and capacity. The bodies and body parts are assigned with sequential morgue number (M-number) next to the recovery number. The minimum space between the bodies in rows should be 2 feet (60 centimetres). There should be proper space including for administrative activities, waiting room for relatives.

Examination involves identification and establishment of cause of death. Identification can be in two phase (i). Technical identification phase, where the post-mortem data of the dead and their belongings are collected. (ii). Tactical identification phase, where the post-mortem reports are matched with ante mortem records. But, it is difficult to gather in the case of unknown victims.

The bodies are examined and described according to outward appearance and significant features are recorded. It also happens for the body parts and belongings. Finger print record and photograph should be taken. The body is then taken to a post-mortem examination which is done by forensic pathologist along with legal officers. According to the protocol, all the marks and signs on the body should be marked including tanner score, state of virginity and breast circumference, tattoos, dental record and surgical scars. Blood and urine samples or muscles biopsies should be collected for alcohol dosage, blood grouping and toxicological analysis. Photographs are taken for all the relevant features. Clothes if required for further investigations should be dried and packed (Hooft, Noji, & Voorde, 1989).

After the thorough examination is completed the identified body should be released from morgue and handover to the relatives while the unidentified bodies are embalmed and stored for further investigation. The bodies should be buried in separate graves and the location is recorded. Dead body do not pose any public health threat which always remained as a myth. Therefore, the bodies should never be disposed in mass graves; cremation in the worse case for disposition.

Problems Faced During 26/11 Terror Attack

India, being a sensitive country with emotions and care. Mass casualty situations be it any and natural calamity or manmade disaster like terrorism creates a havoc among the society.

26/11 was the most critical condition for all the medical departments. In India, hospital preparedness is an evolving area. Hospital plays a major role in such critical conditions. The government hospital facilities are mind-boggling in India.

The 26/11 terror attack creates a lot of chaos and complexities in the hospital response. Since, no proper Emergency Management System (EMS) exists for the hospitals. Field triage at the attack site is problematic in Indian context and it was not done which might be useful to sort among the dead and injured victims to reduce the response time. Triage is a major problem due to lack of such trained professionals in India as well as the culture. The first responders usually used to be the bystander or common people (*aam-janta*). The handling team should be created which will include professionals for identification and proper handling of the dead. Since, dead also deserve to be treated with respect.

The transportation facility to carry dead body was not proper and also created some psychological influence on the people. As the dead bodies were brought and kept in bulk at the casualty department. There should be separate vehicle (ambulances) for dead bodies to bring it to the storage site or mortuary. The information flow to the hospital should be quick so that there will be time to get prepared to receive the victims. The crowd for both dead and living in the casualty unit of emergency department creates a major problem to deal with the victims. The quantum of victims also plays a vital role for the responders and the preparedness of hospitals. The arrival of huge number of victims at a particular period will lead to sudden panic among the hospital responders too. Limited capacity at the casualty department will generate a large number of crowds in the area affecting the response and intervention among the victims.

The documentation of medico-legal cases is also a major step to do during the

mass casualty situations. This will help to keep the evidence of the case history and investigation data of dead bodies. Medico-legal cases (MLC) will enable to issue the death certificate and to determine the cause of death.

The storage space or mortuary should have proper facilities along with autopsy room but in case of Mumbai there was only one hall for doing the post-mortem. Mortuary was congested and no enough place is there to work. Cold storage lacked lighting facilities. Bodies were not kept in the mortuary because it was full and were not kept systematically which was difficult to identify. Staffs used torch light to find out bodies. Since, it took five to six days to conduct the entire post-mortem, the storage becomes a major problem as the bodies were becoming heavy and decomposition was started. Body couldn't be kept refrigerated before conducting the autopsy. The examination process involved with the technical problem of doing X-rays and identification.

There were major issues during the hospital preparedness process - the question arises as how to deal with the dead bodies after mass casualty and the storage of dead? There should be any temporary storage facility? How do the resources should be managed.

Conclusion

Management of dead body is one of the most difficult aspects of disaster response. Death has profound and long lasting consequences for survivals and communities. Handling the sudden appearance of a large numbers of dead bodies does not seem to be well planned for in any society. In the absence of such preparation, the whole process slows down as efforts are made to turn bodies into person. It is very clear and fundamental to know that the dead are not "socially dead" unless the right steps are taken leading to their final and last journey.

To the dead it may not matter, but it does to the living. During mass casualties, it is very important that the management of dead body must be very systematic and planned, it should be deliver according to the requirement of the situation.

Recommendation

- Triage should be done at field itself to avoid chaos in casualty department to fix the priority of needs and to identify dead and injured. This will save lives of many people as well as time.
- X-ray room must be separate to maintained privacy and ease of conducting X-rays.
- Training should be provided to all the staffs so that they can know what exactly is done in emergency situation. First aid must be known by all the staff members.

- Counselling should be provided to the staffs as well as victims.
- There should be coordination among the departments for better service.
- Number of mortuary should be increase to tackle the problem during the emergency with all the facilities. Temporary holding areas should be identified to keep dead bodies in case of limited capacity of mortuary.
- The Disaster Management Plan has to be revised and it should also include provision for the dead body management.

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Importance of Documentation in Disaster Management Lessons from Kosi Floods, 2008

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Introduction: It is critical to create and maintain accurate record of events and expenditures related to a disaster. Proper and accurate documentation facilitates appropriate and adequate response and, later on, formulation, validation, approval of funding process. It is essential to document work performed and costs incurred as this would help recover costs, prepare for audit and review by any agency of central/ state government. It can be used to justify strategy and tactics.

Documentation of activities during a disaster provides a historical record of the emergency. It can be used to provide personnel with written plans so that their actions can be coordinated. It can also be used for legal purposes if, after the emergency, problems arise which may have to be settled in a court of law. On a small incident the documentation tasks may be quite simple and can easily be done. As an incident increases in complexity, so do the documentation procedures and requirements. Documentation would help collate lessons learnt which would help in improving disaster management strategy and tactics in the future. In addition documentation through forms and format proves useful in assessing a situation, deciding on strategy.

1.1 This is being discussed in the background of Kosi disaster, 2008 when the author was posted as Additional Commissioner in the Department of Disaster management, Govt. of Bihar. Thus the author had the opportunity to organize, execute and monitor the rescue, relief and recovery operations. The experience gained during the Kosi disaster needed to be shared with all responders such that lessons learnt could help improve our response to any such disaster in future.

1.2 Here it may be useful to present an overview including impact, evacuation, relief and recovery of the Kosi disaster, appropriately called National Disaster by Prime Minister of India. Later on importance of accurate documentation shall be discussed in respect of each response.

Impact

- Name of affected Districts -
- Supaul, Madhepura, Saharsa, Araria, Purnia

No. of blocks affected	35
No. of Panchayats affected	412
No. of villages affected	993
Population affected	3329423
Live stock affected	712140
Area affected in hectare	368000
No. of human deaths	527
No. of live stock deaths	19323
No. of houses damaged	220174

1.3 Impact. Kosi river, the ''sorrow of Bihar'' breached, (18th August, 2008) its embankment at Kusaha, 10 kms inside Nepal, bordering Supaul district of Bihar and started flowing along a new course, approximately 15 to 20 km wide and 150 km long, affecting 35 blocks, 407 Panchayats and 980 villages in five districts of Bihar. More than 33 lac people and their houses/ land spread in 110258 ha area fell in the path of the new course. Hundreds of thousands of people were trapped in the new course with no means to escape. The entire countryside within this 3000 sq. km swathe was devastated by the rapidly surging flow of the river along its new course. Houses, school buildings, roads, health centers, bridges, telephone towers and railway tracks were flooded or severely damaged/ swept away. Several banks closed their branches in the affected areas causing problems in distribution of cash dole. There was complete disruption of road connectivity and, as such, boats became the only source of reaching the people.

2. Response

2.1 Mammoth evacuation: More than a million people were evacuated under conditions of terrible handicaps with the help of 35 columns of army, 855 personnel of NDRF, 4 units of navy, several rescue teams from other states, 3500 policemen and 5000 others. More than 1500 country boats including 561 motor boats were deployed for evacuation. In addition several SAR teams came from all over the country both government and non government.

2.2 Relief operation: Marooned people were provided food, water, medicines and shelter by helicopters and boats. Rescued victims were housed in relief camps where they were provided with shelter, food and many other things

including clothes and utensils. Toilets were made for them. Hand pumps and water purifiers were installed for clean water supply. During Kosi calamity of 2008, as many as 362 relief camps were setup within a matter of days to house 4,38,324 inmates. Of this, there were 35 mega relief camps with a population of more than 5000 each with the help of 12000 tents procured from army and para military forces. Finally semi permanent camps with GI sheets were set up to take care of victims in winter. Arrangements were made for food, water, sanitation, health, education, sports and cultural programmes in these camps.

3. Documentation

3.1 Search and rescue - The state launched the largest evacuation operation undertaken in the country so far. Rescue teams came from all over the country. 35 columns of army (about 4000 men), 4 units of Navy and 850 personnel of National Disaster Response Force came free, but they were provided transport from airports at Patna and Purnea and rail heads. For this vehicles were requisitioned from owners or seized during transit. And this had to be done in very short time. If log books/records are not maintained properly, the transporters may not get payment or payment would be delayed leading to complaints at various levels and even court cases. During Kosi these vehicles were provided by the district administration by opening log books. There were no complaints of non payment at that point of time. Moreover, correct accounting would facilitate processing reimbursement claims under NCCF/CRF norms.

❖12 Air Force helicopters were requisitioned for rescue and relief work. The record of their date of arrival and operations was maintained at Purnea air force base wherefrom all operational activities were organised. DM Purnea had deputed one senior deputy collector with support staff to manage and log the movement of helicopters, planes, rescue teams and relief material. And offcourse IAF station had its own system of maintaining records. Since entire air operations were mounted from one place, record keeping was to that extent simple. This was essential to ensure proper and timely payment. Absence of such documentation will cause delay in payments and reimbursements of expenditure.

What follows is that we must maintain a record of usage of helicopters and

vehicles to ensure timely payment. This can also help departments concerned to make provision for funds for all these activities in advance so that response does not suffer due to lack of funds.

❖Rescue and relief became our single task for the first 2-3 days. All districts on Ganges were given targets of number of boats and the time of their departure to the affected districts by the Principal Secretary and the 2 Additional commissioners. Since the flood affected areas did not have enough boats, 1500 boats were transported to the affected districts by trucks and tractors from all over the state. These boats were collected in great hurry and sent by whatever means available. The sender and the recipient districts needed to maintain records of the boats for payment of rent and wages to the boatmen as well as compensation for damage/ loss of these boats. While any of these boats got damaged during transportation, some were lost during operations. Many boatmen deserted leaving behind their boats due to adverse/ dangerous operational conditions. It may not be out of place to mention that even army and NDRF boats capsized a few times. Since some authorities could not maintain proper record of arrival and actual deployment of the boats, particularly in the initial phase rent and wages could be not paid correctly and timely. This is typical of poor or no maintenance of records during disasters.

This is quite understandable in the given circumstances- the urgency of sending boats and operating them that too in quick time where most responders were themselves running around for safety. In such circumstances, documentation in initial phase was real challenge for all of us. In the absence of proper records resources are denied payment / compensation for damage in due time. Owner has to run from pillar to post and finally they seek relief from courts which in itself is costly and time consuming, which something most cannot afford. It may be mentioned here that for many such owners the boat or that single resource may have been the only source of livelihood. Here in lies the significance of keeping records.

3.2 Relief and recovery – The magnitude of relief recovery work can be understood by table below;

Phase-II-(6th Jan – 25th Feb 2009)

- Distribution commenced from 6th Jan 2009.
- Distribution of cash @ 1590/- in lieu of one 100kg of grain and Rs.250/- as cash dole for every flood affected family. Rs. 13211.5 lac against grains and Rs. 2077.28 lac against cash dole distributed. obtaining grain difficult-FCI/ SFC. TRUCKS NOT AVAILABLE. RAIL TRACKS GONE.Payment of Rs. 250/- each for blankets from CMRF, Rs. 2161.75 lac distributed.

- Distribution of educational assistance from CMRF for students @ 800/- upto class 8th 1000/- for class 10th and 1200/- for class 12th Rs. 3420.01 lac distributed amongst 422671 students.

❖ Management of relief camps. As mentioned earlier, more than 4 lac victims were housed in camps. The camp managers needed to ensure registration of victims who joined the camps. This was the basic data for provision of all services and commodities to determine how much food to prepare; number of toilets to construct and number of hand pumps to be installed etc. with large number of responders themselves seeking relief, it was gigantic task to establish, man and run the camps. Large number of people kept moving from camp to camp to live with their co villagers/ relatives or for better facilities and some would leave for their relatives /friends houses elsewhere. Government provided 3 meals a day, milk for lactating mothers and children and clothes, utensils. Total of about 2 lac kits from Chief Minister Relief Fund were distributed. This made the registration in camps very attractive. With the result many would visit the camp only for food. Therefore maintaining census became difficult. It would be noteworthy to mention that there were no instances of unrest/protest with regard to camp management at all. This indeed was highly commendable. We, at the state level prescribed a reporting format for reporting relief work in camps and outside. This was to be submitted for every camp daily. It included number of people in camps, status of sanitary, health and other amenities. However, this happened after few days. This to a large extent streamlined the documentation work. Food items were being purchased on daily basis with advance money. Maintenance of records of food and utensils etc purchased / distributed in camps was essential for proper accounting and to take care of more serious problems related to allegations of irregularity at any later stage. Documentation of number of people in camps each day, expenditure on food and lodging, sanitary, health arrangements is essential to claim assistance under CRF/NCCF from Government of India.

❖ National Disaster Management Authority (NDMA), departments of Government of India came forward to support the rescue and relief operations in a big way. They not only provided rescue units, also

arranged for generator sets, water purifiers, lighting systems and tents (12000) from different sources. Several state governments too sent rescue teams, ambulances, medicines etc. These items arrived by AN 12 planes, trains and trucks from different parts of the country. DMs deployed personnel at the rail and air heads to receive and despatch these items to the needed place. Due to urgent requirement of these items were put in operation for establishing camps without loss of time thereby restricting the scope for detailed documentation. Diesel sets, water purifiers would go to camps since they were in great demand. It took some time for DMs to establish units for receipt and despatch. Nonetheless this work was mostly well done. There was need for effective resource management of all these resources for optimal deployment/ re-location at right places/ sites and later on for making payment and returning to the owner. NDMA was quick to send water bottles which were supplied to the people along with food packets and polythene sheets air dropped by 12 helicopters. Rescue teams in boats also carried them to marooned villagers who had refused to come out or decided to stay on rooftops, railway tracks or embankments etc. Initially we did not know that the water bottles were for payment. Later on, when bills were received, there was difficulty in obtaining certificates from the districts/blocks where they were actually used since proper records were not kept by the recipients as a result of which payment was delayed.

- Similarly polythene sheets for shelter, fodder and food packets were procured from several districts and states for distribution among the victims. Polythenes were procured from within the state and outside. Lot of it came from West Bengal govt. When mega camps were created tents were obtained from defence forces and paramilitary forces. More than 12000 tents were received. After allpolythenes had to be paid for. The tents came gratis through GOI, but the basic requirement of documenting its allotment, arrival and distribution to actual location had to be done for future reference. More than 3 lakh food packets were distributed in one month time with the help of 12 helicopters.

This must be biggest relief operation undertaken in the country. Since most of it is taken on credit, the recipient and the procurer, both are required to maintain accounts so that there is no problem in payment, and more important, there are no audit problems late on. Normally audit happens during the tenure of a different officer than the one who handled the relief operations, therefore those involved need to be extra careful.

- Documentation of protocols. It is essential to maintain record of all resources both human & material available within the state/ district that

can be requisitioned. Unfortunately most districts do not keep record of available resources. The IDRN and SDRN are rarely updated with the result that when disaster strikes most does not know whom to contact for required items. During Kosi Floods, 2008, army rescue teams were called in. Fortunately, Danapur Sub Area Command happened to be in Patna and its officers were well known. Therefore the task became easy. Otherwise, in absence of protocols it would have meant loss of critical time. Same was true of requisition of IAF helicopters for relief work. We had to find our way through IAF station Bihta. It took some time before the right person in the air headquarter was found. Even then, many a time intervention of senior officials including Defense Secretary and Secretary Border Management (incharge of disaster management) was necessary to facilitate availability of resources. We fell short of polythenes and tents. While the former was obtained from West Bengal, army and central para military forces together provided 12000 tents. Data base of vendors who could provide such items would go along way in quick procurement. Incident Response System adopted by government of India as response tool provides for an organisational elements that arranges all logistic support smoothly. Similar systems we too need to develop.

- Documentation of losses/ damage assessment. This is a much neglected area of work impacting the state and ultimately the community. Invariably, the assessment is inadequate/ as well as inaccurate. One significant reason for this is that most functionaries (government/panchayat) are neither aware nor trained to do damage assessment.. Another reason is that many of them are themselves affected. The process of damage assessment is extremely difficult especially in the initial phase- with water all around in times of floods and debris in times of earthquake making physical assessment almost impossible. As a result documentation is not accurate. In Kosi calamity too several categories were left out in the initial assessment. Some of them were loss of fisheries/ponds/nets and damage to land due to change of course of river Kosi.

- Herein lays the significance of proper assessment of damage. We all

know that issues related to such calamities, specially the extent of damage, the amount of compensation and expenditure are raised in legislatures and parliament. During Kosi calamity too several questions were raised in Parliament and state legislature. And no one would afford to provide incorrect information, Therefore, the need to maintain proper documentation of damage, payment of compensation and expenditure on rescue and relief works is of paramount importance. After all, this is the basis for every other activity afterwards. Therefore it is imperative that various types of damages are correctly assessed, the most critical being damage to infrastructure (roads, bridges, buildings, irrigation projects, house/ dwelling units, agricultural land/ crop and other means of livelihood. This is significant because of differing rates of compensation for each category of houses/ land ie Kucha/Pucka houses. A pucca house fetches much more compensation than a katcha one. During Kosi floods, 2008 most of the villages were inundated/ made inaccessible due to new stream of the river, very fast current in new course, collapse of bridges, washing away of roads, non availability of block/panchayat/ village level functionaries and poor knowledge of norms and methods of damage assessment. Local elected panchayat representatives were involved by constituting committees at the local and district levels. They were engaged in preparing list of beneficiaries and distribution of damage claims. This ensured transparency and satisfaction among the villagers. We did introduce photography of the houses to ensure correct assessment. Even then taking photograph of damaged houses in the initial stage or even afterwards when the area is marooned was difficult task. The result was different figures at different points of time. While preparing memorandum for Central assistance under CRF/NCCF, these figures assume great significance.

If assessment has not been done properly victims will suffer. So will the State as it may have to provide compensation in many cases where the claim was not included in the memorandum. After submission of the memorandum, Central team comprising of officers from different departments and headed by a Joint Secretary in the Govt of India visit the affected areas to assess the damage and their report becomes the basis for Central assistance. If the team is not provided with correct and justified data, it will have difficulty in supporting the claim for financial assistance and the state will stand to lose.

It follows that those responsible for assessment must have fair knowledge of the provisions. They also must adopt humanitarian approach.

- Ex-gratia payment became difficult because of lack of authentic data. During Kosi disaster a little over 500 people died. Boats capsized, people got swept away and since invariably the dead body is not recovered to

substantiate the death it is difficult to support claims. Boats were swept away by the sudden new course of the river. Current being very fast, bodies could not be recovered in many cases. Many a time, the family/villagers dispose off the body on their own, not aware of the provisions of the ex-gratia. While the administration insists on a FIR in a police station and/or enquiry by a magistrate before initiating the claim, absence of dead body complicates the matter. Many a time family members do not report the matter to police; neither do police properly document the event to help payment of ex-gratia. Therefore, payment of ex-gratia becomes difficult.

- There is serious concern about documentation of missing persons. Like any other disaster, during Kosi Floods, 2008 too people were reported missing mostly due to separation from their families. During such calamity boats capsize wherein, while able bodied males manage to swim to safety, the vulnerable sections especially old women and children get swept away. During Kosi operations, an online portal was opened in camps to register the missing. However, this was not sufficient to fulfil the requirements. Therefore, there is urgent need to devise methods/processes to ensure that the missing are recorded, traced and finally restored to their families /near and dear ones.

- As per law, a person is taken as dead only after 7 years of missing. When this is to be insisted for payment of benefits during a disaster, the misery of the victim will get multiplied and the recovery will be extremely difficult. Hence there is urgent need to revisit the norms for deciding the claims. In Kosi, the government decided to accept claims on basis of enquiry report of a magistrate.

Hence documentation and processing must be completed urgently so that the family of the deceased gets the ex-gratia in quickest possible time. For this to happen, people need to be made aware of the provisions of ex-gratia provisions. The family and others including PRIs must know the legal requirements to be completed. In this regard, the district administration should conduct regular awareness campaigns in vulnerable areas. Most of all, the block level officials must be well trained.

- Resource management. More than a million people were evacuated under conditions of terrible handicaps with the help of 35 columns of army, 855 personnel of NDRF, 4 units of navy, several rescue teams from other states, 3500 policemen and 5000 others. More than 1500 country boats and 561 motor boats were deployed for evacuation. 12 Air Force helicopters were requisitioned for rescue and relief work. Marooned people were provided food, water, medicines and shelter by helicopters and boats. Rescued victims were housed in relief camps where they were provided with

shelter, food and many other things including clothes and utensils. During Kosi calamity of 2008, as many as 362 relief camps were setup within a matter of days to house 4,38,324 inmates. Of this, there were 35 mega relief camps with a population of more .Operational plan for rescue was prepared daily which required locating rescue teams, boats at the water front wherefrom trapped persons could be easily evacuated and brought to nearest camp. This required tracking the status of resources. Since most of the professional rescue teams came from armed forces and NDRF, this could be taken care of. The army had placed one brigadier rank officer in the midst of operations at Supaul and Purnea each for monitoring the operations. Similarly NDRF and Navy had placed senior Commandants in the area for coordination and monitoring the operations.

1500 Boats over 1 lakh polythenes, food packets, water purifiers, ambulances, diesel sets tents were procured/ made available for rescue and relief. Some of these items were brought by air and rail. They came from different agencies including CARE, state governments, NDMA and other private bodies. AN 12 aircraft of IAF airlifted tents, water bottles, water purifiers, diesel sets. Boats were sent to operational centres. They were sent to actual places –operational centres for rescue and camps without loss of time. 3500 policemen were sent from outside to support rescue and relief work. Given the damage to district-office of DM Madhepura had to be shifted, Jail had to close, block panchayat and village administration it became difficult to log the resources properly in initial days. But subsequently systems and processes were evolved and units for receipt and despatch were established. Agreed that such activity will be difficult in any disaster. However, preformed elements at district, state, block levels as in IRS could be useful in future disasters. They needed to be tracked from there itself. When the administrators have no knowledge of the whereabouts of resources there cannot be relocated when required as per revised strategy/ tactics/ operational plan. Somehow there is insensitivity to the issue of keeping records of resources and therefore resource tracking is very difficult. One would be able to appreciate the difficulty in maintaining records in the background of the sheer magnitude of the rescue and relief work and the impact of the disaster as mentioned earlier. Even with best of intentions it as difficult task. DMs/SPs and others were flooded with calls for rescue from all over the place.

- Budgetary control/ financial management. In our country disaster response is largely a government effort where very few resources are hired. Thus the culture of cost accounting has not developed. However, record of expenditure has to be maintained regularly and correctly to ensure financial accountability and obtain additional funds in time so that rescue and relief work does not suffer adversely due to insufficient funds. During Kosi, details of expenditure made per person per day in relief camps

had to be submitted in the memorandum for obtaining assistance from Government of India. However, even though, procedures for procurement were formulated, some camp managers could not keep proper records. Therefore there was difficulty in calculation of expenditure on food provided in camps as a result of which irregularities of non maintenance / absence of records were detected. The sheer magnitude of the problem coupled with absence of procedures/ experience of organizing rescue and relief of this dimension too made accounting difficult. The administrative machinery had been seen such a disaster where over 9 lac were rescued of which over 4 lac were housed in 360 governments relief camps. Agreed that record keeping is a difficult task in such situations, but at the same time it is extremely essential to do the same budget control and ensuring that there are no enquiries after the event and even if there is one, no harm is done.

Conclusion

Proper documentation of activities and expenditure during rescue, relief & recovery is critical to response management. Arrival of resources including, rescue team, boats and equipment from within & outside the district/state must be documented; their movement/ deployment must be tracked to ensure their accountability and payment whenever required. Resource management when done properly would ensure optional utilization. Maintenance of expenditure of relief work including, relief camps would be essential to claim assistance under CRF/NCCF, request/demand for more budgetary allocation, take care of audit and enquiries against allegation, reply to questions in Parliament, State legislation etc. Documentation of activities during a disaster provides a historical record of the emergency and hence the most important significance of documentation would be learning from the experience for streamlining systems and procedures for future disaster management and take care of legal issue if, after the emergency, problems arise which may have to be settled in a court of law.

Proper and accurate documentation facilitates appropriate and adequate response and, later on, formulation, validation, approval and funding process. It is essential to document work performed and costs incurred as this would help recover costs, prepare for audit and review by any agency of central/ state government. It can be used to provide personnel with written plans so that their actions can be coordinated. It can also be used for legal purposes.

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Natural Disasters and Impact on Schools in India

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Abstract

Recent floods in Kashmir and very severe cyclonic stormwhich struck Andhra Pradesh have gone on to reinforce how schools and children get impacted. No structured database is available in India on number of schools and children studying in disaster prone areas. Not much statics is available on such disaster affected children who are vulnerable to drop out, forced to child labour and victims of child trafficking. This article talks of the concerns, impact on schools, initiatives by the government, gaps in plans and implementation and finally the way forward.

Key Words

District Information System for Education (DISE), Regional Consultative Committee (RCC), International Decade for Natural Disaster Reduction (IDNDR)

Natural disasters on rise – Concerns for schools

Natural disasters are aggravated by human intervention. The World Bank Report of 2013 has stated that "Climate change will increase frequency and severity of disasters, stress food and energy production in South Asia". The report also predicts increase of droughts in India. For the time period 1981–2006, there have been significant upward trends in the lifetime maximum tropical cyclone wind speeds both globally and for the western North Pacific and Northern Indian Ocean basins with 30 per cent strongest Tropical Cyclones shifting to higher maximum wind speeds (The World Bank, 2013).

In India, almost 85 per cent of geographical area is vulnerable to one or multiple natural disasters. 22 States in India have multi-hazard zones. It is estimated that 58.6 per cent of the landmass is prone to earthquakes of moderate to very high intensity, more than 40 million hectares (12 per cent of land) is prone to floods and river erosion, of the 7,516 km long coastline, close to 5,700 km is prone to cyclones and tsunamis, 68 per cent of the cultivable area is vulnerable to drought and hilly areas are at risk from landslides and avalanches (Das, 2012).

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Recent natural disasters have shown what adverse effect it can have despite improved warning system and rescue operations. It was estimated that 4,484 villages of four districts in Andhra Pradesh were affected by the cyclone 'Hudhud' that damaged 41,269 houses. The cyclone damaged 455 buildings, including 317 primary and secondary schools, before finally crossing over the state (The Times of India, Oct 25, 2014). Numerous schools remained closed in Srinagar, Kashmir for over a month after recent flood, considering the safety and security of the children (The Indian Express, Oct 02, 2014).

When a disaster strikes,either school buildings are damaged, converted to relief camps or altogether ordered shut by the local administration for months together. Disasters usually result in trauma among the children in addition to the financial and personal loss to the community. The academic sessions run as per schedule, however, the children affected by natural disasters are not able to cope up with the academics leading to exclusion from the school system. Researches state that somehazards are preventable whereas few others are not. But effects and losses caused by hazards can be prevented or mitigated by means of'vulnerability reduction' (Palliyaguru and Amaratunga, 2011).

Vulnerability of schools and school children in India

As per 2011 census, over 21 per cent of total population belongs to 5 – 14 age group. If we consider 5 – 18 as the schooling age (from 1st grade to 12th grade), it is about 30 per cent of total population in India, the community associated with that population is not negligible. According the State Report Card of 2013-14, there are in total 1,448,712 schools in India and total enrolment as per 2013-'14 District Information System for Education (DISE) data is 198,899,659. Out of these, 121,960,862 are enrolled in government schools.

It is indeed unfortunate that no structured database is available in India on the number of schools located in natural disaster prone areas in each State/UT and also number of school children studying in these schools facing same set of problems either seasonally or occasionally. It is also not known how many such vulnerable students have to migrate every year, have to drop out from the school permanently, how many of them add to the total stock of child labourers and how many get trapped in child trafficking business during or after the natural disasters.

Figure 1 shows the natural disasters which are common and regularly or occasionally affect different States/UTs, Figure 2 shows the number of schools located in each of the States/UTs. What does the data set tell us?

States/UTs	Types of natural disasters remarkably affecting the State/UT			
Uttar Pradesh	D	EQ	F	LS
Madhya Pradesh	D	F	EQ	
Rajasthan	D	EQ		
Andhra Pradesh + Telangana	C	D	F	T
Maharashtra	C	D	EQ	FF
West Bengal	C	D	F	T
Bihar	C	D	F	
Orissa	C	D	F	T
Assam	EQ	F	FF	LS
Karnataka	D	F		
Tamil Nadu	C	F		
Chhattisgarh	D	EQ		
Jharkhand	D	F		
Gujarat	C	EQ		
Punjab	F			
Jammu and Kashmir	F	FF	EQ	LS
Uttarakhand	F	FF	EQ	LS
Haryana	D	EQ		
Himachal Pradesh	F	FF	EQ	LS
Kerala	C	D	F	
Meghalaya	F	FF	EQ	LS
Delhi	D	EQ		
Tripura	EQ	LS		
Manipur	EQ	LS		
Arunachal Pradesh	F	EQ	LS	
Nagaland	F	EQ	LS	
Mizoram	F	EQ	LS	
Goa	C			
Sikkim	F	EQ	LS	
Puducherry	C	F		
Andaman and Nicobar Island	F	T		
Dadra and Nagar Haveli	C	F		
Chandigarh	EQ			
Daman and Diu	F			
Lakshadweep	C	F		

Legend	Disaster
D	Drought
EQ	Earthquake
T	Tsunami
FF	Flash flood
F	Flood
C	Cyclone
LS	Land slide

Figure 1: Natural disasters remarkably affecting States/UTs on regular basis (States and UTs are arranged as per descending order of number of schools)

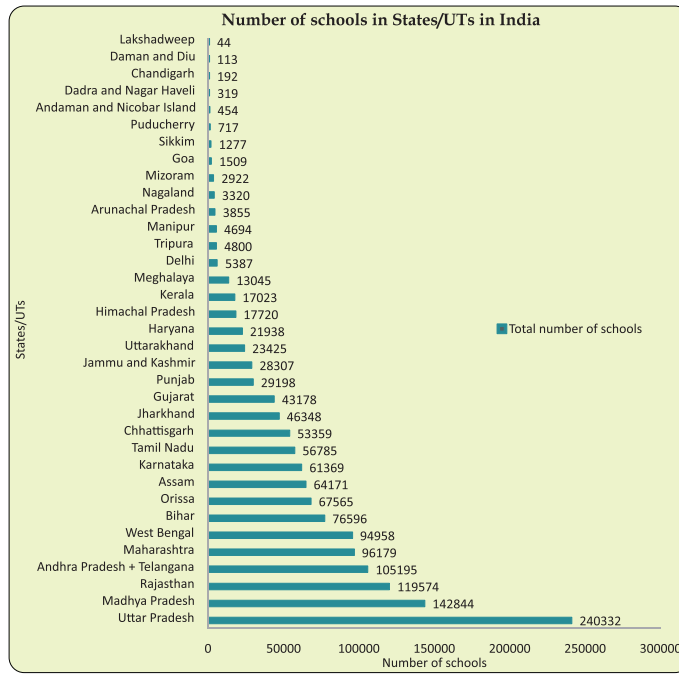

Figure 2: Number of schools in States/UTs in India (as per 2013-14 data)

(1) Most of the States and UTs are affected by more than one natural disasters.

(2) 4 States consist of more than one lakh schools each. These four states are Uttar Pradesh, Madhya Pradesh, Rajasthan and undivided Andhra Pradesh (including Telangana).Some of these States are affected by multiple natural disasters and at various points of time in a year. For example, coastal Andhra Pradesh may experience cyclone and flood in a year, whereas inland area of this State and Telangana may experience draught in the same year.

(3) There are 8 States which have 50,000 to 1,00,000 schools each which also experience multiple natural disasters. These states are Chhattisgarh, Tamil Nadu, Karnataka, Assam, Orissa, Bihar, West Bengal and Maharashtra. Among these, parts of Assam, Orissa, Bihar, West Bengal are chronic flood prone areas; parts of Chhattisgarh and Maharashtra experience draught almost every year. Apart from these, there are possibilities of experiencing earthquake in parts of Maharashtra.

(4) Haryana, Uttarakhand, Jammu and Kashmir, Punjab, Gujarat and Jharkhand have 20,000 – 50,000 schools each. Because of the terrain, Uttarakhand and Jammu and Kashmir have to face complex issues during natural disasters

like flash flood, flood and earthquake. Parts of Jharkhand experience flood almost every year, Gujarat experiences cyclone and flood frequently and of course there is a threat of earthquake in some part of this State.

(5) Three States, Meghalaya, Himachal Pradesh and Kerala have 10,000 to 20,000 schools each. Among these, Meghalaya and Himachal Pradesh experience almost same set of natural disasters such as earthquake, flash flood and flood whereas Kerala's issues are little different, parts of this State suffer from seasonal floods.

(6) There are seven States and all seven UTs which have less than 10,000 schools each.Out of these, six States are located in north-eastern part which is earthquake prone and also prone to other natural disasters like flash flood, Goa is in coastal area and prone to cyclone. Among the 7 UTs, Delhi and Chandigarh are earthquake prone, remaining 5 UTs experience cyclone and tsunami.

DISE data tell us about the number of schools located in each State/UT and number of children enrolled there. But we don't have any dataset on the number of schools located in disaster prone areas in each State/UT. Also, we don't have maps showing schools located in each of the disaster prone blocks.

Mitigation strategy making a difference

Greubel et al argues that "Children in crisis benefit from the sense of normalcy provided by going to school" and therefore, "reopening schools, when safe, should be one of the primary priorities of disaster relief efforts" (Greubel et al, 2012). After Hurricane Katrina, the destructive Atlantic tropical cyclone of 2005, the first elementary school in New Orleans reopened after three months. In 2010, the earthquake in Haiti destroyed 4,000 schools, the schools slowly began to open in the capital after three months. But in Japan, following the massive 8.9 magnitude earthquake in 2011, where schools were physically destroyed and the several lives of teachers and children lost, classes commenced in disaster-proof and multi-hazard resilient buildingsjust after a week (Greubel et al, 2012). The preparedness for disasters makes this difference. Such preparedness can reduce the impact of natural crisis on schools and children studying there.

A study conducted by Shaw et al shows that school-knowledge-based education programmes are useful, also it suggests additional activities e.g. family education and community education for converting knowledge into action (Shaw et al. 2004). It is already proved by many countries who have excelled in disaster risk reduction minimising material damage and loss of life. In Japan, safe school sites are selected through risk assessments. It is ensured that schools are disaster-proofed and multi-hazard resilient. Students, teachers, parents and communities are involved in learning about disaster risk and practicing early

warning simulation drills and evacuation for expected and recurring disasters.

In Bangladesh, there are short-run programmes to resume academic activities of children in the disaster-torn institutions by erecting temporary structures, providing books and study materials often free of cost, waiving examination fees and rescheduling public examinations. The Government of Bangladesh also actively involves local School Managing Committees (SMCs) in rehabilitation of disaster affected schools, for constructing temporary structures and procuring furniture and for distribution of books and study materials (Government of the People's Republic of Bangladesh, 2010).

The trends of thoughts and processes of disaster management have undergone some changes as per the concerns raised by different nations at different points of time. The United Nations designated 1990s as International Decade for Natural Disaster Reduction (IDNDR). After the IDNDR and with the initiation of International Strategy for Disaster Reduction (ISDR) in 2001, a strong shift took place from post disaster activities to pre disaster mitigation and preparedness policy. A Regional Consultative Committee on Disaster Management (RCC) was established at the initiative of the Asian Disaster Preparedness Centre (ADPC) in 2000. Disaster Risk Reduction (DRR) systems have been already introduced to school children in some RCC signatory countries, which regularly or occasionally suffer natural disasters. Some others are also planning to introduce DRR systems to school children soon.

Initiative in India so far

In India, National Disaster Management Authority (NDMA) was established in 2002 and Disaster Management Act was passed in 2005. The National Centre for Disaster Management (NCDM) established in India in 1995 was upgraded in 2003 and now it is known as National Institute of Disaster management (NIDM). NIDM conducts lot of training programmes and workshops in India for disaster management and preparedness for administrative functionaries and provide inputs for policy formulation for disaster management. National School Safety Programme (NSSP) has been launched by NDMA which talks about schools' preparedness for disasters, ensuring safety and security of children, formation of Disaster Management Committee in schools.

In the Tenth Five Year Plan document of the Government of India, the need for integrating disaster management into the education system was highlighted. The Central Board of Secondary Education (CBSE) introduced the subject on Disaster Management as a frontline curriculum in Social Science for Classes VIII in 2003, for class IX in 2004 and for class X in 2005. But other examination boards including State Boards have not yet introduced this.

There are also some initiatives towards introducing disaster management in higher education. For example, the University Grants Commission (UGC), in 2012, proposed an optional paper on disaster management in undergrad education and recommended disaster management in orientation and refresher courses offered by teacher training colleges. Mumbai based Tata Institute of Social Sciences (TISS) also runs a postgrad programme on disaster management.

Gaps in plans and implementation

Sarva Shiksha Abhiyan (SSA) Framework of India suggests schools "to incorporate safety features for resistance against hazards" in buildings. Apart from earthquake resistant design and construction in school buildings, the framework also talks about "other natural and man-made hazards against which appropriate safety should be ensured, such as floods, cyclones, fires, etc" (MHRD, GoI, 2011). But there is a gap in between the policy expectations and ground reality in the domain of disaster management in schools. Some of the issues are as follows:

1. Enough research work has not been done to understand what model of disaster preparedness would be suitable at the micro level for various natural disasters. Disaster management plan at state or district level would not serve its purpose if the plan doesn't consider the local level variations and requirements.
2. There is no database starting from the block level to national level on the schools vulnerable to various types of natural disasters.
3. None of the courses launched and recommended so far address the issues directly pertaining to schools.
4. There is no context-specific approach recommended so far to address the issues related to preparedness of the schools for disasters so that the children can be saved from post disaster impacts. No specific authority has been made accountable to take care of the safety and security of school children and to ensure their continuity in school.

Suggestions for better disaster managementin schools

Numerous institutional structures have been set up between district and school level, in 1990s to strengthen schools as well as school curriculum. Now there are education functionaries at district, block and cluster levels who have defined roles and responsibilities. This structure would be useful to implement plans and strategies from national to school levels. A suggestive plan is shown in Figure 3. The tasks suggested are explained below.

Task 1: Identifying and enumerating disaster prone schools

Regular enumeration of schools and publication of maps identifying schools in each State and Union Territory by the Census of India and National Sample Survey Organisation(NSSO) should be done at the central level monitored by Ministry of Human Resource Development (MHRD). DISE should capture data to show the number of schools in each State and UT located in multi-hazard or single hazard zones. It will help education officials at the block and cluster levels:

(i) to plan for disaster mitigation and come up with contingency plan,

(ii) to reopen schools within a week which will also help impacted community,

(iii) determine number of students migrating or dropping out annually and take precautionary measures and

(iv) to address psychological trauma related issues.

Task 2: Mapping the schools

Digitised maps and satellite images published by the National Remote Sensing Agency (NRSA) and National Atlas & Thematic Mapping Organisation (NATMO) must be made available to education officers at the district, block and cluster levels. With the help of maps and imageries, the regional level education functionaries can prepare disaster management plans for the schools within their respective jurisdiction.

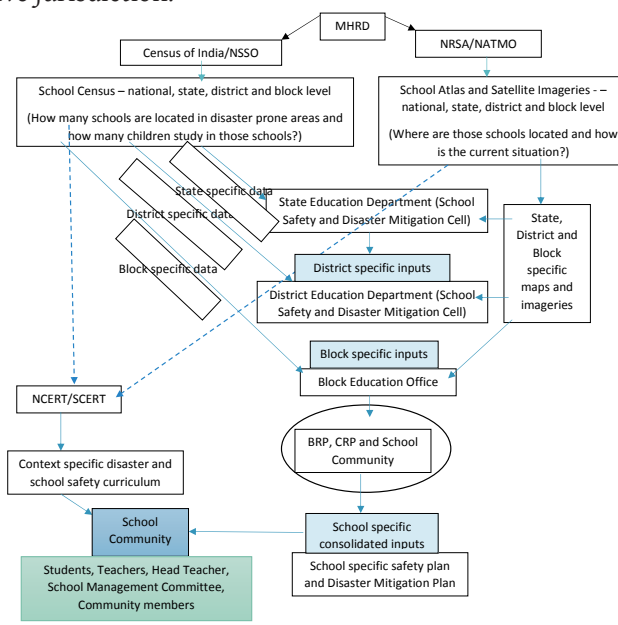

Figure 3: Plan and distribution of responsibilities for disaster management in schools

Task 3: Affix accountability for school safety measures

It must be made obligatory for education officials at district, block and cluster levels to collect and analyse information relating to the number of children within their jurisdictional realm. There must be a structured mechanism to conduct school safety audits and devise contingency plans for managing disasters in schools involving the school community.

Task 4: Regular courses for professional development

SSA emphasizes on the participation of community and civil society in school's regular activities and development. The ground level reality in respect of community participation in school activities and development is at present far from the expectations in many schools. For preparing schools for disaster management, it is important to involve the community and civil society closely in related activities.

Apart from *ad hoc* short programmes to train teachers and education officials, programmes offered by UN agencies, NGOs and the National Institute of Disaster Management (NIDM), long term regular courses need to be offered by the higher education institutions to prepare young professionals to work with schools to provide a better and safer environment for future citizens. Such young professionals must start working with the school education system so that functionaries associated with the department of education at various levels gain an overall understanding about the requirements and can work on context-specific and relevant framework of disaster management for schools.

Acknowledgement:

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Hazard- Risk Assessment and Mitigation Measures for West Delhi District, Delhi, India

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Abstract

Disasters have a lasting effect on human survival, lifestyle, economy, infrastructure, environment and finance. Government of India brought the Disaster Management Act, 2005for prevention and mitigation of any disaster in our country. District Disaster Management Authority (West), (DDMA-W) has formulated the District Disaster Management Plan for West District (DDMP West) which forms the basis of this Study as well as the primary data & the discussions with District Disaster Management officials. The aim of this paper is to provide an insight into the Hazard and Risk Assessment of West District & suggest Mitigation measures. Area has high population density with dense residential areas and pockets of industrial activity. Fire and Structural Collapse are the main hazards in the area which are caused due to different reasons. Primary data of such incidents for year 2012 - 2013 and 2014 are analyzed for casualties & injuries and supports this fact. Risk analysis shows population density and associate housing characteristics in 3 sub-divisions of the district as an issue for emergency services timely response. Pre-dominance of small scale industries, existence of industrial areas, quality of construction material, design etc are also the identified risks. A SWOT analysis is performed which highlights the community awareness towards disaster management activities and good communication and rescue equipment with the authorities as strengths of the district disaster management while illegal electricity connections, unauthorized constructions and inadequate safety measures in industrial areas fall under the Threats category for the district. Proposed mitigation measures include microzonation of areas, retrofitting of buildings, capacity-building strategy, provisions of insurance etc. It is recommended that a detailed research study based on advanced GIS and Remote Sensing technologies should be conducted for the district considering subdivision as a unit, which will help district authorities in decision making for the future.

Keywords

West District, Disaster Management plan, Hazard, Risk, Mitigation, SWOT Analysis.

Introduction

Disasters have been occurring since earth came into existence. Though the actual duration of any disaster maybe short, but it has a lasting effect on human survival, lifestyle, economy, infrastructure, environment and finance. For prevention and mitigation of any disaster in our country and for ensuring a holistic, coordinated, prompt and effective response to a disaster situation, the Government of India brought the Disaster Management Act, 2005 (DM Act 2005). Section 31 of the Act, envisages formulation of a plan for disaster management for every district of the country (Disaster Management Act, 2005).

According to the District Disaster Management Authority (West), (DDMA-W) has formulated the District Disaster Management Plan for West District (DDMP West) which forms the basis of this Study. The plan has been developed to reduce the impact of any disaster on community and infrastructure by reducing their vulnerability and increasing their coping capacity with the objective of protecting lives and property in the district.

This study is largely based on the District Disaster Management plan for West district of Delhi and the primary data & the discussions with West District Disaster Management officials about their practical experience of the disasters in the area. The aim of this paper is to provide an insight into the Hazard and Risk Assessment of West District of Delhi & suggest Mitigation measures.

Profile Of West Disctrict

Spread over an area of 130.6 sq. km., the West district is the fourth largest among the 11 districts in Delhi and covers 8.81%of the total area. It is divided into three sub-divisions/ tehsils, namely, Rajouri Garden, Patel Nagar and Punjabi Bagh (Figure 1). Punjabi Bagh is the largest Sub division of the district. It has a number of rural settlements – Mundka, Ranhola, Baprola, Tikri Kalan, etc. and urban settlements like Punjabi Bagh, Paschim Vihar, etc. Patel Nagar subdivision has only two rural settlements – Khampur Raya and Rajapur Khurd. The overall character of the subdivision is urban with areas like Patel Nagar, Tilak Nagar, Uttam Nagar, Janakpuri, and Moti Nagar, etc. Rajouri Garden subdivision has no rural settlements. The total population of the district stood at 25, 31,583 lakhs (according to Census 2011), with an overall density of 19,625 persons per sq.km.

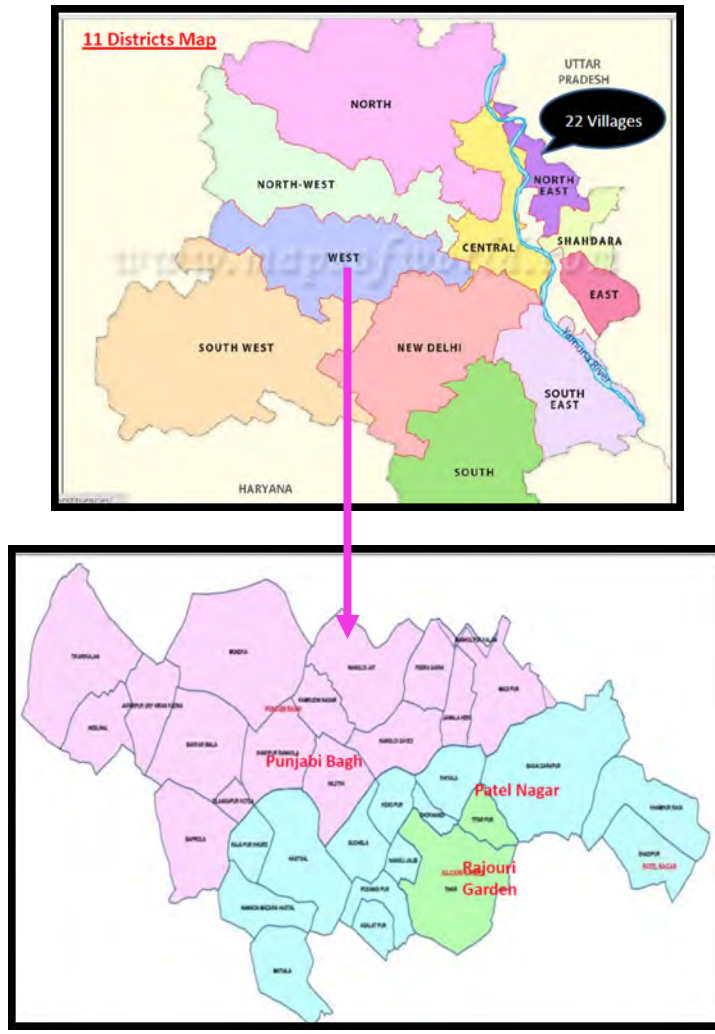


Figure 1: District Map showing Sub-Divisions

Figure 2 (A) shows highly urbanized land use in eastern part of the West district while the agriculture is the dominant land use towards the western part. It also shows in the eastern part small pockets of high density industrial activity. Seasonal water body in the form of storm water drain (Najafgarh Drain) crossing the central-eastern part of the district could be seen. Figure 2 (B) shows the satellite imagery of a small part of the district. It shows the potential hazard to dense residential areas with industrial areas (Keshopur and Naraina) adjacent to them. Also a big open drain (Najafgarh Drain) is crossing the area which is a source of continuous foul smell in the area.

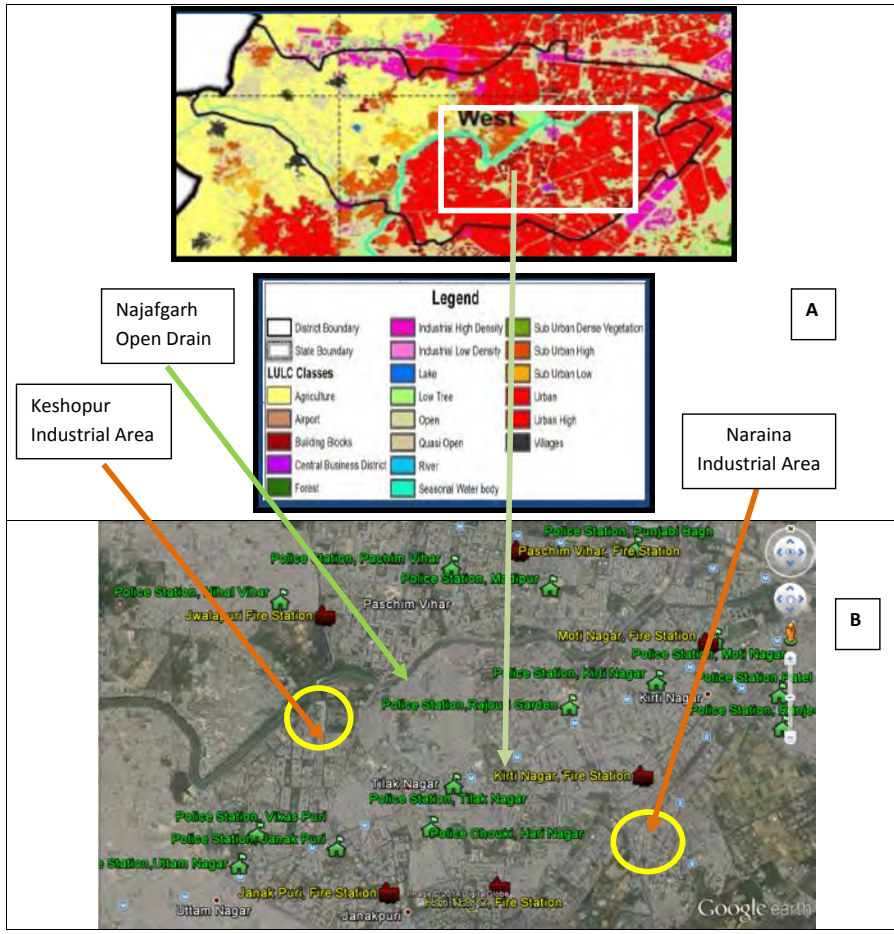


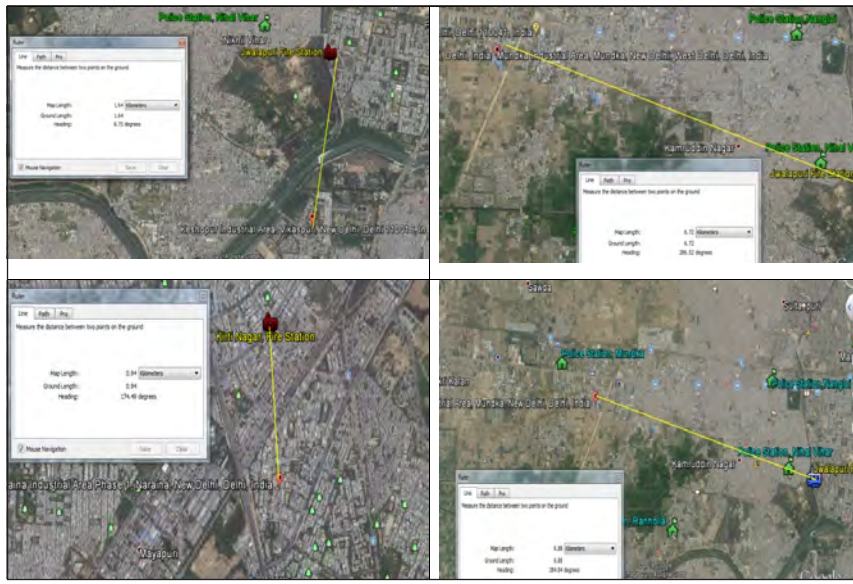
Figure 2: A. Landuse (Ref: Fire Hazard and Risk Analysis in the country for revamping the fire services in the country by Directorate General NDRF & Civil Defense (Fire), Ministry of Home Affairs (December 2011)

B. Najafgarh Drain passing through Dense Residential Areas and Keshopur Industrial Area; Source: Google Maps

C. Keshopur, Naraina, Najafgarh, Mundka Industrial Area; Source: Google Maps

Figure 2 (C) shows the areal distance between the nearest police stations and industrial areas in the district. It also shows the land use around these industrial areas which is usually dense urban settlements. This shows the potential danger for residents of these settlements due to the hazardous nature of industrial setup. The areal distance helps to understand the spatial distance relationship between the responding agencies and the potential disaster from industrial

nature setup although the actual time-based distance for response could be much higher than areal distance. This could be attributed to the actual ground distance, the traffic on the way to reach the disaster event place at the time of disaster, the accessibility for responding vehicles and personnel to the disaster event location.



Hazard And Risk Assessment

The district has been vulnerable to different natural disasters on account of its unique geo-climatic condition. Like other districts of Delhi, West district is highly prone to Earthquakes (Zone IV), Fire incidents, Building Collapse, Bomb Blasts and Terrorist Attacks. Certain parts of West District are vulnerable to Flooding as well.

Hazards

Table 1 shows different hazards and hazard prone areas in West Delhi District in a summarized manner. Earthquake hazard could lead to buildings collapse, fire, hazardous material spill, interruption of civic amenities, water pollution in unauthorized industrial areas like Khyala, Punjabi Bagh Oil Depot, Tikri Kalan Oil and CNG Depots, Udyog Nagar, DJB Water Treatment Plant, Kamruddin Nagar is prone to Chemical / Biological / Radiological disasters.

PVC Market, Tikri Kalan, Mundka Unauthorized Kabari Market, Udyog Nagar, JJ Clusters are prone to Fire Hazard which could lead to toxic releases, explosions, pollution and reduced visibility.

Table 1: Hazards and Hazard Prone Areas in West Delhi District

Hazard	Hazard Prone Areas
Earthquake: Building Collapse, Fire, Hazardous Material Spill, Interruption of Power / Water Supply / Communication / Transportation / Waste Disposal, Water Pollution	Unauthorized colonies of Bindapur, Uttam Nagar, Chander Vihar, Nihal Vihar, Ranjeet Nagar, Khyala Unauthorized Industrial Areas.
Flood: Disruption of Services (Lifelines), Health Impacts (Diseases and Epidemics), Loss of Structural Stability	Peeragarhi, Uttam Nagar, Nangloi, Bindapur(nearby areas of Najafgarh Drain)
Fire: Toxic Releases, Explosion, Pollution, Reduced Visibility	PVC Market, Jwalaheri, Tikri Kalan, Mundka Unauthorized Kabari Market, Udyog Nagar, Kirti Nagar Furniture Market, Rama Road Industrial Area, JJ clusters
Building Collapse: Fire, Particulate Suspension (Dust and Chemicals)	Unauthorized Colony of Bindapur, Uttam Nagar, Patel Nagar
Terrorist Attack	Tilak Nagar Market, Rajouri Garden Mrkt, All Malls and Cinema theatres, Distt. Centre Janakpuri, All Metro Stations, Weekly Markets.
Road Accidents	Rohtak Road, Ring Road, Najafgarh Road, Mayapuri Road
Rail Accidents	Rohtak Railway Line, Metro Line
Chemical / Biological / Radiological / Nuclear Disaster	Punjabi Bagh Oil Depot, Tikri Kalan LPG Bottling Plant of IOCL, Khyala Industrial Area, Mundka Industrial Area, Udyog Nagar, DJB Water Treatment Plant at Kamruddin Nagar

Tihar Jail, which is among the largest complex of prisons in South Asia (Wikpedia), comes under the jurisdiction of West District of Delhi. Many inmates have complained about their deteriorating health (First Post). Any negligence towards health facilities in the Jail premises could result in an epidemic which could spread over the neighbouring settlements also.

Any major break in this jail by the inmates poses a serious security threat to the residents of nearby areas.

Illegal and Weak Construction Hazard

The analysis typically comes out with housing concerns, as the housing conditions are bad to worse when it comes to possible resistance against

disaster. The occupancy rate (persons per room) mean value of 1 (on a 5 point scale) reveals alarmingly high concentrations in general, largely due to shortage of housing. Due to large-scale potential for job-opportunities for labour in the district, sprawling slums and densely built housing clusters are very common. In some areas like Raja Garden, Punjabi Bagh, Peera Garhi, PaschimVihar, Vikas Puri and Moti Nagar etc, quality of materials used for construction though could be satisfactory, there have been large scale illegal construction as even in those approved, proper design / construction have been largely ignored. The cluster of buildings found in areas like Nangloi, Vishnu Garden, parts of Kirti Nagar, Moti Nagar, Jwalapuri, Uttam Nagar, Chander Vihar, Anand Parbat etc only illustrates this point. The mean value of 2 (on a 4 point scale) suggests divergence from the practice of safe designing and construction. Consequently, in the recent years, there has been large number of cases of structural collapse which resulted in the loss of lives in the District. Inaccessibility of the area due to unplanned growth and the illegal parking of vehicles along the roads have further added to the hazards.

Figure 1, 2 and 3 shows the yearly aggregated statistics of West District structure related incidents such as Building Collapse, Roof Collapse and Wall Collapse during 2012, 2013 and 2014 which resulted in human casualties and injuries.

Reasons of these collapses are not given in the data collected. However, the District Disaster Management Authorities are of the view that such collapses happen due to illegal constructions which usually do not follow structural engineering norms properly. In addition, reason could be the low-quality of material in some cases. Justice Lokeshwar Prasad commission has found that the material used in Lalita park building was sub-standard.

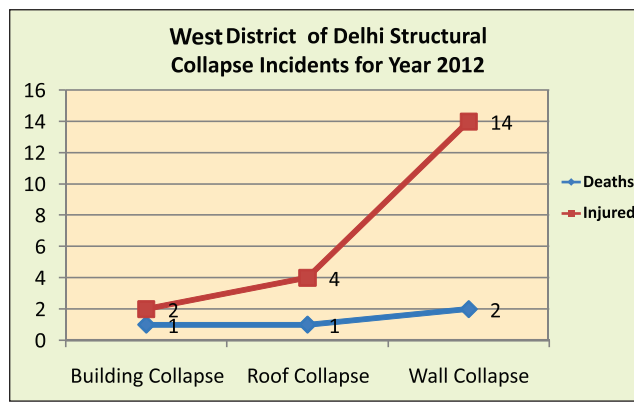


Figure 1: Structure related incident statistics in West District of Delhi during Year 2012

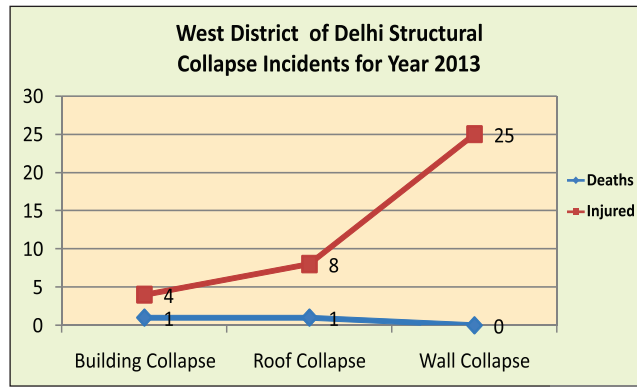


Figure 2: Structure related incident statistics in West District of Delhi during Year 2013

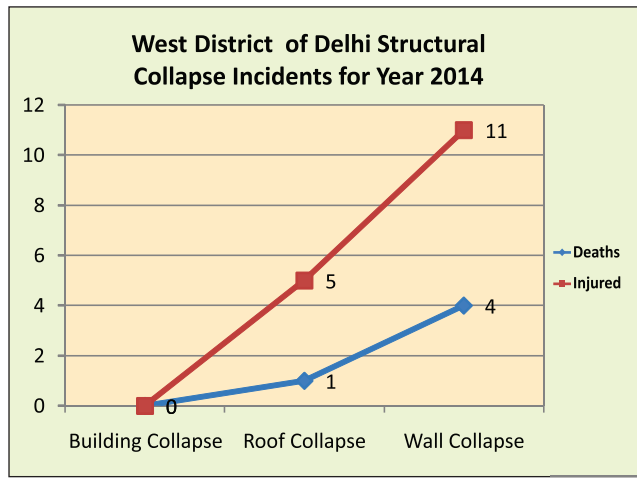


Figure3: Structure related incident statistics in West District of Delhi during Year 2014(upto 15 October)

Fire Hazard

Fire hazard is a major concern in the district. A number of fire accidents took place in the District at regular intervals not only due to the large number of unauthorized factories and houses but also due to the absence of inadequate fire prevention / fighting measures. The fire-fighting teams often find it difficult to reach the spot in time due to the heavy traffic and the narrow congested roads. Fruit and vegetable vendors and other small business units render the situation more difficult as they occupy most of the roads as well. Moreover, the fire stations located in the district being far away from disaster prone sites like Nangloi, Baljeet Nagar, Mundka etc. take long time to reach the affected areas in the event of a fire. In a recent incident, Fire broke out in year 2012 in Mundka

PVC Market (Jaipur Patrika, 2012). Mundka has a history of such fires in past few years (IndiaToday, 2010; RajdhaniDelhi, 2013).

Table 4, 5 and 6 shows the yearly aggregated statistics of West District of Delhi fire related incidents, which resulted in human casualties and injuries, caused due to various reasons such as High Tension Wires, A. C. Compressor Blast, Gas Cylinder Blast, Gas Leakage, Short Circuit and unknown reasons(N. I.) in different sub-divisions / places of the district.

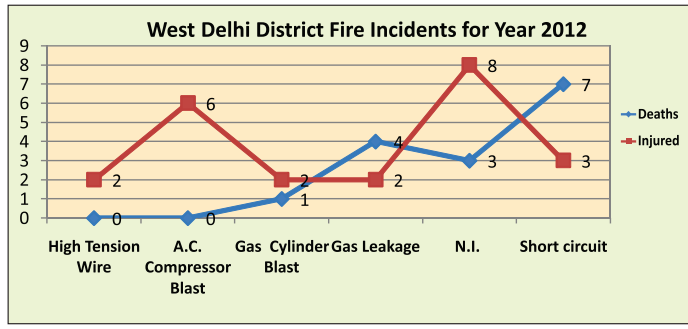


Figure 4: Fire related incident statistics in West District of Delhi during Year 2012

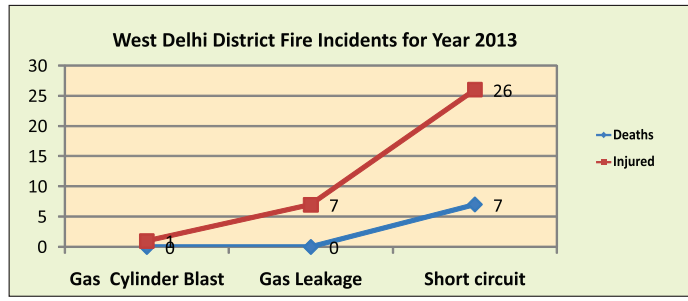


Figure 5: Fire related incident statistics in West District of Delhi during Year 2013

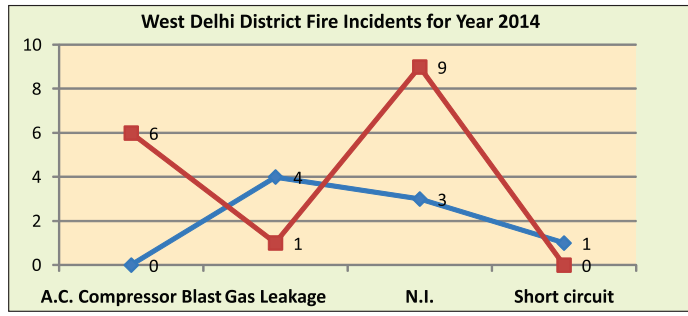


Figure 6: Fire related incident statistics in West District of Delhi during Year 2014 (upto 15 October)

Risk

Risk analysis for West District of Delhi is done against parameters namely socio-economic, infrastructure & Housing and Preparedness & Response.

Under Socio-Economic parameters, Risk is analyzed in terms of Population Density, type and associated housing characteristics in Patel Nagar, Punjabi Bagh and Rajouri Garden sub-divisions having very small circulations and thus restricting the entry of many emergency services. Squatters and JJ Clusters widespread around the industrial areas and Hazardous installations also pose serious risk from fire hazards.

Under Infrastructure and Housing parameter, high occupancy rate in the district, predominance of small-scale industries, existence of authorized industrial and non-confirming areas, quality of construction material, designing and construction part in different areas of district are the identified risk.

Table 9 – Risk Analysis of West District of Delhi

Parameters	Risk
Socio-Economic	– Patel Nagar is densely populated with a large number of squatters, Slums and Unauthorized Colonies – Punjabi Bagh: Least Population Density with agricultural land and village clusters – Rajouri Garden: 100% Urban Population characterized by densely built poor housing structures – Restricts the entry of many emergency services – High Industrial Density and Hazardous Installations: Indane Bottling Plant, Hindustan Petroleum Corp. Ltd., Tikri Kalan and Delhi Jal Board WTP, Kamruddin Nagar are three major hazardous installations. Squatters and JJ Clusters widespread around the industrial areas increasing vulnerability to fire hazards.
Infrastructure and Housing	– Occupancy rate is very high. – Small-Scale industries predominant – 8 authorized industrial areas and many other industries in non-confirming areas – Sprawl of Slums and densely built housing clusters are very common – In some areas like Raja Garden, Punjabi Bagh, PeeraGarhi, PaschimVihar, VikasPuri, Moti Nagar etc. of construction material quality is fair but designing and construction part is largely ignored. – Construction quality and design is poor in areas like Nangloi, Vishnu Garden, some areas of Kirti Nagar, Moti Nagar, JwalaPuri, Anand Parbat, Villages and JJ Clusters etc

Parameters	Risk
Preparedness and Response	– Local Administration's efforts in creating public awareness are taking place at large scale. – The physical, social, economic, Housing and response factors vary significantly across the district but the administration does not have any prioritized initial interventions – Medical Capacities: There are 220 beds per lakh population in the city hospitals but occupancy rates remains high at all times. Smooth run of medical resources remains a concern even during the normal operations

Swot Analysis

A SWOT analysis was performed to assess the Strengths, weaknesses, opportunities and threats of district towards different types of disasters. Table 8 gives the main points of this analysis.

As Strength of the district, from technical point of view, district has good communication system and availability of rescue equipment. From Social point of view, Communal harmony (except the major riots of 1984 (Human Rights Watch, 2014), no major communal strains have occurred in the district) and High Literacy rate (83%) are strong points of the district which helps to give quick & effective response in times of disaster. Among the Weaknesses of the district, high numbers of dense settlements become vulnerable to diseases. Due to high demand for residential units by the worker class & people from lower income strata, slums and JJ clusters exist in scattered form inside the district at various places which are prone to fire and other hazards / disasters. Traffic congestion in most of the areas is a weakness of the district in terms of slowing the reaction of response agencies and associated services in case of an incident. Non-uniform distribution of resources in the district is a weakness in context of disaster management. In terms of opportunities to develop capacity and better response in the future, good response from citizens towards the disaster awareness efforts of the district disaster management authorities, proximity of defense establishments and availability of potential relief centers such as government school building are major points. Analyzed threats to the district are illegal and unauthorized connections of electricity; improper and inadequate water supply and resources. Industrial setup without adequate safety measures like Udyog Nagar, Rama Road, Mundka PVC Market are a major threat to the community as well as environment of the area. Open Najafgarh drain which is the biggest storm water drain of Delhi, is a threat to the community where many incidents of people falling in the drain happen every year. It is highly polluted as there is a direct inflow of untreated sewerage from surrounding populated areas

in addition to other discharges and runoffs. Report of CPCB (November-2006) states that Najafgarh drain of Delhi is the biggest polluter of River Yamuna, which contributes about 26% (year 2001) to 33% (year 2000) of total BOD load and 48% (year 2003) to 52% (year 2001) of total discharge that joins Yamuna river. As per Annual Report 2011-2012 of CPCB, Najafgarh (and Shahdara) drain contribute BOD load is 66% and 72% of total discharge.

Source: Geography and You; April 9, 2014

Table 8 – SWOT Analysis for West Delhi in context of Disaster Management

Strength	**Weakness**
Good Communication System	High Population Density
High Literacy Rate (83%)	Scattered Slums and JJ Clusters
Good Health Infrastructure	1/3 Population lives in JJ Clusters
Compact Area	Traffic Congestion
Availability of Rescue Equipment	Resources Inadequacy including Non-Uniform Distribution
Communal Harmony*	
Opportunities	**Threats**
Easier Capacity Building	Illegal and Unauthorized Connections for Electricity Supply; Improper and Inadequate Water Supply and Resources
Good Response from citizens	Non-earthquake resistant& unauthorized constructions
Proximity of Defence establishments	Najafgarh Open Drain
Availability of Potential Relief Centres-like government school building	Industrial setup without adequate safety measures like Udyog Nagar, Rama Road, Mundka PVC Market, Khayala Village

* Except the major communal riots of 1984

Proposed Disaster Mitigation Measures

Table 10 points out the Disaster Mitigation Strategies, Actions and Suggested Institutions for the West district of Delhi. Before the retrofitting of the buildings / structures can be taken up, microzonation is required to identify various vulnerable buildings / structures. Simultaneously, Rapid Visual Screening Assessment of life line buildings can take place. As per NDMA guidelines on earthquakes, all new government buildings have to be constructed as per National Building Code.

For retrofitting of buildings, prioritization of buildings is needed as per their importance in response activities in case of a disaster event. Such buildings could be District administration office building, police stations and fire stations etc. Hospital and clinics, community centres, office buildings of SDMC, PWD, DDA etc. could come under second priority list. Suggested institutions for involvement are South Delhi Municipal Corporation (SDMC) or Public Works Department (PWD) and Delhi Development Authority (DDA).

Enforcement of Building Codes is a mitigation strategy which involves Review and updation of building codes and their implementation in new engineered and non-engineered constructions through BIS, SDMC&DDA.

Activities like Large-scale information dissemination about basics of new constructions and retrofitting of existing buildings and encouraging fire-fighting arrangements in the building and do's and don'ts during an earthquake or other disasters is a part of Community Awareness mitigation strategy which could involve SDMC, PWD, DDA, District Administration, Police & Fire officials and NGO's.

Under the Capacity-Building strategy, priority-wise training to the engineers, architects, and masons for disaster-resistant constructions is required so that they can provide assistance in retrofitting and reconstruction exercises. To impart such training, District Administration, SDMC, PWD and DDA are suggested to be involved.

As a long-term mitigation strategy from financial point of view, Provisions of insurance according to building bye laws, codes and hazard proneness should be made.

Table 10: Disaster Mitigation Strategies, Actions and Suggested Institutions

Sl. No.	Strategies	Actions involved	Suggested Institutions involved
1	**Retrofitting of buildings**	Prioritization of buildings according to their importance during emergency. **First priority buildings are:** District administration office building, all police and fire stations Nodal Offices All Schools (Government, SDMC and Public) **Second priority buildings are:** Hospitals and clinics Community centres Office buildings of SDMC, PWD, CD & HG and DDA **Third Priority buildings are** 1. Remaining Government Buildings	**South Delhi Municipal Corporation (SDMC)/PWD/ DDA engineers**
2.	**Enforcement of Building codes**	Review and updation of building codes	**BIS**
		Implementation of codes in new engineered and non-engineered constructions	**SDMC /DDA**
3.	**Community Awareness**	Large-scale information dissemination about basics of new constructions and retrofitting of existing buildings and encouraging fire-fighting arrangements in the building	**SDMC, PWD, District Administration, DDA, Fire Department**
		Information dissemination about dos' and don'ts at the time of earthquake event and fire-outbreak	**District administration, Fire and police department, NGO's, DDA**

Sl. No.	Strategies	Actions involved	Suggested Institutions involved
4.	**Capacity Building**	Priority-wise training to the engineers, architects, and masons for disaster-resistant constructions. These people may be further utilized for providing assistance in retrofitting and reconstruction exercises.	**District administration, SDMC, PWD and DDA**
5.	**Insurance**	Identification of hazardous areas in the district	**DC Office, SDMC, DDA**
		Provisions of insurance according to building bye laws, codes and hazard proneness	**Insurance companies, SDMC, DDA**

Conclusions and Recommendations

We conclude that the fire incidents and structural collapse are the main hazards in the area which are caused due to different reasons. A recent review of "Fire and Rescue Service response times" (Fire Research Series 1/2009) concludes that response times have increased due to traffic conditions, which was similar to the finding of the London Fire and Emergency Planning Authority thematic report, which concluded that it now takes 50 seconds longer for a 1st appliance to arrive on average and one minute longer for a second appliance. The location of EOCs should be chosen more scientifically. For example, Habibi et al. (2008), has made spatial analysis of urban Fire Stations in Tehran, using an analytical hierarchy process and GIS. Community awareness towards disaster management activities and good communication and rescue equipment with the authorities are considered as strengths of the district disaster management while illegal electricity connections, unauthorized constructions and inadequate safety measures in industrial areas are the main threats for the district in context of disaster management.

In order to provide best possible/ at par services to people against disaster, the manpower should be recruited in a systematic manner specially certified disaster managers are recommended. It has been observed that there is large number of vacancies present at all levels in the operational as well as at administrative level of the District. These gap needs to be filled up at the earliest.

We recommend that industrial areas need to be regulated by agencies either by closing or enforcing the improvement measures. Encroachments removal should be done on regular intervals and awareness in slum clusters should be

promoted by agencies to ensure disaster risk reduction. Mock drills need to be conducted regularly. Safety audits of big buildings should be conducted. Use of geospatial technologies should be promoted in district disaster management and digitization of housing, industries and other critical parameters should be initiated. It is noted that the conventional methods of research and response to the disasters failed the purpose .Incident response system recommended to be implemented in the District. The strength of EOC of the District required reviewing. Application of state- of – art technology is need of hour. It is recommended that a detailed research study based on advanced GIS and Remote Sensing technologies should be conducted for the district considering subdivision as a unit. The composite risk of each subdivision should be computed and accordingly required resource calculated. The other important recommendation is the development of Investment and financial plan, Institutional assessment & capacity building plan along with a Decision Support System (DSS) which will help in decision making process to the district authorities.

Acknowledgement

We are thankful to the Founder Vice-Chancellor, Vice-Chancellor and Registrar, Guru Gobind Singh Indraprastha University for their necessary support and time-to-time guidance.

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PERILS OF UNDER PREPAREDNESS - J&K FLOODS 2014 - LESSONS LEARNT & WAY AHEAD

Brig (Dr) BK Khanna@ and Nina Khanna++

What caused the Floods and What went Wrong Initially

J&K State Government was in news for all wrong reasons in September 2014, due to unprecedented floods caused by uninterrupted downpour from 02 Sep to 06 Sep. The Jhelum River embankments were breached, as a result, at a number of places on the night of 06/07 September, which flooded not only Srinagar City and district of North Kashmir but other districts, like Ganderbal, Bandipora and the South Kashmir districts of Anantnag, Kulgam and Pulwama, assuming the proportion of national calamity as residents of the Valley had never seen in their living memory. More than 300 people were reported killed, hundreds of cattle perished and over thousands of acres of paddy crop was damaged, and threatening impending famine in these areas after the flood waters recede. What was immediate response? Complete paralyses of the Govt machinery. Never in the history of independent India, a State Government became completely non functional or irrelevant for so long after a disaster. The Chief Minister admitted that he was not in touch with anybody for first 36 hours and even after a week he still had to get hold of his cabinet colleagues!! What about the elected representatives of the people in the Assembly and Parliament? They were nowhere to be seen or heard. Where were they holed up? Was it not their duty to be visible during the worst disaster in 60 years to hit J&K? Where were the J&K Police, the Fire Services, State Disaster Response Force, Civil Defence and Home Guards, Medical Services, Food & Supply Deptt, PWD, Municipal Commissioner and Municipal Corporations and hordes of other stake holders. Stray cases of volunteers helping fellow victims did come to light at places randomly. We are not taking into account the self styled people's unofficial representatives, the Hurriyat leaders and other separatists who are mostly opportunists and would surface only to shout anti India slogans at every available opportunity. They all seemed shell shocked! In India, District is the cutting edge unit and the Collector/DC is the 'Mai-baap'. All departments in the district come under him/her and take instruction/orders. None of the DCs of the affected Districts rose to be counted and did his/her duties as required under Section 26 of the Disaster Management Act 2005. Command and Control completed failed at the State, Division and the district & below level. Admittedly, they were also affected by the floods and would have taken time to bounce back. Instead of rising like a Phoenix, the complete administrative machinery in the State went in a limbo. Army, Air Force, NDRF, CRPF and BRO – all Central Organizations were pressed into

service and they did a commendable job in rescuing and providing initial relief. Weather did play hide and seek thus hampering the rescue and relief. While the rescue and relief measures are over now and next phases of rehabilitation and reconstruction have started, it is time to reflect and see what went wrong, was it inevitable, why no attention was paid to preparedness, what specific lessons were learnt for the decision makers and practitioners to act upon and data for the training institutions to teach the future students.

Were Floods Inevitable

Of Course they were. This was disaster in the waiting to happen! Climate change is taking place but we are not adopting to the changes required at community and Government level. Experts say that the flash floods in Leh region of J&K on 06 August 2010, in which 255 people died and 71 towns and villages were damaged, the Uttrakhand Flash Floods of June 2014, in which officially 5748 persona were killed including 6 foreigners and the unprecedented deluge in J&K in September this year, were caused mainly due to climate change taking place. Other major reasons analysed were unplanned urbanization, diminishing forest cover, erratic monsoons and not taking timely action on the predictions/warnings. If we analyse the lessons learnt from the recent floods, all hydrological disasters which have occurred between July 2005 Mumbai Floods to the J&K Deluge 2014, the officials have all attributed them to interaction between western disturbance and the unusual monsoon systems, excessive rains or freak unusual event. There has been no mention that any of them could have been due to climate change. The mind is not prepared to accept the reality. The Ministry of Environment and Forest (now climate change added) has not uttered a word on these unusual but periodic hydrological disasters. Inter-governmental Panel on Climate Change (IPCC) in its 4th and 5th assessment reports had predicted that extreme rainfall events were likely to set place in Indian sub continent and their intensity and frequencies would increase. Even in the report by Institute of Tropical Research had predicted changes in rainfall pattern across India and especially over the Himalayas which would have a high impact in the region, apart from the west coast and central India. The report by the GIS Deptt in J&K in 2010 had predicted flood situation in the State, but four years down the line, no action seems to have been taken on the ground to strengthen the bundhs along the Jhelum River, to protect the state summer capital, which incidentally is one of the two state capitals in Zone V for earthquake disaster in India. The above predictions, which were not taken note of resulted in the disaster in waiting to happen and it did in first week of September 2014. Other reasons for unprecedented floods and subsequent devastation in J&K may be due to combination of continuous unprecedented and intense rains, mis-management, lack of preparedness, lack of coordination between State Government and other stake-holders and general apathy to taking precautionary and preventive measures.

Unplanned Urbanization and Encroachments

Wular lake one of the largest fresh water lake in South Asia runs the risk of flooding. The lake has lost 88% of its surface area to encroachments and is nearly clogged. All rivers of the valley drain into Wular Lake. Wetlands and water bodies in the valley which used to act as sponge during rainy season have either shrunk or lost for ever. Dal lake had an area of 24 sq km which is now reduced to 12 sq km only and depth is barely 6 metres. Doodganga Canal and Mar Nalla are no more existing. Mar Nalla became a road and buildings and malls have come up on Doodganga Canal. Bemina and Batmaloo wet lands have turned into posh residential colonies. Thus we see that unplanned urbanization, missing link between water bodies which acted as natural drainage, diminishing wetlands and clogging of city drainage accentuated the enormity of floods which struck J&K. The valley is in a bowl and hence it takes time for the water to drain out, which has weakened the buildings & infrastructures..

Unprecedented Rains & Warning

Within a short period between 27 August and 06 September 2014, there was continuous and intense rainfall. The districts of Ganderbal received 891%, Srinagar 373%, Badgaun 325%, Pulwama 668%, Anantnag 497% and Shopian 226% rains above normal during this period. Central Water Commission (CWC) is believed to have given 8 hours prior warning of impending overflowing of Jhelum . The State Govt is said to have made announcements from the mosques and at a few places the police jeeps also broadcasted it. But is by merely making the announcements, the job of the State and district administration over. All means of media, like local cable, broadcast over All India Radio, Doordarshan, social media, civil defence and home guards volunteers, etc should have been made use of. Innovative means like elected representative and volunteers getting connected to the people, would have saved the day and ensured lasting bondage with each other. The State presently does not have a flood warning system, which need to be provisioned and tested through mock exercises. Why did the people not heed to the warnings. May be that floods had not occurred in life time of most people and hence they may have ignored it to their peril. Even the ministers, legislators and bureaucrats did not move to higher places after the warning. The community must have faith, confidence, respect and trust in the Govt. of the day. CWC warning period was also less. Where would the people



have moved to? Were the designated relief camps identified during non disaster period? If so, were they stocked with food , water, medicines and sanitation to temporarily shelter victims? Probably not.

Under-preparedness for Managing Disasters

The State obviously does not have an approved Disaster Management Plan, which is made after hazard, risk and vulnerability assessment, resource mapping, delineating the roles and responsibilities of all stake-holders and trigger mechanism giving possible scenarios. The State and districts do not have mandatory State and District Emergency Operation Centres working in a 24x7 mode, which are required as per NDMA Guidelines on Incident Response System (IRS). The State is supposed to respond to disaster situations as per IRS Guidelines, issued by NDMA in July 2010. Guidelines may be lying in some almirah of an Under Secretary in the State Secretariat. J&K incidentally has a Unified Command under the CM, but apparently it was not made operational. On ground it seems everything worked in an adhoc manner. The authors visited J&K after the floods on their own to physically rescue two of their aged relatives and hence can vouch to an extent for the ground reality. The former Senior Consultant had, while in NDMA. conducted a number of mock exercises in J&K, for floods, earthquake and man made disasters (including for Amarnath Yatra for last four years and in Sri Mata Vaishno Devi Shrine). Hardly ever the State Chief Secretary or for that matter Principal Secretary Revenue and Disaster Management, attended such capacity building measures. And at district level the response at best was luke warm. The concerned Deputy Commissioner had no time to attend the awareness programs. The Nodal Officer and District Officials were more concerned in receiving the financial support for such programs rather than taking them seriously. The gaps identified were reflected in the After Action Reports also, but there was no follow up action at the State and district level. Except for the Fire Services and Police, all other stake-holders avoided being part of the pre-planned events for building the capacity of the community and the first responders. The State has an exclusive Civil Defence and Home Guard Department, but these are mostly employed by the Police for their routine jobs. They are supposed to be trained in disaster management but they were conspicuous by their absence during the floods. The State has also formulated State Disaster Management Force (SDRF), given them

some equipment and got them trained. But they too seemed to have done the disappearing trick during times of reckoning.

Gaps in Response

As the State Govt and District administration officials were themselves affected by the disaster, they probably went into hibernation looking after themselves and their families. They got completely overwhelmed and overawed by the enormity of the disaster. It happens in any disaster, but it is the buoyancy with which the first responders bounce back, to carry out their assigned tasks which makes the difference between a good and bad handling of a disaster. In this case the State and district administration failed in their duty. The Incident Response System was obviously not followed. There was no one incident commander who could plan, make assessment and deploy resources and coordinate their functioning. There was absence of organized help from local volunteers, which play a major role in disaster mitigation. Had the State and District EOCs been there, the incoming resources would have reported there and guided by volunteers, in an organized manner, to the designated areas where people were stranded and evacuated as per their vulnerability and medical conditions. The boats going for rescue should carry immediate relief items, like ready to eat food and water to be given to able bodied people who are left behind to be evacuated later.

Tracing the People Stranded/trapped in the Disaster Area.

Central multiple land-line and mobile numbers should be given wide publicity through print and electronic media, for people who are stranded as also their kith and kin to report the details of stranded and their location, last spoken from. PROs should set up Information Desk in State and District EOCs with help from local NGO and volunteers. Each incoming call should be docketed with callers name and mobile and alternative number. All requests and inquiries of stranded people from all over India and from outside World received by any agency, must be passed on to State Information Centre, manned under PRO. PRO will give details of missing/stranded people to concerned district and Rescue Organizations operating in the area. List of evacuated people should also be provided to this Desk, who should then make it known through various modes of print and electronic media, including social. In the instant disaster, each stake-holder like Army, Air Force, NDRF, CRPF, J&K Police etc gave their contact numbers, which led to selective rescue and in turn made the stranded people feel that selective or VIP persons were only being evacuated and gave their vent by pelting stones at the rescue boats/helicopters. The evacuated affected people must be centrally registered. Once they reach the Relief Camp, they should be made to speak to their next of kin.

Communication Failure

Communications in J&K in normal times is erratic as it is difficult to maintain. After the disaster, there was complete failure. J&K was cut off from the rest of the country, except through the radio/wireless/satellite connections. Mobile towers were inundated, making them non functional. Most land-lines were down. BSNL made some 8000 lines functional after a week, but due to over-load, they were almost overwhelmed and many a times crashed. The stranded people were not able to communicate due to their mobiles not getting charged as there was no electricity and their relatives/NOK were worried about their welfare, especially when they came to know that most of the houses were inundated and people were perched on top of their roofs/top floor. Disaster Communications on which the NDMA was working should be expedited. This is a stand alone communications to be made operational at the time of disaster where multiple stake-holders can communicate, right from the top executive at the Centre to the village/disaster site. It is based on Satellite communication. More number of mobile operators should be persuaded to operate in J&K and set up their towers.

Response from the Centre

Response from the Centre was spontaneous. Army which is deployed in the State and were affected themselves, were the first to respond. Air Force and NDRF teams joined later. CRPF also helped in rescue. All the uniformed forces did a commendable job and received appreciation from one and all, except the separatists!! But our observation is on NDMA, which was created through an act of Parliament. Why was it missing from action this time around. Just because all its Members were made to resign, does not mean it should stop functioning. It still has national level Specialists and Consultants. Of course there is a need to revamp this organization. When it became clear that the State Govt was not doing its duties, the Centre should have taken over the management of disaster on second or third day itself rather than on $8^{th}/9^{th}$ day. Moreover it would have been better if the whole management of disaster was entrusted to a senior Union Minister, not necessarily from Home Ministry or may be from it (MoS dealing with DM) with Home Secretary and staff assisting. This was also to showcase that in a vibrant democracy, political leadership, which represents the people leads it from the front during crisis situation also.

Loot and Over-charging

Some local 'shikarawalas' were noticed charging Rs 7k to 10k per person for evacuating to safer places. A few thefts also came to light from houses evacuated by the victims. This is one of reasons why many stranded families refused to get evacuated, for fear of their houses getting burgled in their absence. Some private airlines were reportedly overcharging passengers from Srinagar to



Delhi despite clear instructions from DGCA not to charge more than Rs 2800 per person for one trip. Some thefts in the baggage of passengers in transit were also reported.

Way Ahead

With the water level receding, most people have gone back to their houses. However some stagnant water will remain in the lower floors due to geological location of the valley. Many a houses, which were weak and not as per National Building Code, which is more likely, may have fallen or become dangerous to live in. Temporary Relief Camps would have to be set up, where the occupants of such houses can stay till new houses are constructed. As the floods would have left a lot of filth and muck, sanitization of whole of affected area would be required. Municipal Corporations have their hands full for next six months if not more. The stagnant water could also cause water borne diseases, like diarrhoea, cholera, hepatitis, etc. Due precautions have to be taken to avoid secondary disaster happening. People would be needing medicines, dry uncooked food items, woollen clothes, beddings, utensils to make a new beginning. Winter months are approaching fast and this year the snow fall is also likely to be early. The temporary shelters for the internally displaced refugees would have to be insulated. The Govt would have to take stock of the number of houses getting completely or partially damaged. The design of the new houses would have to be drawn up now. The State Govt would have to be shaken out of their slumber and made to realize the enormity of work which awaits them. The Intelligence Agencies would have to be on guard to ensure that anti social and anti national elements do not create problems in rehabilitation and reconstruction. Separatists are likely to be spoil sport!

Lessons Learnt

Revamping of NDMA. NDMA was created on 28 Sep 2005, but it was not given its due administrative and financial powers to carry out the assigned tasks as given in Section 6(2) of DM Act 2005. (The author was founding Consultant in NDMA from Sep 2005 to April 2014.) Its composition is top heavy and bureaucratic heavy. It needs revamping. Experts only should be brought in

as Members and Consultants in this Organization and it should not be a refuge for re-employment for the retired politicians and bureaucrats. Dr PK Mishra Committee recommendations on DM Act 2005 need to be analyzed and acted upon with modifications.

Srinagar a Smart City. It is said that every disaster should be taken as an opportunity to build back better. PM has promised to build 100 smart cities. Let Srinagar be the first Smart City in the country!

Relief Work on POK Side. FALAH-e-INSANIAT Foundation, a relief wing of banned Pak based charity JAMAAT-ud-DAWA (JuD) carried out major relief work in PoK side, which was equally affected by floods. It has been reported that it created immense good will among the locals. India will have to be prepared to deal with increased infiltration and terrorists carrying out nefarious activities in J&K with renewed motivation and support and create unrest in the State. Intelligence Agencies and the Army will have to be more vigilant to prevent this.

Warning System. Flood early warning system is not existing in J & K State. A reliable and effective Early Warning System should be installed on priority. Flood warning system should be setup in all other states also which are vulnerable to flood disasters. Use of satellite imageries and GIS should be promoted to capture the spatial heterogeneity of the physical factors so that prediction can be made on the basis of scientific information. Adequate warning should be given to the State and Districts so that they can take action to evacuate people to safer places – 8 hours is too less a period to inform all community members and still give them time to pack up and leave for designated Relief Camps. All types of media should be used to deliver the contents of the warning. NGOs and volunteers should be involved in spreading the warning. All types of media should be used to deliver the contents of the warning At the same time, rumours should be curbed in the bud. General awareness should be created among the community to pay heed to the warnings, through conduct of periodic mock exercises. Relief Camp locations should be identified during non disaster period and stocked before or during the warning period.

Structural Measures. Mitigation measures in infrastructural field to include buildings, dams, bridges, roads and flood protection measures (embankments, weirs, culverts) should be taken up considering the topographic and hydro-meteorological conditions at the local or regional scale. Flood channels should be linked up. Dredging should be carried out wherever is technologically feasible to increase the water carrying capacity of the rivers and other channels / nallahs. To keep a check on cost constraints, locally available material should be used as far as possible.

Environmental Measures. Encroachments in the form of built-up areas should be removed from the flood plains as well as water pathways. This will

allow smooth water flow during such floods without causing much economic and human life loss. Natural lakes should be conserved and their encroached area should be restored to their old scale by allowing water flow input properly and removing obstructions. Wetlands should be revived which act as sponge during floods. If necessary, artificial wetlands may be created. As a long term measure, local land cover and land use should be observed. A soil-erosion study should be conducted in the affected areas so that if necessary, vegetative measures in terms of forestation should be taken up. While doing plantation, tree species should be chosen carefully considering their water holding capacity.

Mapping of Local Resources. Inventory of local DM resources, like boats, vehicles, cutters, expanders, lifters, etc should be made by the District administration and included in the District Plan. These can then be easily mobilized during disasters, under provisions of Section 65 of DM Act 2005.

Communications. Communications invariably would fail in any disaster. It is important to have redundancy by having multi layered communications. NDMA is preparing the stand alone DM communication system with the help of satellite. Action should be taken to expedite its completion and implementation. At district level, two way communication radio sets should be procured for all major stake holders. This will help in getting to know the enormity of the disaster and location of the maximum stranded people.

Setting up of State and District EOCs There was a complete failure of command and control. There was no EOCs at the state and districts level. EOCs should be made functional in 24 X 7 mode on priority at the State and in all districts and practised in response through mock exercises.

Effective State Disaster Response Force (SDRF). The J & K state has created a SDRF out of home guards and civil defence volunteers, given them some equipment and training. This force was missing in action during J & K floods. They should be given training in the management of perceived disaster by NDRF and in some disasters like high altitude rescue by the Indian Army. They also need to be given motivational training.

Public Relations. It failed miserably. Nobody was there to respond to queries of the worried relatives. The stranded people were desperate to get out but no one was there to assure them by physically going there and telling them that all of them would be evacuated. This happened during Uttarakhand Flash Floods 2013 and even in J&K deluge. System need to be evolved and tested before following it on ground. The victims and their relatives must feel reassured of their safety. List of evacuated people must be given wide publicity on multi modes of media, including social.

Media Responsibility. Media did a good job in reporting the enormity of the disaster and failure of the State Govt. *They* should also take interest in

capacity development, mitigation and preparedness and during warning period, informing maximum people within their reach.

Climate Change. Climate change is taking place and the Govt must take note of it and prepare the community and responders on the do's and dont's at each level, to reduce its effect. Efforts should also be made to revive the wetlands which would act as sponge during rainy season. Wular and Dal lakes should also be revived to their original shape for maintaining eco balance.

Conclusion

From this unprecedented disaster, a number of gaps stand identified. Hopefully these will be given due consideration in the right quarters in a time bound manner. This will see a new J&K emerging, where hopefully the people would be more respectful to the Armed Forces and would feel more closer to the Indian Union than feel alienated. It would be as well knit and nationalist a State as any other in India like Gujarat or Sikkim or Mizoram!

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Agro-climatic Drought Risk Management

Anohar John

Abstract:

This paper is an attempt to understand as to how Agro-climatic Drought Risk Management can be brought about in disaster management and how it can be a help to identify and so as to take immediate measures to ensure so that we can tackle the situation effectively. The least understood and most damaging among disasters is the drought it is also comes under as natural hazard. Usually a drought last a single season but affects a larger or smaller areas but some times it lasts for decades and impacts millions of people around the globe.

The path through which we produce our food is variable with the climate change and also with the after effects like drought. The key in achieving agricultural improvements especially in developing countries need to have better Agro climate risk management, which can rapidly and effectively improve food security in this uncertain world.

Thus, overall, the focus would be to see and analyse Agro climatic drought risk management in a new perspective.

Keywords:

Agro, climatic, Drought, Risk Management, Disaster Management, Predictions, Warning, Agriculture.

1. Introduction:

The developing world is the most vulnerable and most ofthe greatest, climate risk management innovations are not utilized for the extent they are made for due to lack of information which paved way to non utilization of available resources. The new technologies provides access to more information about environment and climate which provides accurate predictions on climate and weather. But new ways have to be adopted to translate and use of raw information into useable formats which are relevant as well as understandable and useable for decision makers.

1.1 Features:

A series of climate sensitive decisions are made of relayingEntirely on some features which goes through a range of Scales.

- The estimation of the impacts on the various aspects of Agriculture through the effective use of data on climate Changes and its impact on agricultural systems.
- The decision makers are better equipped to identify and explore the consequences and risks associated with various decisions to be made long before they are actually Implemented live. Creating new tools and adapting the Existing ones helps in identifying the potentials and Act to fight drought with the help of disaster management.

1.2 Major Studies:

In this regard CIAF- Center for Research and Development in Geographic Information of IGAC –Colombia is doing studies in the area of monitoring of drought in agricultural area and very good progress have been achieved in this area . With the help of MODIS data from NASAs Terra satellite a series of analysis have been conducted with NDVI- Normalized Differenced Vegetation Index.

The researchers are now getting more accurate images of the drought from different regions of the world. With MODI-13Q Images a series of research had been conducted and data has been developed which has become a part of history to study the severity and duration of drought in different parts of the world.

1.3. Software used:

The TIMESTAT is a free software used by CIAF to determine the NDVI values this software helps to automatically determine the minimum and maximum NDVI values which is also used to identify the starting and ending of seasonal time periods of pastures. TIMESAT helps to adjust the three statistical- models which are Logistic, Gaussian, and Savitsky-Golay which inturn help to analyse any spectral index according to the seasonality. By using this software the researchers looks to create a model for future climate anomalies say for example EL Nino- the warming of surface water in the eastern pacific it happens in an interval of 2-7 years and lasts for 1-2 years which replaces the cold water with warm one and it usually happens in December time. El Niño is said to been linked to the drought of Africa, colder wetter, winters of United States; hotter drier, summers of Europe and South America which clearly shows the impact of agricultural sector.

2.0. Situations:

Agriculture Drought Risk Management –ADRM brings about three different situations taking into consideration the original key strategies to adapt and to manage climate change and drought.

a. Normal or near normal conditions b.1 Notable or exceptional conditions
b. Extreme conditions.

Every farm in the country needs to get minimum amounts of rainfall to continue farming normally. Any possibility of getting less than the minimum rainfall means that there is a need for change in planning and decision-making.

Many times governments around the world have often hesitated to act or take decisions due to differing opinions on what constitutes a drought or what is actually termed as a drought. Such hesitation hinders the mitigation and the impact of drought before it becomes more intensive and turns to be a crisis.

2.1. Drought:

Drought can be commonly considered to be the deficiency of moisture in the soil when compared to some of the normal or expected amount over an extended period of time.

2.2. Repercussions of Drought:

Source: (Energy Collective)

- Decreased level of agricultural production: range / pasture, crops, livestock,
- Decreased level of water supplies: in wells, dugouts, streams, lakes, wetlands etc.
- Increased fire
- Increased attack of pests, like grasshoppers
- Long-lasting effects of soil erosion & other types of erosions(wind, water)
- Multi-sector effects that results in: Decreased employment opportunities
- Net farm losses which in turn results in decreased GDP of the country.

2.3. Problem:

Usually drought is said to be a disaster in terms of socio economic situations of a region or a country. As drought is connected with climate change can we say that it is a problem or issue to be solved?

No they are just risks that need to be managed.

2.4. Goals:

Actions and Planning are to be communicated to the farmers

- Effectively coordinated
- Consistent over time

- Reporting and Drought monitoring is to be timely and effective.
- Supporting the plans and actions taken.

The Farmers need to get more access to the knowledge provided to them to tackle drought related matters and manage risk associated with them. So that they can more prepared to face the risks and they get less vulnerable

2.5. Managable Approaches:

- Preparedness-of drought have its focus through out the year yet major efforts are made at the time of non-drought to increase in the level of preparedness to prepared for the next drought.
- Monitoring & Reporting-of the soil conditions as well as the water moisture level, amount of precipitation, and the level of temperatures mainly in the agricultural areas
- Response-towards drought involves all necessary as well as appropriate actions and efforts immediately after the drought to reduce the impact of the same on the farmers.

2.6. Drought Level:

A drought action plan is created to address the drought in which various levels of drought is deeply described and also used through out the monitoring and reporting procedures.

2.6.1. Near Normal/Normal Conditions:

- Reserves of soil moisture and amounts of precipitation are near to normal conditions
- Moisture stress in not shown by the pastures and crops of the affected area
- The temperature variations are near to normal
- Reservoirs show normal releases.

2.6.2. Notable /Exceptional Conditions:

- A Region or some areas within a district is operating under potential conditions of the drought.
- Amount of precipitation and moisture reserves of soil is very low or moderately low.
- Moisture stress is shown by the pastures and crops of the affected area

- Water shortages and decline in the level of stream flows begins to emerge
- Temperature variations starts to show up it may be lower or higher than normal conditions.

2.6.3. Extreme Conditions:

- A Region or some areas within a district where the drought is affected
- Amount of precipitation and moisture reserves of soil is extremely low
- Moisture stress is shown by the pastures and crops of the affected area with significant reductions in yield.
- Temperature variations starts to show up it may be extremely lower or higher than normal conditions.

3.0. Conclusion:

As the availability of water resources becomes scarce at the time of drought there will be greater demand for water supply substitution is required and some times illegal ground water becomes the substitute for regular water supply. There are greater chances for low quality water which is distributed along the public lines and people are forced to use it as there is no alternative which may lead to wide spread diseases . Those people who does not have any access to ground water will be the victims of these restrictions.To manage sudden and great impact of the droughts and also make available water to priority areas and to regulate available water supply. A elaborate mix of policy can find better ways to manage the water scarcity issue to a greater extent and exposure of the drought to be adjusted to the need of agricultural sector. By building better institutions a greater transition can be put forward to a sustainable use of water resources and also putting greater incentives to control water demand and to regulate the use of water.

So adequate care should be taken while handling issues relating to drought and water supply for drinking and agriculture purposes.

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Good Practice in Disaster Governance

Himadri Maitra

Abstract

The High Powered Committee on Disaster Management recommended in 2001 for a separate institutional mechanism for a sustained and focused effort in the area of disaster management. Unfortunately, nowhere had this report mentioned the organisational set up for disaster management under Govt. of West Bengal.

It was after the enactment of Disaster Management Act 2005, the Department of Relief under Govt. of West Bengal was restructured in to Department of Disaster Management along with the responsibility of relief and rehabilitation. This paper elaborates this dedicated structural set up and tries to elucidate how this helps in strengthening the disaster governance.

Key Words: Disaster, Governance, Disaster Management, Disaster Risk Reduction

Introduction

"*There is now international acknowledgement that efforts to reduce disaster risks must be systematically integrated into policies, plans and programmes for sustainable development and poverty reduction... Sustainable development, poverty reduction, good governance and disaster risk reduction are mutually supportive objectives and in order to meet the challenges ahead, accelerated efforts must be made.*" - Hyogo Framework for Action (2005-2015).

Natural hazards do not result in disaster on their own. Rather, it is the vulnerability of populations that has a direct bearing on levels of disaster. Supportive governance is necessary to ensure coping- capacities in societies. It is recognised that effective disaster risk reduction cannot be accomplished without integrating disaster risk reduction into development planning and development processes. Governance influences the way in which national and regional stakeholders (including governments, parliamentarians, public servants, the media, the private sector, and civil society organizations) are willing and able to coordinate their actions to manage and reduce disaster-related risk. Governance systems and processes affect the outcome of disaster risk reduction efforts.

Governance refers generally to the set of instruments through which people living in a state, believing in common core values, govern themselves by the

means of laws, rules and regulations enforced by the state apparatus. It denotes a system of values, policies and institutions by which society manages its economic, political and social affairs through interaction among the state, civil society and the private sector. It also denotes those processes and institutions through which citizens and groups articulate their interests, exercise their legal rights, and meet their obligations and mediate their differences.

Governance has three components: economic, political and administrative. This paper only considers Administrative Governance in its discussion. It is the system of policy implementation and requires the existence of well-functioning organisations at the central and local levels. In the case of disaster risk reduction, it requires functioning enforcement of building codes, land-use planning, environmental risk and human vulnerability monitoring and safety standards.

Good governance creates a responsive environment for effective disaster risk reduction through mobilising the political will and facilitating the broad participation and partnerships to ensure that political, social and economic priorities are based on broad consensus in society and that the voices of the poorest and most vulnerable are heard in the decision-making processes. Principles of good governance include broad- participation, transparency, accountability, efficiency and responsiveness. A central criterion of good governance — namely, the principle of ensuring that the voices of the poorest and the most vulnerable are heard in decisions about the allocation of resources affecting them — is essential for effective DRR and sustainable disaster recovery.

Institutional weakness - Problem area in disaster management

The primary responsibility for disaster risk reduction lies with the governments. In all disasters, it is the government which steps in for Relief and Recovery. The government can make budgetary provisions for ex-ante community preparedness and mitigation measures, or relocate resources for ex-post recovery and reconstructions. These opportunities could be used for disseminating knowledge and understanding of hazard mitigation among people and providing technical solutions.

Vulnerability Reduction and consequently Disaster Risk Reduction is a key investment not only to reduce the human and material costs of natural disasters, but also to achieve sustainable development. Vulnerability Reduction and governability are now justifiably linked in the vision of development strategy because in the past a great deal of attention has been paid to the physical, social, economic and environmental aspects of vulnerability and less attention has been paid to political and institutional vulnerability, except when these agencies

are under scrutiny when specifically responsible for emergency management. This vulnerability is understood as institutional weakness of the system – with its negative effects on:

1) the efficiency of public policies,
2) the legitimacy of government action,
3) limited participation by citizens and the private sectors in national efforts,
4) linkage with local governments and civil organisations,
5) the handling and management of emergencies,
6) processing citizens demands and needs, and
7) the capacity to meet them.

This has often been seen to be one of the prime causes of vulnerability to natural phenomenon, and, in turn, even a cause underlying other forms of vulnerability.

Issues for DRR

Based on the lessons of institutional vulnerabilities, four overriding objectives have been identified as guiding principles of the International Strategy for Disaster Reduction:

- Obtaining political commitment from public authorities,
- Growing public awareness and public sharing to reduce vulnerability.
- Nurturing better understanding and knowledge of the causes of disasters through the sharing of experiences and providing greater access to relevant data and information.
- Motivating inter disciplinary and inter sectoral partnerships and the expansion of risk reduction networking amongst governments at national and local levels, greater involvement of private sectors, academic institutions, NGOs and community based organizations.

The Disaster Management Policy of the state and the Manual for Disaster Management has been published by DMD. It is a political commitment to the public which is address through increased inter-sectoral coordination, the adoption of risk management strategies and allocation of appropriate resources (SDRF). Disaster reduction is dealt with as primary policy issue and is pursued as a crosscutting issue aimed at policy integration among various sectors and across topics such as agriculture, food security, health and education. These are not only pursued at top level, but up to the block level which has only been possible for the existence of an establishment at that level dedicated for the cause of

disaster management. Through this institutional arrangement, programmes related to awareness generation are initiated and addressed through public information, education and multidisciplinary training.

DMD is involved in assessment and analysis of issue-specific (gender, disability) socio-economic impact of disasters; the construction of database on disasters, the formation of suitable coping strategies for different social groups, the introduction of early warning systems, and the promotion of relevant scientific research, which takes into account of both indigenous or traditional knowledge and the development and transfer of new knowledge and technologies.

The department is directly involved with the State Inter Agency Group and promotes its activities for effective coordination mechanism with INGOs/NGOs/ CBOs for disaster management, preparedness, response and early warning as well as the incorporation of disaster risk reduction in planning process. After super cyclone Aila, DMD and State IAG undertook Unified Response Strategy to coordinate the whole response process.

Hyogo Framework for Action outlined five priorities of action of which four priorities which are related to the initiatives of the State Government is mentioned. The first priority is to ensure that DRR is a national and a local priority with a strong institutional basis for implementation. It is assumed that the country that develops and institutional frameworks for disaster risk reduction have greater capacity to manage risks. The second action point stated that the starting point for reducing disaster risk and for promoting a culture of disaster resilience lies in the knowledge of the hazards and the physical, social, economic and environmental vulnerabilities to disasters, and of the ways in which hazards and vulnerabilities are changing in the short and long term, followed by action taken on the basis of that knowledge. The third priority action is that disasters can be substantially reduced if people are well informed and motivated towards a culture of disaster prevention and resilience, which in turn requires the collection, compilation and dissemination of relevant knowledge and information on hazards, vulnerabilities and capacities, and the fifth is that at times of disaster, impacts and losses can be substantially reduced if authorities, individuals and communities in hazard-prone areas are well prepared and ready to act and are equipped with the knowledge and capacities for effective disaster management.

The Initiative: Dedicated Disaster Management Set-up under State Government

I. Disaster Management institutionalized

The Bengal Famine Code, 1913, and the Bengal Famine Manual, 1941, were excellent codifications. But they were based mainly on the ideas to maintain

law and order, and once social life was secured, the responsibility to the afflicted ceased. Under modern conditions, however, not only preservation of life but the maintenance of economic health of the people has devolved upon the State. After the independence, it has no longer become the policy of Government "to wait upon events" but to approach events so that distress can be avoided. The Manual for Relief of Distress published in 1959 by Food, Relief & Supplies Department (Relief Branch) stated in section 101 that the Unit of relief organisation should be the Gram-Panchayats where Panchayats have been set-up and Union in the rest of the areas; when distress is anticipated, Gram-Panchayats or Anchal Panchayats or Unions in an area (as the case may be) should be formed into groups or charges each under a Relief Officer. Relief Officers should usually be of the rank of Sub-Deputy Collectors to be assisted by Supervisors of Panchayats in areas where the Panchayats have been set-up and by other suitable Officers in the rest of the areas as the District Officer may decide. Based on this, a separate departmental set up was created in 1961-62 for relief management in West Bengal. Only after the enactment of Disaster Management Act 2005, the Department of Relief under Govt. of West Bengal was restructured in to Department of Disaster Management in 2006 along with the responsibility of relief and rehabilitation. So, only the duties and responsibilities were enhanced, but the institutional mechanism had already been there to accept the change mechanism. There had been no requirement for staffing or funding; only it required to build capacity and modernization. The state government promptly turned attention to capacity building of Relief Officers (now Disaster Management Officers) at all levels of administration.

The institutional arrangements of the Department of Disaster Management (DDM) are represented in the framework in Figure1. As the actors in both SDMA and the DDM structures are common, no gap is generated in decision making and operational management. With more than fifty years of organizational experience in the field of disaster response in its backdrop the Government of West Bengal strengthen its mechanism with the reconstruction of Disaster Management Department (DMD) from Department of Relief to address the institutional weakness with all its organizational memory of earlier Relief set up being remain intact. It had so far been responsible for Crisis Management in the aftermath of any natural calamity and providing various kinds of succour to the life of the citizens of this state. Long before the disaster management got its impetus throughout India, the then Relief Department would follow different operational mechanisms which afterwards came under preview of disaster management. In fact, "The Manual for Relief of Distress, 1959" the coded guideline for Relief Department, were no less than a manual for disaster management and following different codes of the said manual, the Relief Administration of this state had been functioning years along.

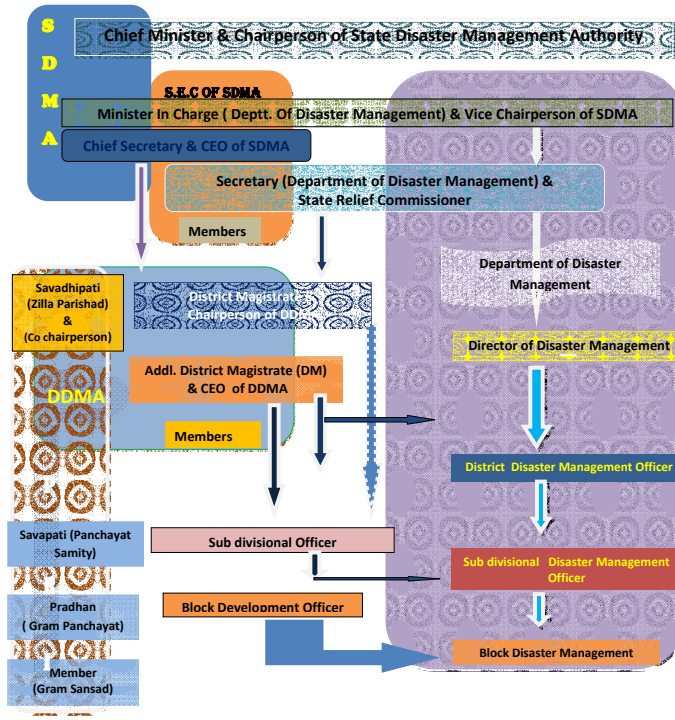

Figure1. The Present Set Up of Disaster Management in the State

The mechanism that was followed is summarised below:

- At block level, in February/March a surveillance team comprising of Block Relief Officer (now Disaster Management Officer) and other concerned officers surveys the banks of rivers and canals and reports it to the Block Development officer.
- BRO (now, Block Disaster Management Officer) would prepare the action plan and contingency plan. The contingency plan of other departments had also been consolidated by the BRO into that block action plan.
- Block level pre monsoon meeting used to be held with BDO, Savapati (Panchayat Samity), BRO and concerned departmental officers. The preparedness measures taken by the different concerned departments would be assessed. A committee would be formed to monitor and functionalise the control room.
- The plans were submitted to the District Magistrate and the District also used to conduct such programmes in the above mentioned line under the supervision of District Magistrate. A district level consolidated action plan was prepared by the Relief Branch of the District.

- These Districts Plans would be submitted to the Relief Department (now, DMD).
- Normally in June, at the State level a meeting used to be convened by the Relief Secretary. The Chief Secretary headed the meeting and all concerned departmental secretaries used to be present there.
- In any other disaster, the crisis management committee headed by the Chief Secretary would sit for a meeting to discuss the emergency response mechanism.
- In post disaster situation, Block Relief Officers (BRO) prepared FIR under the guidance of BDO after completion of immediate needs assessment with the help of PRI members. It would be the duty of BRO under the supervision of BDO to monitor the whole process of distribution of relief, preparation of reports and returns etc.
- Post disaster rehabilitation needs assessment were also done by the BROs through field enquiry.
- The top down chain of command and control from Department to block unit through District Relief Officer and Sub-divisional Relief Officer were properly maintained.
- The bottom up communication chain was also maintained in the same line of command.
- In urban areas Sub-divisional Relief Officers used to play nodal role in case of any disaster.

This was the system that has been the driving force behind the success story of GOI-UNDP sponsored DRMP (2002-2009) of the state in the ten project districts. The BROs easily adapted the mechanism that DRMP initiated. The BROs were already in terms with the PRI system, normally being the Secretary-member of standing committee concerned with relief. In DRMP, in those ten project districts, Gram Sansad level Plan, Gram Panchayat Plan and Block Plan had been prepared under the active monitoring of BROs. They were imparted training by the DMD through ATI and other resources to become a trainer and facilitator in CBDM training. The first State Disaster Management Plan was also published in 2003 by the then Relief Department. It was much before the enactment of DM Act, 2005.

Following the success of GOI-UNDP sponsored DRMP, the state government undertook WBDRMP in 2009 in other six districts through its own budgetary provisions.

In three Districts, MHA-UNDP sponsored DRR programme is done under the supervision of DMD. In this programme also, the departmental officers have

taken the role of trainers and facilitators up to the community level. In this process, Capacity Building Programme initiated by 13th finance commission has also been completed. A resource pool has been generated with the departmental officers who have already successfully conducted training and workshops on Mainstreaming DRR into Development, Gender Mainstreaming in Disaster Management, DM Plan, School Safety Programme, Earthquake Risk Mitigation, etc.

II. Pre positioning and Distribution of Relief Materials:

The department is vastly experienced in pre positioning and distribution of relief materials in pre and post disaster period as a measure of preparedness. It is noted in various studies that relief agencies are confronted with a problem of identification of what relief materials has been received, where it is, and to determine exactly how useful the supplies are. Situation such as this bring out the following problems:

1. The means of transportation and time are limited.
2. Technical information of supplies is missing,
3. The donor and mass media receive a negative impression.

SUMA (the Humanitarian Supply Management System) model, launched in Latin American countries to improve the supplies in the aftermath of disaster is acclaimed by different agencies as best practices in this area. But the practice DMD follows is one of the best practices among other operations in disaster management in this region.

Directorate of Disaster Management (erstwhile Relief) is designed to operate under the control of Disaster Management. The principle facilities of this system are:

- Defining parameters to be used such as reception sites, delivery directions, defining the main users in consultation with and the needs assessment of the concerned Districts,
- The presence of an established and experienced departmental chain of command,
- The integration of information sent by the Block level unit,
- Supporting consultations and making up reports which serve to lend the support to the decision making process and promote internal coordination of the structure.
- Presence of organizational memory that supports future decision making process in case of pre positioning of materials.

The Block level unit (Block Disaster Management Officer) is designed to access needs and to work at points of entry, local godowns, distribution points, etc.

The main work accomplished at Government Relief Store under the control of director is:

- The separation, identification and classification of supplies through labels,
- Random sample checking of items,
- Balance of inventory,
- Inventory follow up of other subordinate godowns,
- Making up various reports regarding stock, distributions, etc.,
- Consolidating data to send to the DMD.

The block, sub-division and district units maintain stock registers for reasons such as in the event that the need to gather data requires their use or to show to the audit. Also the stock position of these units is shared with the central body on regular basis.

III. Institutional Arrangement of Disaster Risk Managemnt Programme

The Govt. of West Bengal has designated the Relief Department as the State Nodal Agency for implementing the programme in the 10 selected districts of the state. Subsequently, a State Steering Committee has been constituted under the Chairmanship of Chief Secretary of the State in May 03. This project has been successful in generating and sustaining a range of outputs across the geographical region on different aspects of disaster risk management at various levels. More than twenty six thousand villages are targeted by the program in 10 project districts.

Following a multi-dimensional approach in pursuit of the programme objectives, achievements have been made in institutionalising disaster management at various levels. While the Programme pervades all sections of the society in rural and urban habitats, it is sharply focussed on more vulnerable disadvantaged groups including women.

Some notable highlights of programme impact includes significant formulation of DMTs & DMCs at various levels, training of its members, satisfactory involvement of women in programme activities, witnessing community preparedness by holding mock drills at Village level.

Human resources from the State officials up to the block level have been designated under leadership of Joint Secretary of the Nodal Department in implementing the programme at various levels. Up to Block level, there are relief cadre officers. 194 Blocks have Block Relief Officers, now redesignated as

Block Disaster Management Officers, Sub-Divisions have Sub-Divisional Disaster Management Officers and 10 districts have District Disaster Management Officers, all are fully discharging their tasks for successful implementation of the programme.

In replication of this programme, W.B. Disaster Risk Management Programme [2009-11] has been launched in six districts by the Govt. of West Bengal itself (state funded) after understanding the impact of the DRMP which was started in ten districts with partnership of United Nations Development Programme in 169 districts in India which are prone to natural calamities.

Lessons Learnt

Governance defined by political commitment and strong institutions is identified in the Framework as a key area for the success of effective and sustained disaster risk reduction. Good governance will:

- elevate disaster risk reduction as a policy priority – DDMWB published its Disaster Management Policy in which it gives priority to DRR.
- allocate the necessary resources for disaster risk reduction – the department from its own budget provision allocate resources, e.g. funding for WBDRMP-II;
- enforce implementation of disaster risk reduction measures and assign accountability for failures – involved PRI at grass root level implementation of DRR; and
- facilitate participation from civil society - DMD is directly involved in State Inter Agency Group- a common platform for NGOs and Government.

The major components of governance for disaster risk reduction are:

- Policy and planning;
- Legal and regulatory frameworks;
- Resources; and
- Organisation and structures.

Disasters are not viewed as isolated and rare events which break "normalcy" for a while. The policy makers of this state did not adhere to the dominant perspective believe, even from early sixties, that disaster would supposedly be a provisional break that could efficiently be reversed with emergency interventions largely based on rescue and relief. Contrary to the prevailing practice in other parts of India to manage emergency situation by deputing officials from other departments, this state administration created this dedicated setup up to the field level. This extended setup addresses the operational management even in post disaster build back period and ensure the governance to the community.

The field level platform smoothes the interfaces between government and the communities and helped the communities directly accessing the government and feels a sense of ownership over government.

Challenges:

1. Risk Management is a concept and a knowledge-based work. Accordingly, the progress of DRR depends upon the conceptual framework of the workforce involved in this department.
2. Disaster Management is not only an operation level job; it is a strategic management process. The understanding of the whole process requires specialised skill and awareness.
3. The visibility of the DRR is less than any other social development work. So, there is always a chance that this departmental works are not viewed as mainstream government works and as such it is neglected.

Summary:

The Disaster governance of West Bengal evolved through a culture of decentralised practices. From its inception, the DMD extended its branch down to block level, which is the lowest level administrative set-up. After the 73rd and 74th constitutional amendments, the department collaborates with local bodies with a view to enhance the last mile connectivity to shoulder the responsibility to the afflicted properly. The annual expenditure on this set up during the past several years is due to this responsibility which Government have taken upon themselves. This expenditure on relief is more in the nature of social service payments.

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Sunkoshi landslide in Nepal and its possible impact on India: A remote sensing based appraisal

P.K. Champati ray

Abstract

A massive landslide blocked Sunkoshi river near Mankha village in Sindhupalchowk district, that killed at least 156 people and formed a massive lake which spread up to 3 km upstream that affected the 2.5 MW Sunima hydropower project (constructed in 2004-5) and the intake dam of the 10.5 MW Sunkoshi hydro project. Apart from the losses and effect in the immediate near vicinity, the landslide and the reservoir with an estimated capacity of 8.26-10.50 MCM of water posed danger to the population living in the downstream areas of Nepal and Bihar. Particularly, the Kosi barrage at India-Nepal border was in danger and as a precaution, authorities in India evacuated hundreds of thousands of people to safer locations to avoid repetition of 2008 Kosi disaster. Realising the potential hazard and in order to address wide spread concern, the satellite data from various sources were analysed. Satellite data analysis revealed that the area was an old landslide zone, which was reactivated in the past as well as on 2nd August 2014. Using remote sensing inputs, the dam height and reservoir volume could be established, which corroborated well with the ground information. The discharge data available at downstream and upstream areas were analysed to assess effect of blockade till Kosi barrage. Overall, it has been demonstrated that remote sensing inputs along with automated gauge and telemetry data can immensely contribute to optimise the disaster response mechanism.

Key words: Landslide, Sunkoshi, Kosi, Satellite data, Discharge data, Disaster response

1. Introduction

A devastating landslide occurred on the early hours of 2nd August 2014 on the right bank of the Sunkoshi river above Jure village, Sindhupalchok district, at a distance of 70 km ENE of Kathmandu, Nepal [1]. As a result of this, Sunkoshi river was blocked at the river meander and it created a large landslide dammed lake (LDL) which extended up to a distance of more than 2 km in the upstream direction and submerged the economic as well as strategic Nepal-China Arniko

highway on the right bank, many settlements, 2.5 MW Sunima power project area and most importantly it caused potential threat of landslide lake outburst flood (LLOF). The river Sunkoshi and its tributaries have a history of lake formation due to landslides and subsequent breaching and flooding [2]. The Kosi disaster of 2008 is still fresh in mind when Kosi changed its course after 200 years due to breaching of embankment and flooded large parts of North Bihar that affected 3.3 million people [3, 4]. Therefore, there was a wide spread concern in Nepal and India and as a preventive measure tens of thousands of people were evacuated to safer locations in eight districts along Kosi in order to avoid the repetition of 2008 Kosi disaster. In order to support the disaster management efforts, National Remote Sensing Centre (NRSC), Hyderabad quickly acquired satellite data over the region using optical (Resourcesat-2) and microwave satellite (RISAT-2) and provided information on spatial extent of the landslide and lake. International Charter for Disasters was also activated to acquire satellite data through global satellite operators. In the present context, an attempt is made to analyse all the available satellite and ancillary data and provide inputs that would aid in disaster management.

2. Satellite data interpretation and analysis

Satellite data such as LISS-IV of 5.8.2014, RISAT-II of 4.8.2014 (Source: NRSC), images prior to 2014 (source: Google Earth), SRTM DEM, 90m resolution, and Worldview-2, MX, PAN, 13.02.2013 (source: International Chater) were used in the present analysis. The landslide (27^0 46' 00" N, 85^0 52' 25" E) is located on the right bank of a meander of river Sunkoshi at Jure close to village Mankha, between two hydropower sides, 2.5 MW Sunima Hydropower site on upstream and 10.5 MW Sunkoshi Hydropower intake dam on the downstream side at a distance of 1 km (Figure 1 and 2). The major trade and strategic route, i.e., Arniko Highway between Nepal and Tibet passes through the landslide on the right bank and after two kilometres on the upstream side it crosses over to left bank at Bahrabise. It is needless to say that the road has been completely destroyed for a length of 850m-1km in the landslide section and further upstream it is submerged in landslide lake for a length of about 2 km (Figure 2).

The location of landslide was a very vulnerable location as it is a site of old landslide in a topographic hollow and at the outward side of the river meander where maximum toe/bank erosion is expected. It has been reactivated in the recent past as shown by landslide scar at an elevation of 1300-1350m which is above 500-550m from the river level of 800m as shown on pre-event IRS-LISS-IV data (www.nrsc.gov.in) as well as on World View satellite images (available in Google Earth for the time period 2000 to 2012, Figure 3 and 4). On 2nd August at around 2.30 AM the landslide was again reactivated and completely covered the old slide zone and the crown had extended further upward at least up to

an elevation of 1500m. The landslide length is 1.3 km and width is 853m (www.nrsc.gov.in). The landslide debris volume was so huge that it could not be accommodated in the narrow valley of Sunkoshi river, although the river was widest (60-70m) in this part of the course due to meandering. The landslide debris that descended from a height of 1500m on the right bank to river valley at 790-795m and then it moved up on the left bank and covered 4 levels of terraces observed at 796m, 800m, 812m and 823m (Figure 4). Thus, the landslide debris has reached up to a height of 825m from lowest level valley elevation of 790-795m.

It is interesting to note that similar to 4 levels of terraces at the landslide location, 2km in the upstream direction on the left bank also 4 levels of terraces are observed at an elevation of 828-830m, 832m, 850m, and 870m. The relative relief difference between the river level and the highest terraces in both the cases is around 30-40m and both have formed on the left bank thus showing the overall hydrodynamic pressure on the right bank at both these locations and the present landslide has occurred at one such location. Movement of landslide masses from one bank to another is not very uncommon, as has been observed during Ukhimath landslide in 1998 in Garhwal Himalaya and Hatian Bala landslide in 2005 in Kashmir region. In all these cases rivers were blocked and dams were formed like the present one. The most spectacular and oldest of these events was the Gohna Tal landslide (Garhwal Himalaya) that occurred in 1893 and blocked river Birahi which breached first in 1894 and later in 1970 causing devastating floods in Garhwal Himalaya [5,6].

In the present case, the landslide dammed lake rapidly grew in size and on 5th August its length and width were 2.36 km and 202 m respectively as observed on IRS-LISS-IV satellite image (source: www.nrsc.gov.in). Gradually its length increased to almost 3.0 km as observed on Radarsat fine beam image acquired on 6th August 2014 and reported by International Charter on Space and Major Disasters. The landslide dam has submerged the 2.5 MW Sunima Hydropower site, Arniko Highway on the right bank and settlements. In case of breach, the power project immediately on the downstream side, 10.5 MW Sunkoshi hydropower will be most affected followed by cascading effect on all hydropower projects in the downstream of Sunkoshi river. Attempt has been made to estimate the volume of lake, based on the discharge data in the upstream area at Bahrabise. The discharge was recorded around 160m^3/s, and considering the blockade was for 13 hrs, it is estimated as 7.4 million cubic meter (MCM). However, it is lower estimation as there are two more streams discharging into lake between Bahrabise and the lake. Based on the water spread as observed on satellite image on 5th and 6th August and maximum height of the landslide dam at 30-35m above the valley bottom, lake volume is estimated as 8.26-10.50 MCM.

Geologically this area is underlain by Lesser Himalayan rocks (known as Kunchha Formation, the oldest rock in this part) consisting dominantly of phyllite, schistose phyllite and quartzite (personal communication: Dr. Dinesh Pathak, Trivuban University). The area lies very close to Main Central Thrust zone and most importantly it is traversed by two sets of prominent joints oriented in NW-SE and NE-SW directions. One such lineament in NW-SE direction passes through the landslide zone showing the overall structural weakness in strata. Overall the slope of the area is around 58-60^0 and the entire landslide mass can be divided into two zones with one resistant layer in between. On 2nd August 2014, failure was observed on both the portions: the upper portion shows more of rock slide where as the lower portion shows rock and debris slide.

3. Hydrological data analysis

Hydrological data, particularly water level and discharge data was analysed for two important stations from both upstream and downstream side of the landslide blockade area. The discharge was approximately around 160 m^3/s on 2nd August 2014 at Bhote Koshi, Bahrabise on the upstream side at a distance 3.5 km. However, the actual discharge to the landslide lake would be higher due to contribution from two tributaries on the left bank between the measurement site and landslide location. Water level was around 2.2m which rises in tandem with discharge of Sunkoshi that confirms consistent data quality. Due to the landslide dam, a lake was formed and from 5 o'clock to 17 o'clock in the evening, the discharge was reduced from 416.2 to 214.2 m^3/s as measured at Pachuwarghat on Sunkoshi at a distance of 35 km from the landslide. It clearly shows blockade of the Sunkoshi and balance discharge was from tributaries of Sunkoshi between landslide location to Pachuwarghat. From 17.00 hrs onwards, the discharge started increasing along with the water level and by 22.00 hrs it almost regained normal discharge of 400 m^3/s (Figure 5). This increase in flow is attributed to controlled blasting of landslide dam by Nepal Army to allow passage of water from the reservoir. Discharge data at Pachuwarghat was analysed for 8 days (1-8 August), peak flow was observed on 4th, 6th and 8th August at Pachuwarghat. The discharge data at both the upstream and downstream provides very crucial information that needs to be monitored continuously for effective disaster management.

4. Impact in India

Indian border lies at a distance of 270 km from the landslide and lake area and the most important hydrological structure, Kosi barrage was at a stake. In the event of sudden release of water due to breach, it could have been severely affected. Therefore, all 56 gates were kept open at Kosi barrage and nine districts of north Bihar were advised to be on high alert till 4th August (Times of India,

4th August). The Kosi barrage with a capacity to handle 9,50,000 cusec (26,900 m3/s) had embankment breached at 1,44,000 cusec (4100 m3/s) in 2008 [3,4]. Therefore, there was a concern and it is important to note that due to siltation and river aggradations, the barrage capacity has reduced since its construction in 1964 [3,4]. The peak discharge in 1968, 1971, 1980, 1984, 1991 are associated with major flood events, even these were lower than the highest capacity of Kosi barrage as well as estimated peak flood discharge (Figure 12 and Table 1). Kosi basin has a high sediment yield rate and larger catchment area compared to its alluvial plain, which suggests that large volume of sediment is deposited in the relatively small area and as a result of which river aggradations takes place in downstream areas close to Kosi barrage and adjoining areas [3, 4, 7].

Table 1. Return period of peak discharge at Kosi barrage (Source: Govt. of Bihar)

Return period (years)	Peak discharge by Gumbel's method (cumec)		Peak discharge by Log Pearson method (cumec)	
	Barahkshetra G&D Site	Hanuman Nagar G&D Site	Barahkshetra G&D Site	Hanuman Nagar G&D Site
50	20235	17812	18519	17157
100	21555	18783	18994	18633

In order to assess the damage control efforts at Kosi barrage, the immediate upstream data available at Chatara, Nepal was analysed. The discharge of Sunkoshi was between 3000-4000 m^3/s during the first week of August 2014 (Figure 6). It shows a reduction in discharge around 17.5 hrs after the reported time of landslide and dam formation (2.30 hrs on 2nd August 2014), which is equivalent to travel time of the water from landslide area to the gauge site at Chatara on Sunkoshi. Considering its distance of 43 km from Kosi barrage, it was expected that the flood water would reach Koshi barrage approximately after 20 hours in the event of breach. Therefore, if the breach time is known then very efficiently preventive measures can be taken as sufficient time would be available to evacuate. However, in the present case as a preventive measure, a large number of people were evacuated, which is a welcome move, but scientific data should be considered in future to optimise the evacuation plan.

As Kosi catchment has high sediment yield and the landslide dam provides readily available sediment to be transported, it is important to assess the sediment that would be deposited both in short term in the event of breach and long term in case the lake/reservoir is emptied in a controlled manner. Therefore, it is very important to make a quantitative assessment of sediment

yield through out the course of Sunkoshi and at the barrage site in India. The high sedimentation rate in and around Kosi barrage can severely affect the total reservoir capacity and even at lower discharge the highest flood level (HFL) can be exceeded. Secondly considering the 2008 event when at much lower discharge, the eastern embankment was breached, it is very important to assess the total load of sediments ever since the construction of Kosi barrage in 1963-64 and its impact on maximum storage capacity. Landslides are the main source of sediment yield in Lesser and Higher Himalaya as many researchers including Gabet et al. [8] have reported the same. There is an intricate relationship between landslides, resulting flash flood, high sediment supply to river system, high sedimentation in the upstream of dam/barrage, reduction in the reservoir volume, finally breaching or overflowing of embankments/dams and flooding that can affect almost entire north Bihar

The present landslide has brought large amount of sediment to the river bed and if the slide continues in future, it will further add to the sediment load of Sunkoshi, that will eventually reach Kosi barrage. Therefore, the flood risk assessment at Kosi barrage need to consider the following: monitoring of the landslide and landslide dammed lake, discharge of Sunkoshi from landslide point to Kosi barrage, sedimentation and actual capacity vs. highest flood level recorded in recent times at Kosi barrage. Kosi flood disaster management should look into three major aspects, viz. 1) river valley monitoring using remote sensing and hydrological observations in all the three rivers (Sunkoshi, Arun Koshi and Tamur Koshi), 2) barrage management to regulate flow at Kosi barrage, and 3) effective evacuation plan based on actual scientific data. Additionally as a long term measure, valleys of all major rivers that enter India, need to be monitored for possible landslide dam and lake formation in future.

5. Summary and conclusions

A massive landslide blocked Sunkoshi river near Mankha village in Sindhupalchowk district, Nepal which is about 70 kms from Kathmandu. Around two dozens of houses were buried in the landslide; 33 bodies were recovered; and all 123 missing people were declared dead. The landslide has also buried strategic Arniko Highway at dam site in Mankha vilage. The government had mobilized security forces which blasted off a small portion of the 30-35m high landslide dam that had blocked the flow of Sunkoshi river and formed a massive lake which spread up to 3 km upstream. The 2.5 MW Sunima hydropower project (constructed in 2004-5) was inundated in the upstream and in the downstream, the intake dam of the 10.5 MW Sunkoshi hydro project was also affected and faces the risk of inundation in case of dam breach. Apart from the losses and effect in the immediate near vicinity, the landslide and the reservoir with an estimated capacity of 8.26-10.50 MCM of water posed danger to the population

living in the downstream areas of Nepal and Bihar. Particularly, the Kosi barrage at India-Nepal border was in danger and as a precaution, authorities in India evacuated hundreds of thousands of people to safer locations to avoid repetition of 2008 Kosi disaster.

Realising the potential hazard and in order to address wide spread concern, the satellite data from various sources were analysed. NRSC (ISRO) acquired data on emergency basis and provided very valuable preliminary results. Satellite data analysis revealed that the area was an old landslide zone, which was reactivated in the past (as revealed by temporal satellite data) as well as on 2nd August 2014. Unfortunately, the landslide was not monitored and no preventive measures were taken. Using remote sensing inputs, the dam height and reservoir volume could be established, which corroborated well with the ground information. The discharge data available at downstream and upstream areas were analysed to assess effect of blockade till Kosi barrage. The hazard potential at Kosi barrage was also assessed in the light of peak flood level vis-a-vis current situation. Hydrological data at Kosi and upstream of Kosi provided valuable inputs for emergency management. Overall, it has been demonstrated that remote sensing inputs along with automated gauge and telemetry data can immensely contribute to optimise the disaster response mechanism. One of the major gap area is information on local precipitation through AWS, sediment yield, discharge measurement at close interval, particularly close to landslide dam (in an emergency), temporal satellite data and very timely acquisition and global dissemination of such data for scientific as well as for disaster response. Govt. of Nepal has facilitated on line (hydrological) data availability and similar efforts should be made in Indian side to utilise data for disaster management.

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Community Based Disaster Management in Andaman:

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ABSTRACT:

Floods, droughts, cyclones, earthquakes and landslides have been frequently occurring in many parts of the world. About 60% of the landmass is prone to earthquakes of various intensities; over 40 million hectares is prone to floods; about 8% of the total area is prone to cyclones and 68% of the area is susceptible to drought. To be effective, local communities must be supported into analyzing their hazardous conditions, their vulnerabilities and capacities as they see themselves. The goal of any disaster management initiative is to build a disaster resistant/resilient community equipped with safer living and sustainable livelihoods to serve its own development purposes. The community is also the first responder in any disaster situation, thereby emphasizing the need for community level initiatives in managing disasters. This paper will deal about how the sustainable and community based disaster management will help the people to cope up with the future conditions. Without sustainability, disaster management efforts will not preserve. A critical element of sustainable disaster management is communities' participation in these activities. The most common elements of community involvement are partnership, participation, empowerment and ownership by the local people. The emphasis of disaster management efforts should focus on communities and the people who live in them. Unless the disaster management efforts are sustainable at individual and community level, it is difficult to reduce the losses and scale of the tragedy. There needs to be an opportunity where people can be involved from the initial programming stage of disaster management activities.

Different natural, calamities can be distinguished from each other in terms of their nature and extent of their impact. Calamities like earthquakes, hailstorms, avalanches, landslides, etc. occur quite suddenly but they are restricted in their impact in terms of time and space. Natural calamities, of one description or the other, affect nations all over the world. Because of the large geographical size of the country, India often faces natural calamities like floods, cyclones and drought occurring fairly frequently in different parts of the country. At times, the same area is subjected to floods and drought situation in successive seasons or years. Similarly, though floods and cyclones occur with some element of .warning yet their occurrence is confined in duration. Drought, on the other hand, spans over a much longer time-frame and its adverse impact on the economic activities and life of an area is of a more lasting nature.

Disaster risk is on the rise throughout the world. Over the past two to three decades, the economic losses and the number of people who have been affected by natural disasters have increased more rapidly than both economic and population growth. The physical, social and economic losses caused by these disasters are particularly harsh for developing countries since they have a long-range effect in the development process. The impacts of the disasters are deeply related with the socio economic conditions, tradition, culture, and climate of the communities. In case of disasters, the people at the community level have more to lose because they are the ones directly hit by disasters, whether major or minor. They are the first ones to become vulnerable to the effects of such hazardous events. On the other hand, they have the most to gain if they can reduce the impact of disasters on their community. This concept gave rise to the idea of community-based disaster management where communities are put at the forefront.

Keywords: Disaster, Community, socio economic conditions, tradition, culture, and climate, sustainable disaster management,

Introduction:

Disaster risk is on the rise throughout the world. Over the past two to three decades, the economic losses and the number of people who have been affected by natural disasters have increased more rapidly than both economic and population growth. The physical, social and economic losses caused by these disasters are particularly harsh for developing countries since they have a long-range effect in the development process. The impacts of the disasters are deeply related with the socio economic conditions, tradition, culture, and climate of the communities. The Community Based Disaster Management (CBDM) approach promotes a bottom-up approach working in harmony with the top - down approach, to address the challenges and difficulties. The disaster management plan would start from the village/ward level and would be consolidated through similar planning at the Panchayat, Block, District and Urban Local Bodies levels in the selected districts. A cadre of village volunteers would be created to carry out the village based natural disaster risk management programmes in the select programme districts. These Village Volunteers will be drawn from the community with the help of civil society organizations such as NCC, NSS, NYKS, Scouts and Guides and Civil Defence etc. The plans would focus on the disaster risk prevention and early recovery through community-based preparedness and response plans, skill development for construction of hazard-resistant housing and enhanced access to information as per the need of the community. Information Technology Specialists would be responsible for development of disaster database at state and district levels for emergency response.

Rationale and objectives

The union territory of Andaman and Nicobar Islands is a group of 349 islands of which 325 are in Andaman and 24 are in Nicobar group islands. Only 38 islands are inhabited - 24 in Andaman and 12 in Nicobar. Administratively, the entire Andaman and Nicobar islands are divided in 3 districts – North and middle Andaman, South Andaman and Nicobar. Out of total area, 7094 Sq. Kms (86%) is covered under forest. Physiography of these islands is characterized by undulating topography and intervening valleys. There are, however some flat island like Car Nicobar and Trinket (in Noncowry group of islands). Except Kalpong in north Andaman, Alexendra, Dagmar and Galathea River in Great Nicobar, there are no major perennial fresh water river. Ground water reserve is limited.

Being located in the Bay of Bengal, the islands are in the **cyclogenesis zone** and significant number of cyclones striking the east cost of India and Bangladesh are generated every year in the Andaman Sea. Heavy rainfall due to monsoon weather resulting in localized flooding is very regular hazard out here. The Andaman groups of islands have volcanoes at Baratang and Barren islands. In Baratang, two major and some minor **mud volcanoes** among the chain of dormant ones., Study says that the **volcanic activity** at Barren Islands is also triggered by 26th December earthquake. Even with low intensity of ground shaking, the long duration of shaking coupled with low water table in many coastal areas may have contributed to possibility of increased damage locally in some areas. Evidences of **liquefaction** are noted by scientist in the South, Middle and North Andaman Islands.

Community Based Disaster Management Plan or CBDMP is a conscious effort of the Administration of Andaman and Nicobar in association with Humitarian Organisation like CARE India to prepare communities for dealing with natural and man-made disasters. It has been observed in the past time and again that members of a community are not only the first responder in any situation but are also the best placed human resource to recognize and anticipate their Vulnerabilities and develop their own coping mechanisms against a disaster. It is imperative that any planning for multi hazard management should attempt down-to-earth approach to develop a culture of safety and security of its own people. Community Based Disaster Management (CBDM) Plan aims to raise awareness on multi hazards faced by people of a given area, and to encourage the community to assume a sense of responsibility to protect itself and to support public and institutional efforts geared towards disaster preparedness, management and mitigation. This Community Based Disaster Management (CBDM) plan is to be prepared, practiced, and biannually updated by the local residents themselves under the leader ship of Community Disaster Management

Committee (CDMC), in order to make it worthwhile and fruitful in times of emergency.

The wind speed is fairly constant (5 knots to per hour) but during cyclonic weather it may go as high on 12 to 13 knots per hour.

As per 2011 census total population of Andaman and Nicobar Island 3,79,944. Tribal community is concentrated more in Nicobar district. The Andaman and Nicobar groups of islands presently have 6 living aborigine groups namely Sentinelese, Jarawa, Onge and Great Andamanese of Negrito origin, whereas the Shompen and Nicobarese are offshoot of Mongoloid stock. Andaman and Nicobar Islands is prone to multi-hazards that include natural disasters such as earthquake, tsunami, cyclone, flood and other disasters. The Andaman and Nicobar region lies in Zone-V of earthquake vulnerability map.

On 26 December 2004 earthquake ,although about 50000 people have been directly affected by tsunami, its indirect effect encompasses entire population of this territory. The earthquake has caused horizontal and vertical movement of land mass in Andaman and Nicobar Islands. As a result whereas there are **increased risks of floods** in the southern area, the Ground Water Table in the Andaman district particularly in Middle and North Andaman's has considerably gone down resulting in **drying up of wells/ponds** etc and creating moisture stress for vegetable and other standing crops. It is also apprehended that 'fissures' have developed due to earthquake beneath the earth surface which is also responsible for lowering the Ground Water Table. The force of the Tsunami also **destroyed coastal protection** provided by mangroves, while inundation caused by the Tsunami loosened land area and created stagnant water beds in once-dry and low-lying areas.

About village contingency plan

After massive earthquake followed by Tsunami, the community came forward to minimize the damages to develop awareness and to prepare themselves to face such type of disaster in future.

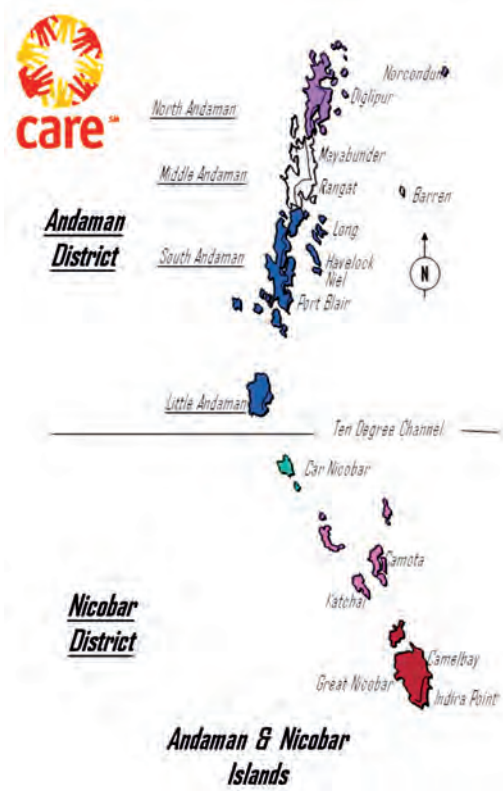
The "village contingency plan" prepared by Amkunj villagers supposed by PRI members with assist from CARE INDIA(ANDAMAN). This plan is to minimize the possibilities of damages of any type of disaster that may happen to the community and forward planning process in a state of uncertainty in order to better respond to an emergency situation.

It consists of five different maps with analysis namely social map, disaster time line map, risk and vulnerable map, resource map and chapatti map.

It also have village disaster committee to look after all the ten task forces. There are responsible persons for village contingency fund, for mock drill and for village contingency plan update with time and process.

Geographical location of the village:

The area become a settlement in 1973 when 1015 families were alloted the land when they first arrived in campbell bay. The family members were primarily engaged as wage labour, In Govt infrastructure is building efforts, During the initial years of settlement of Great Nicobar, as the year's went on by others fallowed the area had 'PATTA' land as well as encroached.



Origin of the village and development:

The area become a settlement in 1973, when 10-15 families members were alloted the land when they first arrived in campbell bay the total population of indira nagar is 529 person's in village.

The population is Primary Tamil, Malyali, Telugu, Adivasi from Ranchi and are the majority Community in the village. In indian nagar 1 R.C.C structure (Double stored) thatched house six, There are also semi Structure house as well as Tin sheet house and mostly Govt servant having Pucca House, Wooden Structure with G.I Sheet.

The village community profile of Indira Nagar is available in Table No.1

Table No.1

Demographic details are required to identify a community specifically, which will be useful for rescue relief, and rehabilitation procedures.	
Particulars	**Numbers**
Total House hold in the Community	84
Total Population	337
Total Male Population	160
Total Female Population	167
Total Children Below 10 yrs	38
Total Senior Citizens Above 60 yrs	27
Total Physically Challenged Persons	2
Total Mentally Challenged Persons	2
No. of Hamlets	2
No. of Wards	11
Total Area of the Village (Hect)	2.50 (Hect)
Distance from GP head quarter	½ km
Distance from Tahesil	½ km
Distance from District	278
Distance from Port Blair	544

Summary and Seasonality of Past Disasters

Certain disasters occur in a specific intervals and the history of disasters in the community may help to plan out future constructions and to be prepared for certain specific disaster. Also focused intervention is possible to common calamities. The details are available in Table No.2

Table No.2

S. No.	Type of Hazard	Last Occurred [Date and Year]	Preparedness	Damages				Intensity (High, Low, Medium)
				Human lives	Live stock	Infra structure	Agri culture	
1	Earthquake	2004	Nil	Nil	Nil	Yes	Yes	High
2	Cyclone	1989	Nil	Nil	Yes	Yes	Yes	High
3	Tsunami	2004	Nil	Nil	Nil	Yes	No	High

Analysis of Disaster Time Line

In last 20years there were major four disaster-cyclone, earthquake, flood and Tsunami. There was unfortunately no preparedness for any type of disaster.

- The cyclone came in the year 1989 dated 6th Nov. at 2:30 a.m. It had a bad impact on the coconut tree paddy, many orchards, few poultry birds lost their life. There was relief but not accordingly..
- The earthquake came in the year 2004 dated Sunday 26th Dec. at 6:30 a.m. It had a bad impact on paddy land. The paddy land lost its fertility. Some people having pucca houses were cracked, water pipe line damaged AT road also damaged. Each family were given a compensation of Rs.2000/-.
- The Tsunami came in the year 2004 on dated Sunday 26th Dec. at 7:06 a.m. It had a bad impact on the fishing boat. The saline water entered into the paddy land., the sea shore coconut tree lost its life. There was only damages but also the people became panic. There was compensation of Rs.2000/- per family.
- The details of the village can be viewed through village social map in Figure 1.

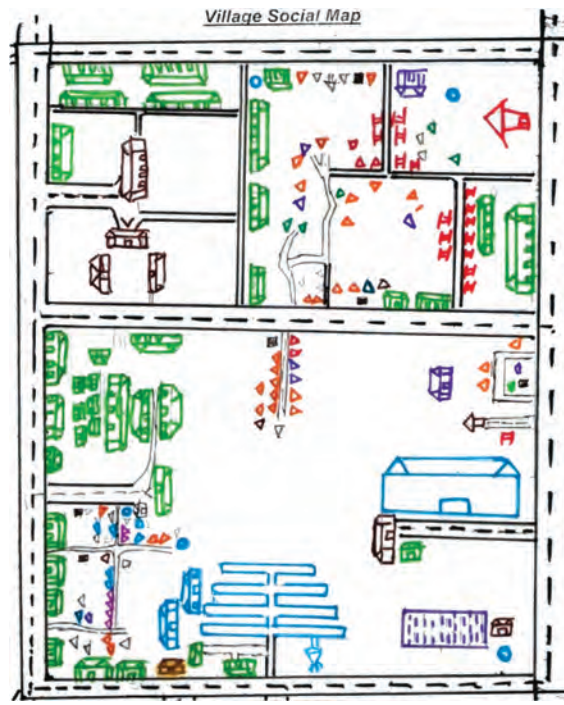
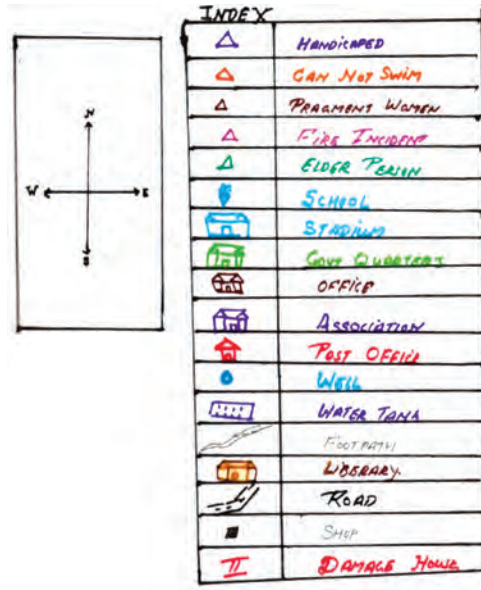


Figure 1.



Risk and vulnerability Map

Through the Risk and vulnerability map of the village we can also come to know what are all the areas are under constant threat and need frequent intervention. The same is available in Figure 2.

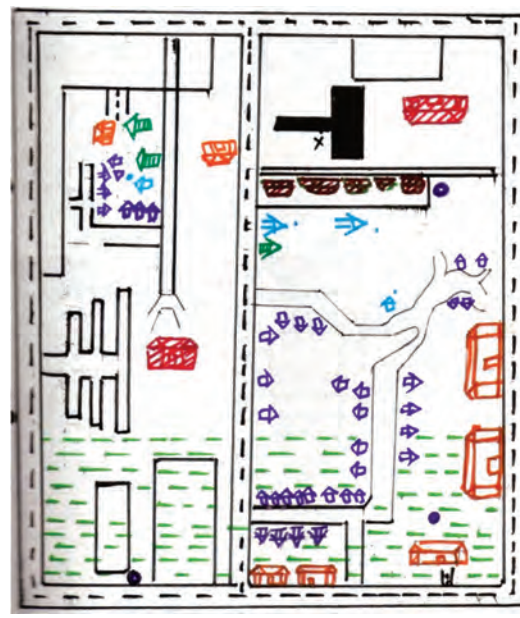


Figure 2.

Vulnerability Profile

Each community has certain area or installations that either lead to calamity or prevent smooth rescue/relief activities. These places and installations need to be identified and necessary precautions to be taken to minimize vulnerability. The following table is to provide such information.

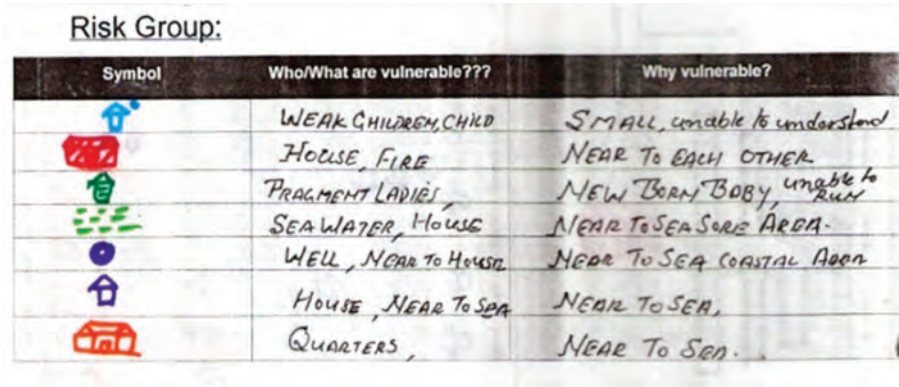


Table No.3

Sector	Total No. Available	Condition	Risk prone (yes/No)	Remarks
Health		No	-	Not Available
Sub-center	-	No	-	Not Available
Water Supply		No	-	Not Available
Water Tank	-	No	-	Not Available
Ponds	-	No	-	Not Available
Well (Ring)	4	Bad	Yes	Salt Water
Pipe Lines (Public)	2	Good	Yes	Good condition
Electricity	337	Good	-	Good Condition
Street Light	-			
House hold electrified	-	Good	-	All Electified
Torches		Good	Yes	Near to sea
Communication				
Mobile Phones	94	Good	Yes	In Village
S.T.D/P.C.O	_	No	-	Not Available
Transportation				
Pakka road		Not	-	Not Available

Sector	Total No. Available	Condition	Risk prone (yes/No)	Remarks
Kaccha road	One	Good	Yes	Normal use
Private(Bus)	Two	Bad	-	Sunami Effected
Others (Maruty/ Omni)	No	-	-	Not Available
Four Wheeler	-	-	-	Not Available
Dingy	-	-	-	Not Available
Trackter	-	-	-	Not Available
Autos	-	-	-	Not Available
Education				
Anganwadi	-	-	-	Not Available
Pre-primary	-	-	-	Not Available
Primary	-	-	-	Not Available
Secondary	-	-	-	Not Available
Senior Secondary	One	Good	No	Not Available
Sanitation	One	Bad	Yes	Work Going On
Community Toilets	One	Bad	Yes	Work Going on
Other Facilities				
Community Hall	No	-	-	Not Available
Fire Station	No	-	-	
Branch Post Office	One	Good	Yes	Surrounded by sea water
Co-operative store	No	-	-	-

General Resources

A disaster may end up with massive casualty, loss of property, mass debris and damaged public utility services. Disposal of carcass and corpses is one of the major tasks after a calamity as well as clearance of debris and reinstallation of basic amenities like power supply, water supply etc. The following table is intended to serve this purpose.

Particulars	Total Number	Location and Distance
Nearest Police Station	1	Jetty Bazaar, ½ km
Nearest Fire Station	1	Near P.H.G, 1 km
Block Office	1	Jetty Bazaar, ½ km

Particulars	Total Number	Location and Distance
Panchayat Office	3	Bazaar, ½ km
Electricity Office	1	In Village, 50 M
Market	1	Bazaar, ½ km
Tehsil Office	1	Jeety Bazaar, ½ km
Banks	2	Bazaar ½ km P.H.C 1 km
Educational Institutions	1	Near Village, 150m
Health Facilities	1	Bazaar , 1 km
AWC	1	Bazaar, ½ km
APWD Office	1	Near Guest House, 1 km
Post Office	1	In Village, 50 M
Fair Price Shop	2	I/ Nagar, 20 M Bazaar, ½ km

Mitigation Plan – to – reduce risks:

To reduce risk a Mitigation Plan had been by C.R.P in the Village like, House hold preparedness, Short and long term Needs, Training for all task Force, Concern Authorities also the Exposure visit to mainland Effected Places.

Short term mitigation

Sl. No.	Needs	Programme to address	Responsible Agency
1	Sea wall	A.P.W.D and A.H.W	A.P.W.D and A.H.W
2	Public Tele-phone Booth	B.S.N.L Dept	B.S.N.L Dept
3	Water tank	A.P.W.D	A.P.W.D

Long Term Mitigation

Sl. No	Needs	Programme to address	Responsible Agency
1	Community Toilet	A.P.W.D and Panchayat	A.P.W.D and Panchayat
2	Community Hall	Panchayat	Panchayat
3	Mobile Phone	B.S.N.L	B.S.N.L Dept

Role of PRIs

The main roles and responsibilities of the PRIs are as follows:

Normal times:

- Prepare the Gram Panchayat Disaster Preparedness and Response Plan
- Help the village NGO workers,Task forces and the ward members in preparing the Village Disaster Management Plan
- Monitoring the training activities of the task force members at the village level
- Updating the Gram Panchayat Disaster Management Plans
- Integrating normal development work of the Grampanchayat with vulnerability reduction.
- Awareness campaign for different types of hazards like flood, cyclone, earthquake,Tsunami sunstroke, fire etc.
- Carrying out mock drill twice a year preferably during the month of **April** and **September**
- The Panchayat may Procure some sorts of warning equipments which work in the time of disaster when there is no electricity.

Pre Disaster Situation: [48 hours before disaster] for Flood, Cyclone and Tsunami:

- The Pradhan to immediately have a meeting with all the PRI members and update the Village contingency Plans and clearly specifying the roles and responsibility of each Task force group and PRI members.
- Ensure that all the resources needed immediately as per the plan are readily available.
- Early warning dissemination in the villages especially the vulnerable groups like the fishing community, villages vulnerable to that particular hazard.
- Stock piling of food grains for human and bovine population, medicines like (ORS, Halogen tablets, bleaching powder) etc.
- All the resources available to be kept ready like (polythene, tarpaulins, boat, generator, Diesel/petrol/kerosene, Transportation and communication aids available and other necessary equipments listed in the Village contingency plan.
- Human resources like the boat man, specially trained taskforce, Police & Fire personals.
- Telephone and address of the local officials to be kept ready

During Disaster:

- Rescue and evacuation
- Monitoring of the relief distribution
- Coordination among various task force groups in the villages
- Coordination with ,Tahasil, block and various line departments.
- Coordination between the NGOs and the CBOs working in that area
- Weather tracking if possible and sharing

Post Disaster:

- Monitoring of the relief distribution
- Coordination among various task force groups in the villages
- Coordination with Tahasil, block and various line departments
- Coordination between the NGOs and the CBOs working in that area
- Damage Assessment
- Weather tracking and sharing

Coordinating with the government and NGOs with the reconstruction and rehabilitation work carried out in the villages of that Panchayat.

Disaster Psychology

Since all the task force members will be in constant contact with survivors it is important that they understand thedistinct emotional phases that the survivors go through.

Stages	Characteristics
The Impact Phase	During this phase, survivors panic, they display emotional disturbances and indulge in whatever they can to keep themselves and their families alive and safe.
The Inventory Phase (Immediately after a disaster)	Victims experience complete shock, survivors assess damage and try to locate other survivors. Survivors may protest to any kind of help given to them
Rescue Phase	Emergency rescue services and task groups arrive on the scene and survivors are willing to take their directions without protest. They trust that the rescuers will help to address their needs so that they can get their lives together quickly.
Recovery Phase	Survivors feel that rescue and relief efforts are not proceeding quickly enough and this coupled with a sense of frustration with insurance and compensation claims aggravates stress levels. Frustration may be directed towards task group members.

In post-disaster scenario as people pick up the pieces of their lives shattered by calamity they may experience the following psychological and physiological conditions.	
Psychological	**Physiological**
Fear of recurrence	Loss of appetite
Frustration	Headaches
Self-blame and blame towards others	Stomach cramps and diarrhoea
Feeling overwhelmed	Hyperactivity
Sadness and grief	Increase in alcohol or drug consumption
Co-ordination and memory problems	Fatigue and low energy
Denial	Nightmares and sleepless

It is important for all Task Force members to remember the following:

- Talk to the survivors and encourage them to express their feelings and needs
- Listen attentively to what the person has to say
- Respond with empathy, understand the concerns of the individual and reassure them that such feelings are expected
- Keep information confidential and respect their trust.
- Be very careful about exploitation of the victims by anti socials.

Responsibilities:

- To maintain law & order inside the community.
- To provide security & safety to the property of all affected persons.

Village Disaster Management Committee (Vdmc)

There will be a village disaster management committee(VDMC) to coordinate the all task forces and to establish a inflow and outflow system. The committee will be responsible to coordinate in Gram Panchayat level committee. By Village Disaster Management Committee we mean a group of socially active and responsible citizens representing a community who may or may not be a part of a registered Resident Welfare Association or any other predefined community structure, authorised by the district administration to undertake various' disaster management related activities for their Community. The principal functions of the committee are to coordinate the disaster management activities like preparedness, Planning, mitigation, relief, rehabilitation and documentation as well as implementing mock drills. This committee will coordinate Community Task Forces as well.

VILLAGE TASK FORCES (VTF)

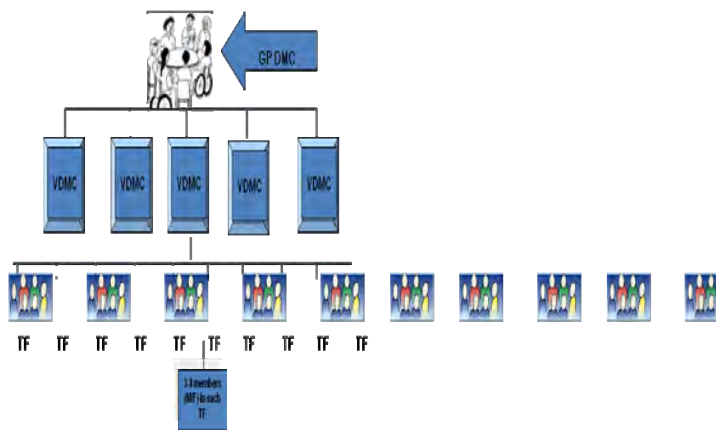
Village Task Forces (TF) are groups of volunteers from the community, meant for assisting their own neighbors in pre-post disaster scenario as well as to prepare the community to cope up with any disaster in future. Minimum three to five persons shall be named in each group, out of which one will be the team leader. Any number of members can be added to the group. These groups will be given specialized trainings.

THE FOLLOWING ARE THE TASK FORCES

1. Early Warning and Communication Task Force.
2. Search and Rescue Task Force.
3. First Aid Task Force.
4. Psycho social Counseling Task Force.
5. Temporary Shelter Management Task Force
6. Water and Sanitation Task Force.
7. Relief Management Co-Ordination Task Force.
8. Damage Assessment Task Force.
9. Carcass disposal Task Force.
10. Patrolling and Peace Keeping Task Force.

Overall responsibilities of

- Coordination with GP level Committee and with all task forces
- Community Mobilisation
- Liaison, networking and advocacy with GO and NGO
- To maintain law and order within community



Pre-Disaster	On receipt of warning	During Disaster	After Disaster
Coordination with GOs and NGOs for Capacity building of Task Forces and up gradation of the shelters. Regular updating of Contingency plan and conduct f of Mock drill. Focus on mitigation strategy Linkage to Development plan. Coordination with all Task force members	Maintaining law and order and proper coordination to handle the disaster. Coordination with other relief Agency.	Special arrangement for vulnerable people. Coordination with all Task force members	To chalk out proper plan for relief and rehabilitation. To work out a long term development plan. Coordination with all Task force members Review of the situation Coordination with GO and NGOs for proper compensation and relief.

Conclusion:

An effective disaster risk management campaign strategy will be developed in consultation with all stakeholders of the selected states for public education to take preventive measures in the wake of natural hazards to minimize the loss. The state nodal agency with the help of civil society response groups would take up a massive awareness campaign throughout the selected districts for preparedness through rallies, mass meeting, different competitions like essay, debate, drawing etc. among school students, posters, leaflets. Similarly wall paintings will be done in each village explaining Dos and Don'ts of various disasters, showing the safe shelters and safe routes for evacuation etc.

Courtesy: Disaster Management Department, Andaman & Nicobar Administration.

Reference:

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The Flood Vulnerability Assessment of River Killiar In Trivandrum District of Kerala in India: A Critical Analysis of the Rainfall Consequence on the Site-Specific Vulnerability

Amalraj.M1,2*Keshav Mohan1

Abstract

The high intensity rainfall on 30th December 2011 had resulted flash floods in various parts of Trivandrum city of Kerala in India. The present study focuses on the assessment of the flood vulnerability of one of the affected locations, the Maruthankuzhy area of the Trivandrum district through interviews, questionnaire surveys, and analysis of the statistics reports, and meteorological data (rainfall). The study revealed that the river Killiar posses an intrinsic vulnerability to flood in the Maruthankuzhy area. The study recommends various specific vulnerability mitigative measures with structural and non structural components to reduce the risk associated with the community. It recommends inculcating the Disaster Risk Reduction activities with the developmental programmes of the Local Self Government, depending on the geomorphology of the location. As part of developing the non structural preparedness practice of the community to flood hazard, awareness programme is recommended for equipping the community by enhancing the knowledge base of the people to cop up with future flood hazards and its influences on their daily life. The possibilities of using open source GIS, the 'Quantum GIS' has used for the study

Key words: Flash Flood, Quantum GIS, Intrinsic Vulnerability, Specific Vulnerability, Rainfall

INTRODUCTION:

Flood vulnerability assessment is an uncommon task during disaster preparedness practices in Kerala. During flood, relief camps are opened and aids are distributed among the victims. The financial parameters are met from State Disaster Relief Fund (SDRF) and Chief Ministers Disaster Relief Fund (CMDRF). The Culture of Disaster Preparedness has not come in to the real picture till now. An endeavor to identify the flood vulnerability in policy maker's eye is envisaged here. The objective of the study is to assess the factors contributing the site-specific vulnerability. The work is expected to be beneficial to the

disaster management planners - practitioners at various administrative levels of the state.

Background

River flooding is a recurring event, in Kerala, along with heavy or continuous rainfall exceeding the absorptive capacity of soil and flow capacity of streams and rivers. This causes the water courses to overflow its bank on to flood plains. Reclamation and settlements in floodplain areas is a major cause of flood damage in Kerala. Study by Centre for Earth Science Studies (CESS, 2010) showed that 5642.68 sq.km of area which is 14.52% of total landmass of the state is prone to floods.

An event can be called as disaster when it affects the people and their living conditions exceeding their capacity to cop up with it. A disaster risk space is encompassed by Hazard – the potential threat which affects the people, Vulnerability – the space where the impact of the hazard hits, and Exposure – the proximity of vulnerable population to be exposed to the danger resulting their life in Risk- apparently, the effect of the interaction between hazard and vulnerability on the exposed population. Crichton depicted this frame as given in figure 1 (Crichton, 2001)

Figure 1. The Crichton's risk triangle

A hazard details the threats in a given area - the vulnerable area, which helps the society to understand about the havoc that they are prone to. Depending on the physical property of the vulnerability, it can be expressed in two ways, the Intrinsic Vulnerability and the Specific Vulnerability. In the case of intrinsic vulnerability, the stake holders or the vulnerable population has little control on the factors that contribute the vulnerability where, Specific Vulnerability is a function of management factors. For example, consider the case of a place where the ground water is getting contaminated from fertilizers. Here the proximity of the aquifer to the land surface is the Intrinsic Vulnerability factor and the quantity of the fertilizer used or the season in which it is applied contributes the specific vulnerability (California University, 2004).

The vulnerability varies with respect to time, at different levels. The frame work of vulnerability, as shown in figure 2, explains five levels of vulnerability. The layer 1 and 2 deals with the community /society that face the direct impact of the hazard, where the layer 3, i.e. Risk Assessment Model, deals with the infrastructures, equipments etc which inter alia shows the susceptibility and coping capacity of the community. Layer 4 explains the field level activities of

the local government on mitigation, rescue etc., which shows the multiplicity in phases. The multiplicity varies such as susceptibility, coping capacity, exposure and adaptive capacity where, these vulnerabilities are influenced by the activities Local Self Government. Layer 5 contains the large scale factors of vulnerability such as political - environmental – ecological factors which are viewed as the vulnerability of the central government (Tingyeh et al, 2008).

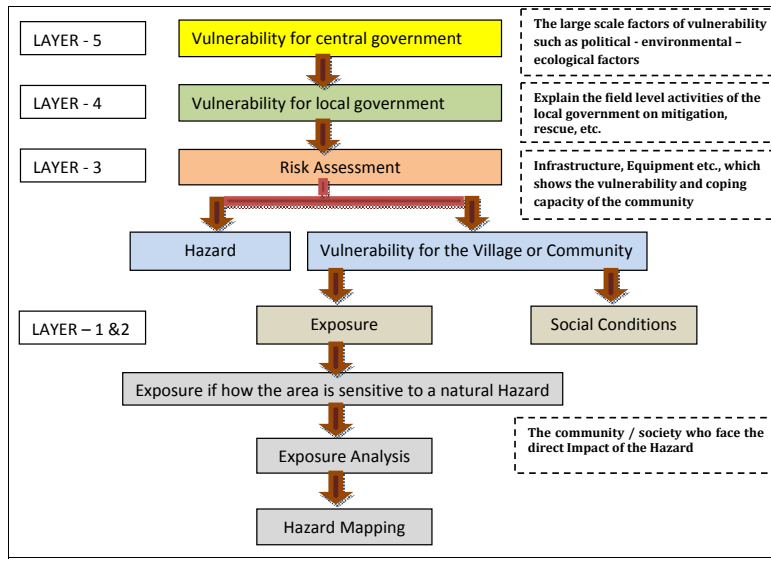

Figure 2. The frame work of vulnerability (Tingyeh, 2008)

The Flood Hazard:

The flood plain of the Killi River and its tributaries, extends over tens to hundreds of meters across its banks in yester years, were mainly used for paddy cultivations. Presently most of these sites are reclaimed land, catering to modern real-estate requirements. The history of flashfloods in the city has a temporal frequency of 8 to 10 years. On 30th December 2011, the river overflowed resulting inundation in the housing colonies. The population under the study area is more than 1000 people belonging to 250 to 300 families. The flashflood has affected the inhabitants of this area noticeably. Other than the effect of inundation, the power supply, electrical systems, vehicular transport like two wheelers and four wheelers of the area were damaged and disrupted. The pictures given below depict the effect of the flash flood during (3a & 3b) and after (3c& 3d) the flood the hazard. (The pictures were taken by the tenants during the disaster days with their own low resolution mobile phone camera).

The high intensity rainfall on 30th December 2011 resulted in a flash flood in various parts of Trivandrum city. The present study focuses on the assessment

of the flood vulnerability of one of the affected locations, the Maruthankuzhy area of the Trivandrum District in Kerala State, India.

3(a)

3(b)

3(c)

3(d)

The Study area

Trivandrum is the headquarters of the district and the capital of the Kerala State, which is located on the west coast of India near the extreme south of the mainland. The district stretches between latitude 8º17' & 8º51' North and longitude 76º41' & 77º17' East. The district can be divided in to three geographical regions: Highlands, Midlands, and Lowlands. The administrative subdivisions, the Taluks, Chirayinkeezhu & Trivandrum are located in the midland - lowland regions, while the Nedumangad Taluk lies in the midland and highland regions,

where the Neyyattinkara Taluk extends the 3 regions. Trivandrum is the largest and most populous city in Kerala State. According to the 2011 census, the Trivandrum district has the population growth rate 2.25%, over the decade 2001-2011. Trivandrum has a sex ratio of 1088 females for every 1000 males, and a literacy rate of 92.66%.

The Karamana River is the main River draining through the Trivandrum District. The highest elevation of the river is in the southern tip of the Western Ghats at Agastyar Koodam. Killi River, also called Killiyar, which is the main tributary of Karamana River, originates from Panavur in Nedumangad Taluk of Trivandrum district. The upper catchment area of the Killiyar basin lies in the Nedumangad taluk region. The river enters Trivandrum city at Vazhayila and flows through Mannammoola, Maruthankuzhi, Edapazhinji, Jagathi, Killippalam, Attukal and Kalady. The thickly populated Maruthankuzhi area fall along the flood plains and valley portion of Killi River. The study area, Maruthankuzhi flood plains is in administrative limit of the Corporation of Trivandrum City. The number of households selected for the study was 65.

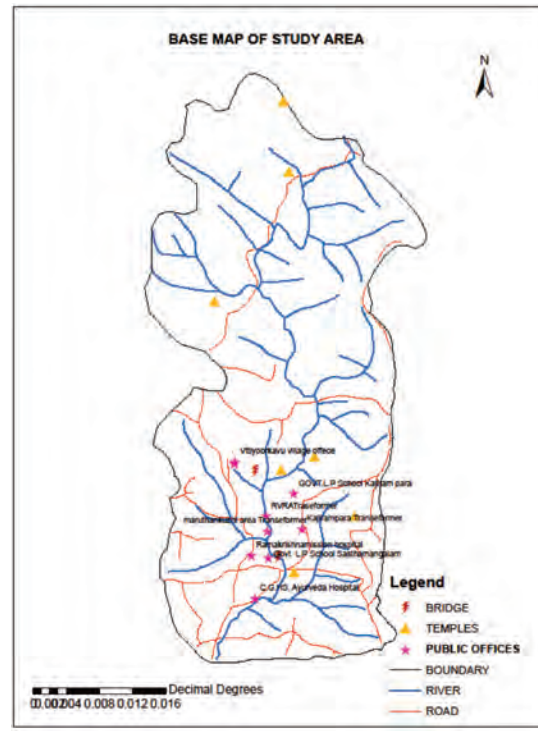

Figure 3 The map showing the study area.

Methodology

The vulnerability assessment was carried out through the analysis of the primary and secondary data. The primary data collection has been done through direct observations in the flood affected area, interviews and questionnaire surveys. The secondary data has been obtained from census and statistics reports, meteorological data (rainfall) and small scale hazard zone maps. Survey of India Topographic maps (1:50000 scale) and watershed atlas of Centre for Water Resource Development & Management, have been used to prepare the base map

of the area, in the GIS Platform. For getting the newly built roads and other recent geographical changes, which was not visible in the Topo maps, were extracted from Google Earth images. For the interoperability of various themes in the GIS application, the open source platform of Quantum GIS *Ver 1.7.4* has been used.

Intrinsic Vulnerability Analysis: The Rainfall

Heavy Rainfall results flash floods which are extreme and short lived, and can result in heavy damage. The major reason for heavy rainfall is the cyclone disturbances and thunderstorms (Rakhecha, 2002). It is observed by Indian Meteorological Department, Trivandrum that the cyclonic disturbances occurred in the Bay of Bengal resulted the heavy rain in Kerala on 30th December 2011. The rainfall characteristics are shown in the following graph.

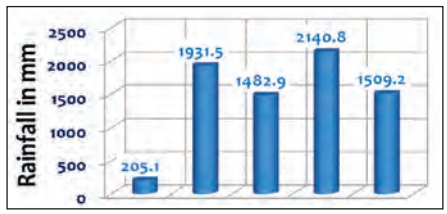

Figure 4.1: Annual Rainfall 2007-2011

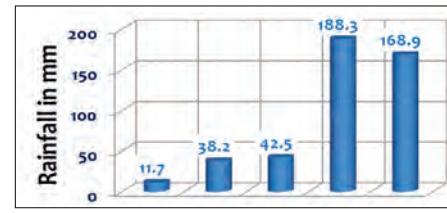

Figure 4.2: December Rainfall 2007-2011

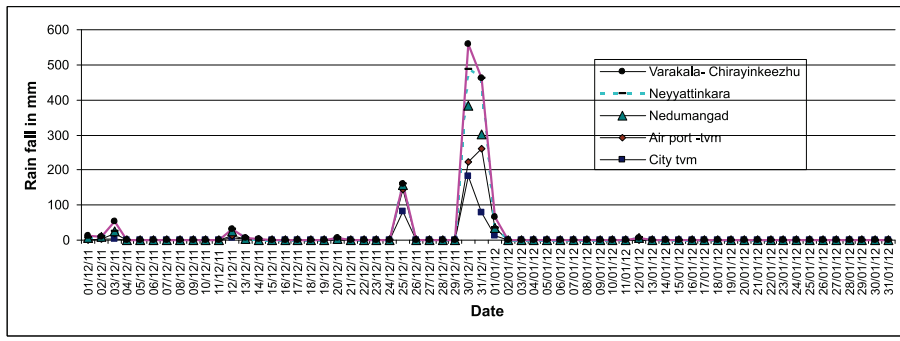

Figure 4.3: Daily Rainfall, from 01-12–2011 to 31-01-2012, recorded in Rain gages within the limit of Trivandrum District

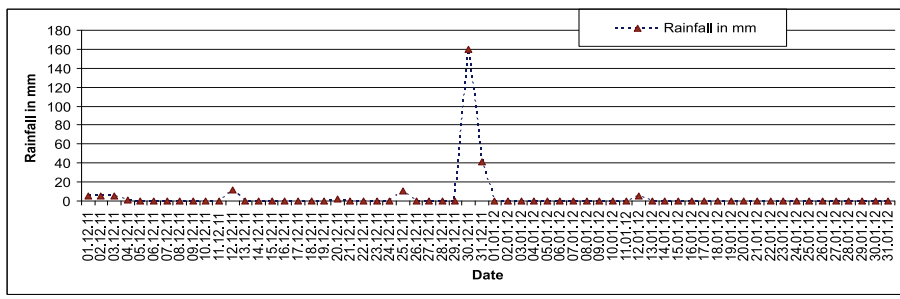

Figure 4.4: Daily Rainfall, from 01-12–2011 to 31-01-2012, recorded in Nedumangad Rain gauge station from where the Killi River originated

According to the annual rainfall data by Indian Meteorological Department, the year 2010 and 2011 reported heavy rainfall, in the month of December. The study area faced high levels of inundation in these two years. The Intense torrential rainfall, having an anomalous behavior to that of the previous year's rates (four times higher to that of 2009), resulted the flood hazard and in turn, the locality became vulnerable.

The Figure 4.1 depicts the annual rainfall from 2007 to 2011, and shows that the year 2011 was one of the years which received the lowest rainfall during the last 5years. In the figure4.2, the graph shows a heavy rain fall record in the month of December, in the year 2010 and 2011 in comparison to the previous years. The other rain gauge stations of the district also showed rainfall at various levels as shown in figure 4.3, in which it is visible that all rain gauge stations situated at various geographical locations of the district recorded heavy rainfall during 30th and 31st of December 2011.Figure 4.4 depicts the daily Rainfall from 01-12–2011 to 31-01-2012, recorded in Nedumangad Rain gage, which is the upper catchment area of the Killyar. In this gauge station, the rainfall rerecord on 30th December 2012, was 160.4mm.

Specific Vulnerability Analysis: The Infrastructure.

The two key issues relating to flood control are the failure of the structural approach to flood control and the institutional dysfunction with respect to trans-boundary flood management. (Shrestha, 2010). On the basis of Questionnaire survey, it is identified that, the rapid urbanization made the location more vulnerable, in the aspects of its social vulnerability. Figure 5.1 depicts the base map showing the sample houses and figure 5.2 shows the urban city where the white spots are the houses & other such buildings.

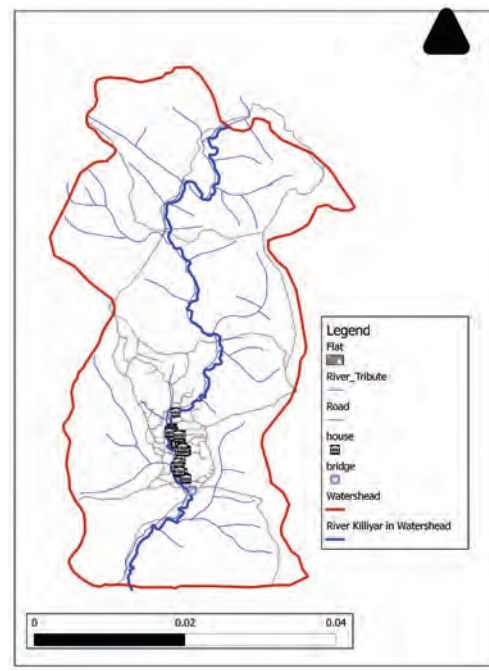

Figure 5.1: Base Map of the Study area Prepared in Quantum GIS open source software

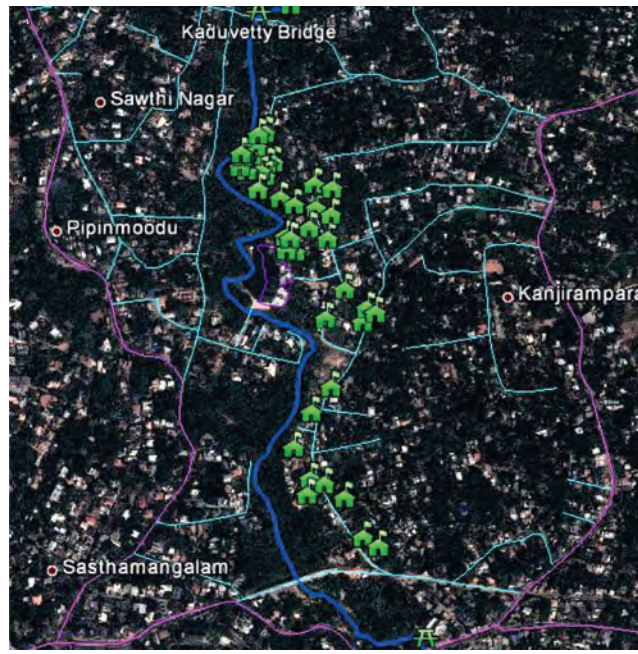

Figure 5.2: Surveyed houses in the flood prone area superimposed on Google earth image (houses shown in green color)

The survey results showed that out of the total sample, 11% of the population were tenants in the rented houses and others inhabit in their own houses. This indicates, as the calamity relief is benefited to the land holders, 11% of the population may not receive the government financial supports. The literacy rate of this area is found to be good and the employment status were also good (89%- Government employees). Most of the households were above the poverty line or economically safer condition and they are having private vehicles for transportation. Majority of the people are having good hygiene practices but 26.15% of houses showed only basic level of hygiene.

Majority of the people in the area are depending up on public water supply through pipelines for the drinking water. At the time of a flood event, the pipeline can have the tendency to be destructed which could result the drinking water scarcity. A few families possess open well as their main water source. The statutory minimum distance between the water source and toilet septic tank should be 30 feet. But In the Maruthankuzhi area, being a heavily populated part of city, in majority of cases, the distance between the toilet and water source was on the range of less than 20 feet, which could result the contamination of drinking water source with fecal coli forms during the flood season.

The people have an assumption that ongoing development activities and encroachment on the flood plains of the river are the main reason for flashflood.

In the survey, a few people stated that the flashflood occurred due to high rainfall. Further it was opined that effective early warning should be given to the community for better preparedness.

The survey result showed that, 86 % of the houses located in the flood prone area were double storied. At the time of flooding, the inhabitants of the houses used to stay at the first floor, till the inundation water receded. The remaining 14 % of the household evacuated and depended on relatives or neighbors. Considering the above, the construction of any public utility buildings like schools, Anganvadies or hospitals may be chosen at the safer zones with sufficient elevation. The possibilities of shelter location's need also be explored. In this regard the Digital Elevation Model of the study area was also developed. Figure 6 depicts the Digital Elevation Model, from which high altitude safe zone can be identified.

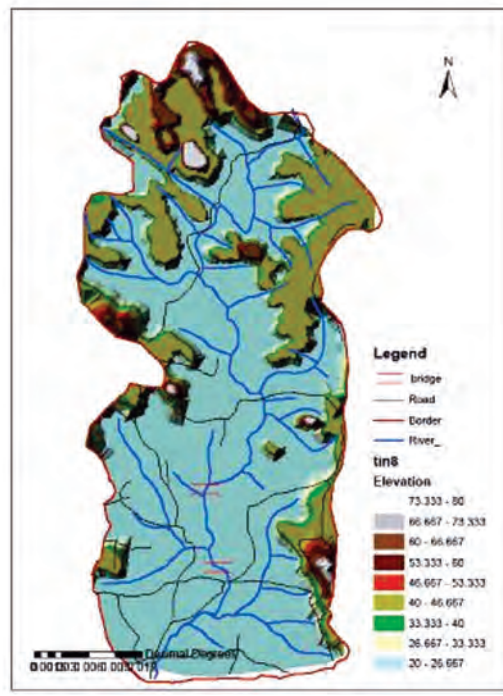

Figure 6: Digital Elevation Model of the study area

Conclusion

The present study focuses on an assessment of flood vulnerability of the Maruthamkuzhy area of Trivandrum district with the aim of identification of the elements of vulnerability and the root cause of the Disaster. The study revealed that the River Killiar posses an intrinsic vulnerability to flood at the

Maruthankuzhi area. Rainfall data analysis showed that flood situation occurred because of the unprecedented rainfall on 30th December 2011.According to annual rainfall data from 2007 to 2011 for the month of December; the heavy rainfall reported in this period is the main Causative factor of the flood. The people have the tendency to live in the urban area of the district, without considering the environmental risk factors or the vulnerability aspects. It is the reason behind the high population density of the study area which is a low lying - flood prone region.

In general, natural disasters are said to affect more on the economically weaker section of the community. But the affected people in the study area are economically sound. The congested buildings without proper garbage disposal facilities could raise the issues of waste management, which may causative for the public health problems, in the post disaster phase. The basic needs like drinking water supply, transportation facilities etc were also affected in flood situation. The awareness level towards mitigation practices or pre disaster preparedness to flood hazard seemed very low in the study area, even if the academic standards of the society seemed good.

Recommendations

The risk factor associated with a society can be reduced by minimizing, either the vulnerability or the exposure. In order to reduce the risk of the people residing in the Maruthankuzhi area, it is recommended to have the mitigative measures such as floodwall construction, channel straightening, channel widening or embankment construction which may be incorporated with the developmental activities of the Local Self Government, depending on the geomorphology of the location. This can be a level 4 activity of the vulnerability framework. The Community Based Disaster Preparedness would be the apt methodology for generating awareness on preparedness, as part of developing the non-structural mitigation practices that may enhance the knowledge base of the people to cop up with future flood hazards.

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Youth Participation in Disaster Management

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Abstract:

The article focuses on the role of youth in disaster management activities. Youth is the group of energetic young people indulged in the activities in and around their world. They are highly willing to participate in community based programmes and can contribute tremendously if involved and trained properly. Their involvement in the very initial stage of Disaster Risk Reduction programmes could not only help in effective management after the disaster but can also reduce the risks of disasters. The article emphasises on the involvement of young people in their own community for identification of risk, preparing disaster management plans, dissemination of warning and organisation of mock exercises.

Key Words: Youth, disaster risk reduction, management, community, preparedness and mitigation.

Article: A bright and better future lies in the hands of strengthened & empowered youth. Youth has infinite energy and considered to be powerhouse of the nation. If used constructively, this enormous pool of zeal, enthusiasm, talent, energy and versatility can work wonders for the country & self. In order to make them responsible, honest and open-minded, we need to ensure their involvement in all the activities taken up around their life. The youth, are the agents of change that determine what the future will be. They possess unique strengths which are enhanced by community support & collaboration. Education comes foremost in capturing this energy and moulding it in the right direction.

Disasters threaten the lives, the rights and the needs of millions of children & youth around the world, and their vulnerability to disasters is expected to increase as the frequency and intensity of natural hazards is rising. Unforeseen disasters require immediate, coordinated and effective response by multiple government agencies, volunteers, relief agencies and private sector in order to meet human needs and speediness in recovery of efforts. Despite of being destructive, disasters also offer opportunities to build back better and safer world. There is a need to integrate Disaster Risk Reduction into education so that maximum number of youth can be involved.

Disaster Risk Reduction is a systematic approach for identifying, assessing and reducing the risks of disaster. It aims to reduce socio-economic vulnerabilities to disaster as well as dealing with the environmental and other hazards that trigger them. Realising the strength of youth and increasing number of disasters, the importance of their involvement is being felt all over the world to make the

universe disaster free. Research has shown that youth disaster preparedness education is vital in building and maintaining resilient communities. Comprehensive disaster management and emergency preparedness should be based on the concept of active young people's participation in all phases of the disaster cycle.

Young people are often seriously affected when disasters strikes. They face severe difficulties in coping with unexpected and traumatic interruptions to their lives. They represents more than one third of disaster victims. Rather than being the mute spectators as victims, or passive recipients of outside assistance, good disaster management must recognize the value of including them in the planning process. Resource building enhances community capability and provides positive response to various emergencies; reduce disaster risks, and helps foster confidence, dignity, and resilience.

Building resilience in youth and reducing their vulnerability to disasters has, therefore, become ever more imperative. A distinctive rights-based approach to Disaster Risk Reduction that proposes a shift of youth as passive victims to agents of change for their own well-being and the development of their communities is realised.

Involvement of youth in disaster preparedness process will not only benefit them, their families, and communities, but also contributes to grassroots empowerment which boosts levels of ownership within their overall disaster preparedness plan. It is a fact that when a disaster strikes, local people are the first to respond before any other outside agencies arrives to, and assist in recovery efforts. Many of these first responders who struggle to save lives with limited resources at their disposal before more help arrives to take assist are energetic young people.

There is no better resource in the community than young people. The world's youth are also the very people who can teach their communities - and the wider world - how to reduce the risks and impact of disasters. They have tremendous potential to reduce vulnerability, build resilience and contribute to the well-being of communities and sustainable development. Providing them the opportunity to be directly involved in disaster preparedness activities enables them to develop skills that prepare them for any threat that may come.

Youth based Disaster Risk Reduction is an innovative approach that fosters the agency of youth, in groups and as individuals, to work towards making their lives safer and their communities more resilient to disasters. It is empowering for youth, and respectful of their views and rights as well as their vulnerabilities. It is a flexible rights-based approach combining activities with interventions geared towards bringing about change in community, local and national duty

bearers. It applies strategies such as awareness raising, capacity building, group formation, institutional development, research and influencing and advocacy across a range of arenas.

Administration and disaster management facilitators have to recognize the powerful agents of change to encourage their unique abilities and skills specially in innovation of technology and thought to engage them in public awareness and education and their involvement in decision making and planning at all levels.

Youth is unmatched by any other demographic group in their ability to bring about meaningful change in social behaviour and attitudes. Their potential cannot be underestimated to make a real difference in the time of disasters. There unique role and the value make them available as innovators, inter-cultural ambassadors, peer-to-peer facilitators, community mobilizers, and advocates for vulnerable people.

The role of youth can be ensured through their involvement in identification, assessment and monitoring of disaster risks management activities. Their participation results in better decisions, higher quality services, greater access to those services, and better development outcomes as a result of those services.

Youth has a unique and holistic perception of risks. They have a comprehensive approach to perceiving risks, encompassing natural hazards, personal safety and social and economic threats. Their perception influences their behaviour and determines their readiness to mobilise for action in a range of disaster and development arenas. They often have a longer term perspective of risks than adults, who are primarily concerned with meeting day-to-day needs, in particular with regard to the environment.

Youth have the capacity to communicate effectively on risk and risk reduction with their parents, siblings and peers and through informal communication networks. They are enthusiastic innovators of risk communication tools. Empowered youth are innovative agents of change. The holistic awareness of risks gives them a sound understanding of the consequences of disasters on local livelihoods, development and protection. Equipped with relevant knowledge and skills, young people can make informed decisions about how to adapt individual lives and livelihoods as well as ecological, social or economic systems in a changing environment.

Youth centred DRR can also empower young people to make informed choices and develop behaviour that reorient society towards more sustainable practices for sustainable development, which reduces local vulnerability and increases resilience. They have a vital role to play when building community resilience

and should be involved in planning for, responding to and recovering from natural disasters.

The tremendous contributions that young people can make to disaster management are largely untapped. Any comprehensive disaster management that is designed to incorporate youth in its programs, not only benefits creativity and energy of young people but also in the process strengthens partnerships for resilience. Youth involvement in planning, decision making and in the implementation of emergency preparedness programs is critical to the long-term success of sustainable disaster management initiatives and community resilience.

Although our social norms have such often portrayed young people as dependent and helpless victims in emergencies. The notion that excluding young people from direct involvement in calamities helps protects their well-being and trauma that adult face is undermining their resilience and coping in the context of adversity. In practice, however, the reverse often applies and youth commonly have far more options open to them than do adults. Around the globe young people have proven to be faster in responding and volunteering in relief efforts when disaster strikes. They should be encouraged to use their potential to become agents of change globally. Their ideas and energies can be put into good use.

The idea of involving youth and encouraging their participation in risk reduction measures is in line with international commitments which legally bind the signatory states to observe the rights of children and youth.

Involvement of young people will equip them to take on new roles and become active agents of change. The inexperienced young people likewise need mentors in disaster preparedness process who are willing to work closely with them by involving them in active roles that gives them hands-on experience to eventually fill-in the shoes of their adult mentors when they are no longer available for duty. Adult mentors should work closely with youth in an effort to incorporate their ability and talent in disaster management process. This is preparing future leaders, who are disaster resilient, compassionate and good citizens. Thus, the united effort of young and old will result in strength, while diversity may only hinder the effort of the desired community resilience when disaster strikes.

Information sharing is another principal component of an effective emergency management strategy to help a community improve its level of preparedness, response capabilities, and resilience which is generally unavailable with youth. Relevant information shared with young people on disaster risks will unify communities and promote a culture of disaster readiness and collaboration at all levels that include disaster experts, responders and other stakeholders.

Youth designed community training programmes will also promote them to take personal responsibility in preparing for and responding to a disaster. It also makes them understand and recognize the importance of their participation in disaster response, relief and recovery efforts. Special programmes like providing first aid service, shelter for homeless, care for elderly people etc. can be planned to ensure their active participation.

Besides training, the awareness and knowledge of youth about disaster management activities can also be increased with their involvement in mock drills to assess strength, weakness, opportunity & threats. A good caring relationship among youth & emergency personnel need to be developed.

Emergencies and disasters are a reality that all face together. It is important to recognize that youth engagement initiatives, collaboration and partnerships in disaster management have multiple payoffs that save lives and promotes resilience in difficult times. Moreover, involving young people in disaster preparedness will bring a revolutionary change in society through passing this knowledge from one generation to other. Through youth, we empower communities to take responsibility for reducing their own risks and do better in influencing decision-making and planning in disaster management. Working with commitment & hard work in a team of youth will help us to establish culture of preparedness & mitigation and bring sustainable development.

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Role of Geospatial Techniques in Incident Command System for Disaster Management

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Background

During 1970's, US agencies identified several recurring problems in their multi-agency response during a disaster event. It includes non-standard terminology, lack of structure for coordinated planning between agencies, inadequate & incompatible communications and lack of designated facilities such as from where to operate or where to store the material etc.

Growing need for multi-agency & multi-functional involvement in incidents / emergencies has increased the need for a single standard management system that can be used by all emergency responding agencies (LBSNAA, 2005).

Incident Command System and Incident Response System

Incident Command System (ICS) is a framework, which makes use of management concepts such as unified command indicating clear line of authority, organizational flexibility for different scale of emergencies, standard terminology for better communications, resource management procedures for efficient use and systematic guidelines for an effective incident response (LBSNAA, 2005).

In Indian context, ICS has been changed to Incident Response System (IRS). IRS is a mechanism which reduces adhocism in response through a well conceived team. It is a flexible system and only those Sections / Branches may be activated in the team which is required to meet the disaster situation. Main features of IRS include Management by objectives & Incident Action Plan, Resource Management, Common Terminology and Chain of Command etc. (Sinha J.K.)

Geospatial Technologies for ICS

Spatial science based GIS technologies can play a significant role in the operations performed by Integrated Command System during a disaster event.

Geospatial technology is used throughout the operations supporting response, recovery, mitigation, preparedness, and prevention efforts. The missions reflected in these efforts include the saving of lives and property, the provision of food and shelter, financial assistance, damage assessments, and recovery.

With coordination and a strategy for resource use, geospatial technology can be more effective in meeting the requirements of any incident (Geoplatform). These technologies can maintain information on resources to be used during such event. GIS systems can be used to compile check-in information and then be maintained to reflect current resource status and location (LBSNAA, 2005).

An example of usage of this technology can be seen in the geospatial application system 'Incident Command GIS' developed by a commercial entity SuperGeo Technologies for Taipei City Government. Incident Command GIS is the professional system which perfectly integrates various disaster rescue information, and allows officers to create, manage and publish various types of maps and rescue resources. With the GIS solution, the Fire Department commanders in Taipei City Government can timely make better rescue decisions to save lives and properties (GIS resources).

Another such examples are Eagle One or Cedric developed and employed in different safety regions in the Netherlands. They provide tools and interfaces to create common operational picture to support communication between responders and sharing of information. They are based on the so called net-centric way of working, meaning that data are stored on different servers but access is ensure to all and from nodes of the network.

Generally, many system are developed all over the world for different purposes: simulation, monitoring, early warning, visualization and simulation. They are based not only on state-of-the-art technologies in GIS, but also image and video processing, computer graphics, human machine interfaces, communications, gaming, etc. (Zlatanova and Fabbri 2009). Due to importance of location, most of the systems use vector digital maps, raster maps, images (aerial, satellite, range, radar, etc.), three-dimensional models as background and for simulation and forecasting. The diversity of systems is extremely high. There are systems devoted to a particular disaster type (e.g., fire, flood, avalanches, etc.), others to a group of responders (e.g., fire brigade, ambulance, police, Red Cross), to a particular activity (e.g., early warning, evacuation, following patients to hospitals, etc.).

The types of systems can be subdivided in two large groups: scenario-based and on-demand-based systems. Scenario-based systems usually concentrate on a specific hazard problem (flood, landslide, etc.). They integrate monitoring, alert, simulation and prediction models, i.e. they have a significant dynamic component combined with the spatial dimension. The notion of a scenario integrates both the pattern of stresses and the behaviour of a model of a

physical/environmental system submitted to external pressures. The data and the interfaces are dedicated to the type of scenario.

In contrast, on-demand systems are highly dependent on the dynamics of disaster and therefore difficult to predict the needed information. Such systems have to fulfil two premises: ensure supply of sufficient data from the field and discover, access and fetch the most appropriate data from existing sources of information. Typically the information is scattered among many sources, with different representation, semantics, accuracy and dimension. Finding, integrating and analysing of these data is still problematic.

Regardless what kind of system is needed, the need of geographical information is apparent (Friedrich and Zlatanova, 2013).

To analyze the role of geospatial technologies for ICS, we have elaborated the support provided by these technologies in the context of:

- Clear line of authority, (well-defined responsibilities)
- Organizational flexibility for different scale of emergencies, (well-defined semantics)
- Standard terminology for better communications,
- Resource management procedures for efficient use

In an integrated format, a spatial system addressing these contexts using different spatial data, non-spatial data and management concepts, could work effectively as a Spatial Decision Support System (SDSS). The different contexts of ICS could take a shape of SDSS.

A. Clear Line of Authority

A web-based or LAN based ICS using geospatial technologies can be an effective tool to define the clear line authority among the chain of command during a disaster event. An authorization based access to ICS can give responsibility based access to information needed, resources mobilization and management, monitoring the response and taking the correctional measures if needed.

The figure 1 shows the logical flow of an example of authorization based access for various level of authorities. At the highest level of command / authority, we get an integrated view of all the components involved in the management of a disaster event. With the further levels of command, it can be restricted to the responsibility assigned for a particular component.

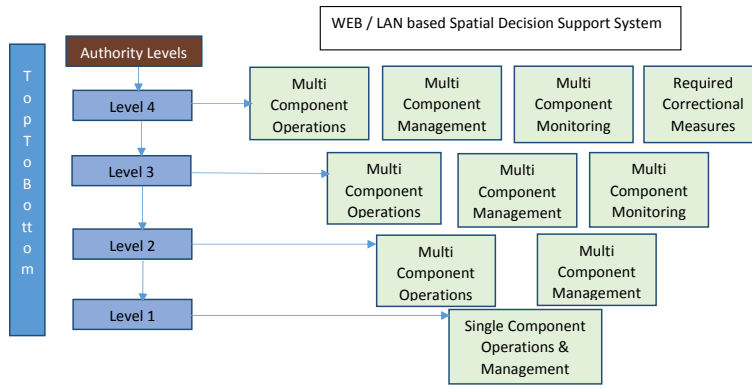

Figure 1: Authorization based Access to Response Actions

B. Organizational Flexibility for Different Scales of Emergency

Defining the scale of emergency could depend on the spatial scale of disaster event or the intensity of the disaster impact in the affected area. GIS based ICS can easily take a multi-criteria informed decision for the level of involvement of organization about responding towards the emergency situation. This can be achieved by analyzing real-time status of different spatial layers and their associated data such as landcover, terrain, water supply networks, QRT centres, emergency vehicle routes, health centers, spatial spread of disaster, other assets locations.

For example in the Netherlands, 4 levels of emergency are specified (Zlatanova, 2010), which reflect the impact of the affected area but also the number of emergency response units which have to be involved in the incident management. Having well-specified tasks and responsibilities is promise for identifying needed geo-information and the manner it should be provided to the responders. The levels of involvement as per disaster scale could be seen in Figure 2.

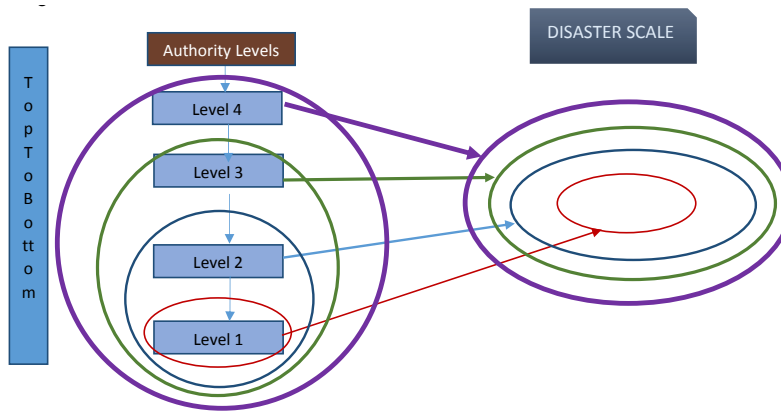

Figure 2: Organizational Flexibility to respond as per emergency scale

C. Standard Terminology for Better Communications

In the armed forces, mostly it is a standard while communicating between the command centre and the field operatives to use word 'Yes' for a positive answer and to use word 'Not Clear' instead of word 'No' for a negative answer during a field operation. This standardization of communication avoids any possibility which can lead to the confusion between the words 'No' and 'Go' due to human error and thus causing a disaster during an emergency. The above example shows the need to have a standard terminology for better communications between a command center and the field operatives during a disaster event. The standardization or uniformity in data creation, preparation and maintenance could lead to avoid occurrence of mistakes in response or avoid unnecessary delay or inefficiency in resource usage and management in such conditions.

Among the GIS community, it is a common practice to use standard terminologies like elevation data is used either in the discrete data format of Contour and spot heights or continuous surface format of Digital Elevation Model (DEM). Similarly while creating the attribute data, it allows to pre-decide the data value options for TEXT data format. This avoids multiple forms of data entry for the same name, place or object due to spelling differences. An example could be the surname 'Agarwal' which could be entered with different spellings 'Aggarwal' or 'Agaarwal' or instead of 'Bangalore', it could be 'Bengaluru' or 'Bengalore' etc. In case of numbers, 10 are different from 10.00 (Integer and Float Data Formats). The practice of creating spatial data infrastructure on national and state level is also based on the standardization of terminologies. In fact there is a dedicated terminology to match different terms in different themes having the similar meaning which is called 'Ontology' and software are developed to provide such services. One of the most popular ontology software is Protégé which is a free, open-source platform that provides a growing user community with a suite of tools to construct domain models and knowledge-based applications with ontologies(Gang Cheng et al., 2008*)*. Ontology can play an important role in semantic formalization, interoperation and integration in both geospatial data and services (Ontology and GIS).

The standardization benefits immensely when we need to do a query (spatial or non-spatial) to filter out the information to be extracted quickly for further decision making in an emergency situation. The query could be a spatial query like how many fire stations are located within 10 kilometers of a fire incident? Or a non-spatial data query like what is the average age of victims drowned during flooding?

In most of the cases when disaster happens, many maps reflecting the status of the emergency response need to be prepared by local and international authorities. Presently the content and the presentation of these maps is not

standardized. However standardization approach is needed there as well. The Geographical international societies have worked for more than two year on a project investigating which products and systems are most appropriate for a specific type of disasters. Questionnaires were sent to all parts of the world to investigate which the most appealing hazards per region are. Then for the first 10 disaster maps products were identified as most valuable. For example it was identified that damage assessment map, risk map, inundation map, flood risk monitoring map and recovery process map are most appreciated (and prepared) in case of flood. The content of these maps was defined and again sent to the user for approval. Details of this investigation is available on-line here: http://www.un-spider.org/sites/default/files/VALIDPublication.pdf

This approach can be applied for a part of the world, a specific region or a country. Such investigations can help establishing common understanding about the type of maps and other products that are needed for hazard monitoring, alert, emergency response and recovery. The ontology then can be built up for each map content.

D. Resource management procedures for efficient use

Resources whether physical or human are usually spread over a geographical region which generates a need to manage these resources. To capture the dynamics of spatial relationships while managing these resources, it becomes essential to use the GIS and Remote Sensing technologies. These technologies can cover a large area or inaccessible areas in terms of landcover, terrain, hydroinformatics, infrastructure etc.

During a disaster situation, it is required to manage resources for efficient usage to serve the most needy on a priority basis which requires certain procedures to be followed in a certain sequence. The procedures are formulated to help the implementation of priority for the prepared and response measures involving different resources.

The geospatial technologies help to identify, access, use, store and distribute the resources. Keeping procedures in view, these technologies could help in deciding to whom the access has to be given for certain facility during a disaster which could optimize the response time and effectiveness. It can also help in deciding storage places for equipment as a preparedness measure.

Conclusion and Recommendations

We conclude that GIS technologies have an important role in ICS where it has to be applied in context of clear line of authority, standard terminology for better communication, organizational flexibility for different scales of disaster and

resource management procedures for efficient use. Many systems developed all over the world for different purposes: simulation, monitoring, early warning, visualization and simulation can work in these contexts. An authorization based access to ICS can give responsibility based access to information needed, resources mobilization and management, monitoring the response and taking the correctional measures if needed. GIS based ICS can easily take a multi-criteria informed decision for the level of involvement of organization about responding towards the emergency situation. The standardization or uniformity in data creation, preparation and maintenance could lead to avoid occurrence of mistakes in response which can be done in GIS. Keeping procedures in view, these technologies could help in deciding to whom the access has to be given for certain facility during a disaster which could optimize the response time and effectiveness.

We recommend to increasingly use the geospatial technologies for planning, visualization, data capturing, situation analysis, simulation and modeling in disaster management. Unlike developed countries, for eg. Netherlands, research on application of geospatial technologies for disaster management is in nascent stage and thus there is a lot of scope to research in various dimensions of disaster management using such technologies. For gaining a better understanding of technology based micro-management and how it can be applied in context of developing countries such as India, we need to have international collaborations between academia and research institutions of developed and developing world.

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Natural Disasters Threat To National And Regional Stability

Brigadier Narender Kumar

Abstract

Disasters have obliterated the civilizations and are considered as one of the top five threats to humanity at large. In the last five decades more lives and property has been lost due to disasters and not by an act of war. Disasters have the potential to destabilise the nations and even the entire region as well. Ebola has caused widespread fear among the global community. Biggest challenge due to disasters is sustaining lives during and after disasters, because the entire chain of life support system is disrupted. It causes system collapse which also give rise to the lawlessness and the breakdown of communication between the people and the government. Srinagar floods had shown that there was a complete vacuum of governance and communication between people and the government. Therefore, as a regional power India no more can accept disasters as fate or an act of nature. Loss of lives and property is a too precious to be lost in disasters. The time has come for India to build capabilities to mitigate and lead disaster relief operations within the region. India must assume regional leadership to act as a net security provider during disasters in the subcontinent.

Keywords. National Security, Environment, Humane Approach, Mitigation, Disaster Intelligence, Concept of Operations.

Introduction.

Disasters cause human tragedies and more often than not underprivileged members of the society suffer the most. On one hand, disasters bring despair and unimaginable violence and destruction, but it also compels the society and state to introspect the contempt by humans against nature. Today humans are far more exposed to the risk of natural disasters as they were in the past.[1] Human intervention in initiation of disasters was un-heard of then, but the danger of man-made disasters today have increased manifold. Nature is uncompromising and the culpability of humans for tinkering with the law of the nature is not likely to go unpunished. It forces the collective wisdom of the humanity to introspect and put in efforts to minimize and mitigate the impact of disasters in the interest of the future generations.

Sun Tzu had said, that, strategic wisdom lies in the prevention of war, and the absence of a strategy is in fighting a war. Similarly, prevention and preparation

1 Shelly Barclay, 8 Natural Disasters of Aniciant Times, http://listverse.com/2010/09/27/8-natural-disasters-of-ancient-times, September 27, 2010.

for disaster is a strategic wisdom and circumstances leading to undertaking disaster relief operations is absence of strategy and wisdom. It is more economical to prevent disaster or mitigate the impact by proactive actions than to deal with disaster relief and recovery operations. In the light of the above facts, there is a relationship between hazards, vulnerabilities, and conflict between humans and nature. Disasters do occur when the threshold is crossed and repeated warnings from the nature are overlooked. There has been a pattern and Himalayan States have been affected by flood fury since the last four years. Ladakh flash floods, Uttarakhand disaster and now Kashmir floods. There was a clear window of one to two years between each of these disasters with adequate time in between to put the system in place to plan, prepare and prevent such calamities. Cumulative loss due to floods in the three recent disasters are far higher than the cost it would have required to reconstruct. But the most precious loss is human lives which cannot be valued in currency.

National Security andRepercussions of Untold Truths of Disasters

Disasters as Threat to National Security. Disasters have far more serious implications for the national security, it has the potential to initiate riots, conflict within the society and large scale violence. Instability is triggered post disaster when there is a question of survival and life sustaining essentials are far meagre to support millions of affected persons. The Pentagon has listed disasters among the top five threats to national security. In response to this observation, Defence Secretary Leon Panetta,term disaster as serious security crisis and said,. "In the 21st century, we recognize that disasters can impact national security ranging from severe droughts, to floods, to more frequent and devastating natural disasters that raise demand for humanitarian assistance and disaster relief".[2]In nutshell disasters have become a serious threat to peace. If an empirical analysis of disasters is carried out,losses can be categorised as under :-

a. Loss of lives is an irrecoverable loss.
b. Loss of life sustaining chain.
c. Loss of infrastructure and resources.
d. Struggle for survival overtakes the sense of being "Humans First". (Loss of human values).
e. Ground zero and zone of impact plunges into un-controlled chaos and at times leads to lawlessness.
f. Loss of cultural values and heritage (Irrecoverable loss)

2 Sandra I. Erwin, Stew Magnuson, Dan Parsons and Yasmin Tadjdeh, Top Five Threats to National Security in the Coming Decade, National Defense India, November 2012

Natural Disasters from Acts of Nature to Acts of Man. There is a consensusamong the scientific community, in this field, that the trend and the damage caused by human intervention cannot be reversed. The perception of natural disasters being an act of God is no more true in entirety. Human interference has altered the law of the nature and the philosophy of disasters an act of nature is losing relevance. Uttarakhand and Srinagar floods had three similarities, unprecedented rains which may have been the outcome of global warming or impact of change of weather, encroachment on flood plains by undertaking construction at massive scale thereby putting lives of citizens at risk and forewarning of impending disaster did exist. Environmentalists and people with common sense were not surprised at these tragedies since it was a foregone conclusion that it could take place, what surprised the people was the time and the impact. There is a need to introspect,whether itis too late to reverse or minimise the impact or we can delay and stop the process of self destruction. Notwithstanding the above, the damage may be irrecoverable, but the loss can be limited by collective efforts and wisdom.

Good Cause Gone Bad by the Misrule of the Few. The very thought of holistic development is a good cause and larger good for humanity, but it has been exploited by the few for selfish interests and greed. Nonation, no institution should have the right to tamper with the law of the nature on land, sea, air and space. The environment is completely mis-ruled and misread, since it cannot respond immediately. Un-sustained industrialisation, infrastructure development, extraction of minerals and pollution of water and air, exploitation of ground water and overall degradation of the environment benefit limited people for a limited time, but has an irreversible and irrecoverable impact on nature and flora and fauna. To reverse the unsolicited behaviour of humans, "**Environmental Magna Carta**" which could alter the norms of environmental governance at the global platform is urgentlyneeded.In India we have paid a heavy penalty for environmental degradation. The nexus between greed of politicians, the misdeeds of bureaucracy and immoral conduct of business houses has caused havoc on the environment. Every day the rule of law and norms of the environment is violated. Pollution of rivers, degradation of forests, construction activities on flood plains and Eco sensitive zones has become a mundane/routine activity and the citizens at large have become insensitive to such violations. There is a need to develop and build intolerance against such activities and neglect.

Disasters Lead to Lossof Culture, Values and History. Three and half thousand years ago a thriving Minoan civilization in Greek was wiped off from the planet by a volcanic eruption which subsequently triggered a Tsunami. It not only destroyed the lives, but also destroyed the culture and history forever. But what is detrimental is that disasters wipe off the physical and cognitive paradigm on

which the societies are built for centuries. Humans are thrown back to primitive mind set where the prime focus is survival and morality has no value under such circumstances. It causes loss of sense of direction, purpose of being humans and human consciousness. It was evident in Uttarakhand disaster and during the Hudhud cyclone. Food lorries were literally looted by the unruly crowd as a result, the cost of food, water and medicines were skyrocketing. Imagine if a large geographical zone is impacted, the uncontrolled chaos at the ground zero and surrounding areas may become unmanageable for security agencies.

Un- controlled Chaos a Second Disaster. Government and people have to deal with two disasters simultaneously. First by pre and post disaster impact and second by the aftershock of lawlessness. Police and law enforcement agencies are the first responder at the disposal of the government to deal with the disaster for re-location of citizens and resources, relief operations and rehabilitation before armed forces and NDRF moves in. At the same time riots for food, water, looting and crime can trigger uncontrolled chaos which in itself becomes another disaster. The fringe elements both internal and external have the potential to cause instability taking advantage of the fragile security environment on the ground. This creates a deep perceptional divide and often shows that the efforts of the government are far from adequate. It was evident in J&K where even the separatists disrupted the relief operations by stone pelting and snatching of the relief boats led by some Hurriat leaders. These actions were primarily to discredit the government efforts and prevention of connect between people and law enforcement agencies. These aspects of disaster relief are a reality and must be paid attention to.

Moral Disaster. The biggest threat post disaster is moral disaster. It is a fallacy to assume that disaster victims will be rational in their approach. The greater casualty before and after a disaster is moral disaster. Though everyone is expected to behave in a civilised manner, but it does not happen. Cultural approach to collective survival in the face of life threaten situation demands discipline of an extreme order, which unfortunately does not come naturally due to poor awareness and lack of faith in fellow victims. Disaster awareness among the citizen and future generation will only come if they are exposed to such training periodically. Apart from this, law enforcement agencies must declare the zone of disaster under the "Essential Services Maintenance Act" (ESMA). It must be understood that disaster aid will never mitigate the cost of the sufferings and loss of material wealth of victims. Therefore, unscrupulous elements cannot be allowed to take advantage of the circumstances.

Defensive Measures and ConsideredResponse

Mitigation and Preparations Against Disaster Hazards. The Chilean earthquake was 500 times stronger than the Haiti earthquake in 2010, but caused

about 0,4% of the deaths that occurred in Haiti because, amongst other reasons, the buildings in Chile were better designed and constructed. The community was prepared and aware of the measures required to be taken. Israel is surrounded by inimical nations and non state actors yet it has never been surprised. People have risen to the challenges at zero notice. The best way to deal with disasters is to prepare the community to react and assume leadership at zero notice without waiting for the government efforts to move in. The government agencies should only act as facilitators rather than the sole agency to work from the scratch. It is said that the golden period during a disaster is the first couple of hours of the disaster, either you control the situation or you suffer the multiple ill effects of disasters. Based on the nature of disasters, it can be categorised as under-

a. **Slow Onset**. Climate change, environmental degradation and desertication are very slow onset events, but can and should be considered as disasters in terms of the damage and disruption to lives that they may or indeed already do create. Developed nations have been able to work out a strategy to deal with such disasters. Similarly a cyclone is not entirely slow onset disaster, but it gives adequate notice for preparation and minimising the casualties. The Hudhud cyclone in spite of intensity and area of landfall, it did not cause human loss to the extent it could have done.

b. **Rapid Impact/ Onset**. Earthquakes, volcanic eruption, tragedies such as Bhopal gas cause irreparable and irrecoverable damages. It strikes at zero warning with no time to prepare. Only better infrastructure, aware population and well defined drills and procedures can assist rapid response.

c. **Complex**. Complex disasters are a combination of natural and man made disasters. Earthquake in Japan led to a tsunami and later caused nuclear disaster. First two acts were purely due to natural hazards, but the subsequent losses were due to man made disasters. Japan had to spend 30 billion dollars to reconstruct and rehabilitate the displaced population. Moreover, nuclear disaster has created an urban wasteland which cannot be recovered. China and India have constructed huge dams in areas which are earthquake prone. The population down stream is at risk and therefore, plan to relocate and evacuation drills must be put in place. The population at large should be aware of the emergency drills. Chances of complex disasters cannot be ruled out and even if it is one out of 100, well it is a significant threat.

Key to Disaster Relief Operations. Worlds 40% natural disasters take place in Asia.[3] It is important to understand the character of disasters to put the system in place and also prepare population to deal with such calamities. There are

3 DWF works on mitigating against and adapting to the impact of both rapid and slow onset hazards and disasters.

few 'natural' disasters which are natural in the real sense, although the hazards that create them - a cyclone or earthquake for example - are natural events. Human presence and his actions alter the nature and extent of a disaster. In most instances, without the presence of humans, there is no disaster.[4] Principles of disaster relief operations are as under:-

a. **Humane Approach.**Empathise with the victims and consider as your own family members.

b. **Neutrality.** Agencies should be neutral there is no caste, creed, no adversary,everyone is human first.

c. **Impartiality.**There are no favourites,everyone must be looked at with same prism. Priority can only be given to sick, wounded, old, children and then the rest.

d. **Independence.**Work without fear, pressure or influence.

e. **Clearly defined concept of operations and priority of actions.** Operations of such magnitude must be initiated by having a clear and concise "concept of operations". From the concept the task and responsibilities will flow. The Concept will define a holistic system approach to entire relief operations starting from rescue to relief camps. None of these operations are in isolation, they are interlinked. Therefore, operations of this magnitude without a defined concept of operation is moving in the darkness without light. Broad aspects of the concept are as under:-

i. Identify criticality.

ii. Allocate resources based on criticality and create reserves to generate options.

ii. Rescue those highly vulnerable, sustain those who can withstand and not vulnerable.

iii. Establishment of staging A and relief camps near simultaneously with multi facilities (medical, communication, food, rest areas and counselling).

iv. De-congest and move people where they can sustain with limited help from government.

v. Modify and alter strategy if criticalities are over or criticality has shifted from one sphere of activity to another.

Disasters Relief Operations a War Against the Nature and Time. Disaster relief operations are "**Rapid Reaction and Rapid ResponseOperations**" which need precision and surgical holistic capabilities. These are typical military operations "**ruthless in speed and humane in approach**". Sustaining life is as important as rescue of people. Duplication of efforts and rescue in bits

4 Ibid.

and pieces increases vulnerabilities and psychological trauma. No matter how well trained civil agencies are but cannot match the precision and speed with which militaries can react and respond to a crisis. They are masters to control the circumstances even if there is an information vacuum under hostile environment. The men and leadership are trained to identify and find solutions to the complex problems. Criticality of disaster relief operations lies in the following:-:-

a. Identification of vulnerabilities and criticalities.
b. Allocation of resourcesand capability to fan out to critical areas.
c. Accountability and responsibility.
d. Optimum utilization of resources to ensure economy of resources.
e. Focused approach and a system of monitoring.
f. Critical analysesof rescue operations and allocation of tailored bricks.
g. Resource diversion in case of vulnerabilities.
h. Continuous communication with the people to keep them updated that there is a far greater crisis elsewhere. Assistance will reach them as and when the crisis is elsewhere is resolved. We have not forgotten you.
j. Fragmented Approach will lead to antognisation of the public than the goodwill. This gives an impression that no one is in control of the circumstances or situation.
k. Management of public perception is most important. Reassure public, restore faith, highlight credible actions, let the public know what is being done for them on the ground. People need to be told they are not being left alone to suffer. Use social media, leaflets, radio and TV. Briefing by lead agencies from single platform daily is important.
l. It is not too late even to alter the strategy and adopt a system approach. What needs to be done is let people not invent the wheel, but to reshape and restructure the entire strategy and methodology of disaster relief operations with the leadership with hands on experience.

Risk Preparedness and Introspection

Disaster Response Audit andPost Disaster Analysis. More lives have been lost during disasters than conventional wars: Should this be treated as one of the biggest adversary a nation is facing in modern times? Post disaster analysis determines the prevention and mitigation of disasters. It rectifies and sets a stage for the avoidance and forecasting of an impending disaster. It is naive to suggest that Srinagar floods and Uttarakhand disasters were a tragedy caused by nature. Indeed a common man with no geological knowledge could forecast that the state is playing with the fire. Disregard to the laws of the nature had

it written all over that sooner or later disaster will cause havoc. The only thing which was not determined was the time and place. History cannot be ignored and there is need to go back to history to dig out the furry of nature which has caused irrecoverable loss to the mankind and the wealth of the nature.It is also important to ask questions, post disaster, why the collateral damage could not be minimised and who are responsible for the lapses if any. It cannot be allowed to go un-noticed. The authorities responsible for calamity or failure to deliver must be made to answer. At the same time it is important to fix accountability of the NDMA. Disaster mitigation audit is imperative and it is essential for NDMA to issue a notice in public and national interest to caution and prevent acts of gross violation against public safety, especially if the red lines are crossed which can put public safety and infrastructure at risk. Similarly, evaluation of accountability, responsibility and dereliction of duties leading to disaster needs to be examined by an independent agency. UN Report on Disaster Preparedness for Effective Response has laid down following significant principles for preparation and prevention of disasters.

a. Making the disaster risk reduction a priority.
b. Improving risk information and early warning.
c. Building a culture of safety and resilience.
d. Reducing the risks in key sectors.
e. Strengthening preparedness for response.

Disaster Intelligence. The role of intelligence agencies to forewarnthe impending threat from nature and violation by government or private agencies should form part of the charter. This is an important security threat to a nation and should be part of charter of duties. Analysis, and impact of violation of environmental laws or after effects of unsustainable development in near and distant future is must. Braod intelligence analysis, which should form part of the intelligence agencies are as under:-

a. Acts of government agencies or private citizens which could trigger disasters (man-made or natural).
b. Impact of disaster on security of citizens and infrastructure.
c. Forewarning government agencies about law and order problems which may occur post disaster and resources required to deal with it.
d. Intelligence updates about the extent of damage and real picture.
e. Flow of information during and post disasters.
f. Updates on the progress of relief operations and identification of critical areas.
g. Information about fringe elements causing disruption of relief operations.

Integrated and Inclusive Approach. An integrated and inclusiveis warranted to plan, prepare and prevent disaster, which at the moment appears fragmented and is in desperate need of direction. The population becomes more desperate and edgy as the news of deaths and destruction start trickling. Disaster riots get triggered primarily when there is information vacuum or disruption in relief operations due to either lack of coordination or by any other reasons.

It is Time to Take Disasters Seriously. There is a global consensus about the measures required to be taken to mitigate and prevent disasters. Often it is considered incapability of a nation to prevent, mitigate and minimise collateral damages. It is part of the capability building process of a nation. Time has gone when a nation could plead innocence and accept losses as a fate. It is a crime to allow citizen to lose lives or lose infrastructure. Time for sympathy has gone,it is now a question of national pride, accountability and reputation. These are non-traditional threats to a nation and can no more be brushed aside. National awareness programme and response actions by the victims and population in sympathetic zone needs to be carried out in a structuredmanner. India has a plethora of holidays and at least few of these holidays could be converted as the "**Disaster Awareness or National Security**" days where people at large are trained to undertake disaster relief and disaster mitigation drills.

Regional Solidarity for Collective Containment

Regional Contingency Response Capability. The subcontinent is vulnerable to disaster more than any other region in the world. Density of population in South Asia, (India, Bangladesh, Pakistan, Maldives and Srilanka) is close to 1800 people per square kilometre, which is highest in the world. Disaster of huge magnitude will put India under enormous strain, because there is a danger of the flux of refugees or displaced population. Therefore, India must take lead to build capabilities to be a net security provider against such threats. It would need logistic planning, relief operations, containment of population in the geographical boundaries of these nations and border security to prevent mass relocation of population. India did face mass exodus from Bangladesh and Srilanka in the past and it cannot be prevented in future until or unless there are systems and capabilities in place. Even India may have to pitch in to rehabilitate and rebuild the ravaged areas to ensure that displaced population goes back to their original place of living. It is indeed a tall order, but there is no option other than to put a system in place to deal with such catastrophe. It is an obligation and compulsion worth accepting.

Regional Disaster Response Centre. India must take lead in establishing a regional disaster response centre, which should undertake training and act as a coordination agency during disasters in the subcontinent. Rapid response

to a regional crisis can even save and strengthen the diplomatic relationship. Cooperation on humanitarian assistance and disaster relief is one of the easiest ways to build trust and goodwill between two nations.[5] In fact disaster relief and humanitarian aid is a tool to establish goodwill even with a hostile nation or population. Such acts of humanitarian aid turn into historic missions, which, alters the mindset of the people for ever.

Conclusion

India is at the cusp of breaking into the regional power status. No nation can afford to lose precious lives and heritage to mindless violence of nature and humans. Natural disasters and extreme environmental events are expected to increase in number and severity on a global scale, elevating levels of economic, social, and political stress that could provoke both civil and international conflicts.[6]Disasters cause extreme hardship to the survival and have deep and far reaching impact on people and societies. Civilisations have been lost, precious land has been lost to an extent of no recovery. The bigger danger is that large natural disasters could also degrade key dimensions of the global economy—food, water, energy, medicine, supply chains, livelihoods—arousing widespread popular anxieties.[7] India has to build the capability to be a net security provider in this filed in the subcontinent because the impact of disaster in Bangladesh, Bhutan, Nepal and Pakistan will certainly impact India socially economically and demographically.

Note:- The Views expressed in this article are those of the author in his personal capacity and do not carry any official endorsement.

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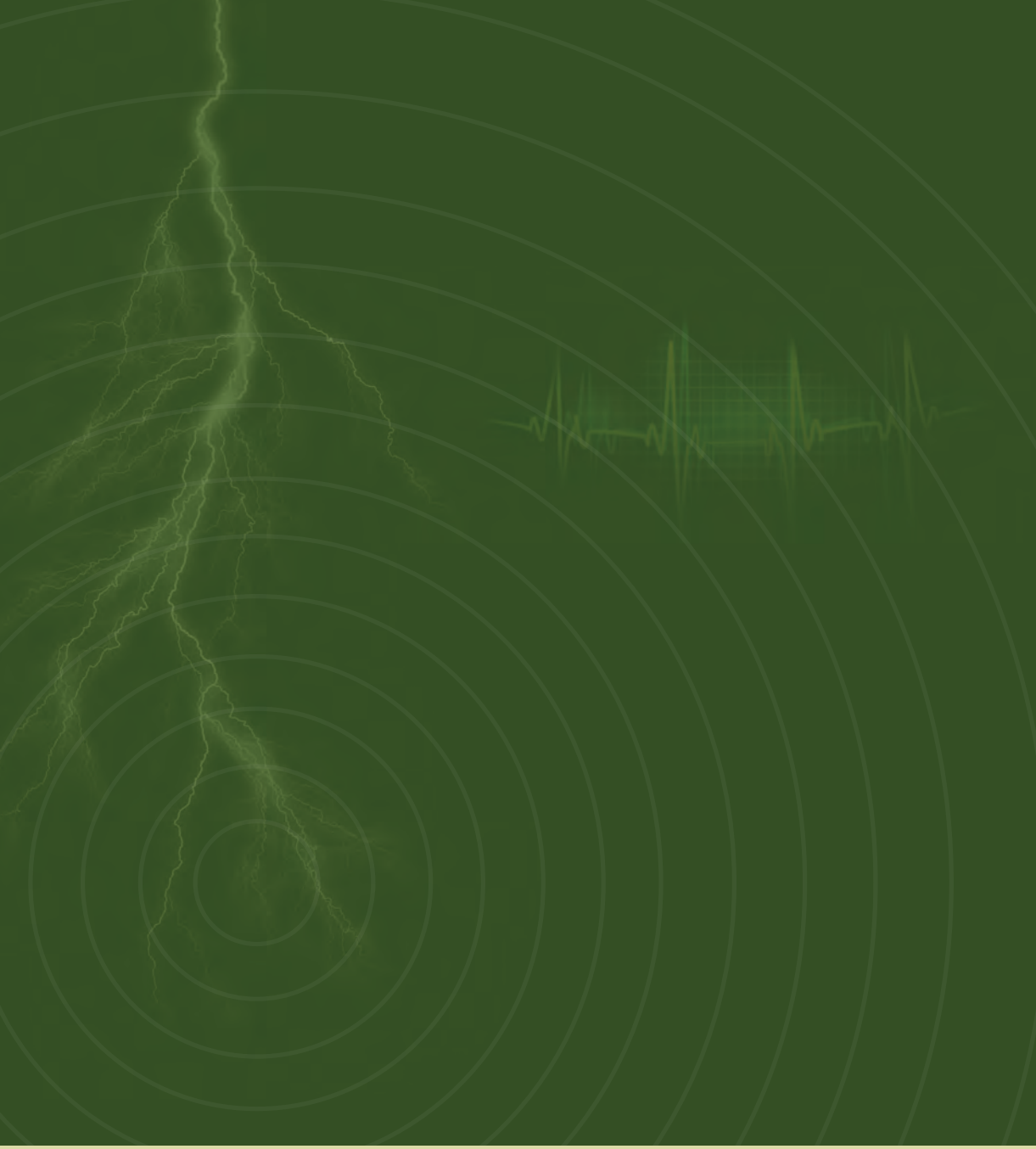

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