A Dissertation Report on Role of Information Communication and Technology in Disaster management of Uttrakhand

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CERTIFICATE

This is to certify that Mr.Abhishek Chandra, Roll No.500016264/R750211001 student of MBA ISM 2011-13 has done his dissertation on the topic "Role of ICT in Disaster Management of Uttrakhand" for the partial fulfillment of the award of the degree of post graduation under my guidance.

This Report is the result of his own work and to the best of my knowledge no part of it has earlier comprised of any other report, monograph, dissertation or book. This project was carried out under my overall supervision.

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EXECUTIVE SUMMARY

The world has been prone to more and more disasters recently. In the Indian context, earthquakes in gujrat and Kashmir, floods in Gujrat, Cloud Burst in Uttrakhand, Bihar and Andhra Pradesh and cyclones in the south eastern region of India have caught the attention of government agencies and NGOs. The public at large recognize today that more efforts need to be directed towards disaster management. Although a lot of attention has been given to aspects of disasters like advocacy and community awareness, use of Information and Communication Technologies (ICT) in various phases of disaster management has received little focus.

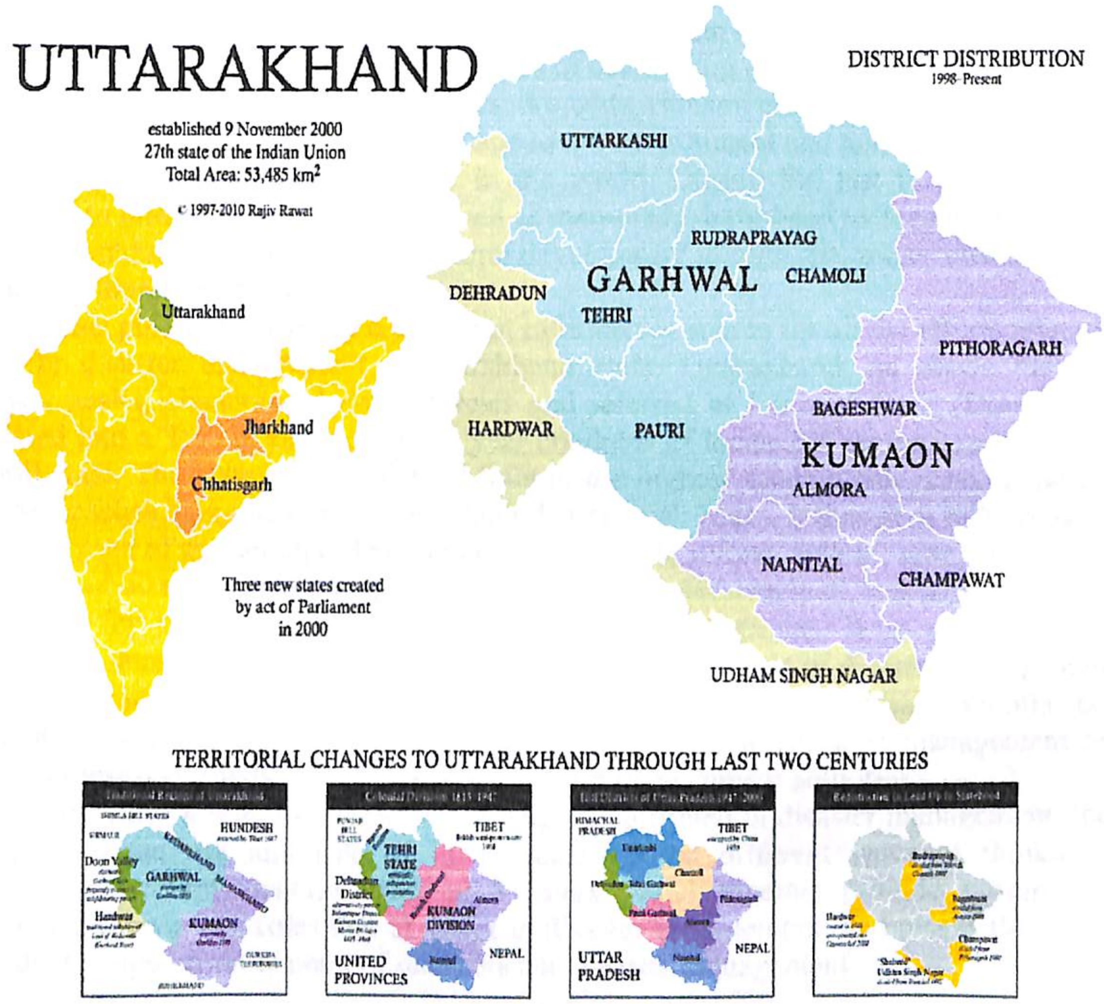
The aim of this project is to set up a one point information source for all the efforts related to use of ICT for disaster management in Uttrakhand state. The project looks at definitions, terminologies, and types of potential hazards (including natural and non-natural disasters); understanding disasters, their causes and implications; and the contents of an effective disaster management plan. Uttarakhand, an abode blessed with Himalayan peaks, glaciers and dense forests and referred as Land of Gods (Devbhoomi) has transformed into a 'land of disaster'. Each year hundreds of locals fall victim to natural disasters in the hill state.

The state of Uttarakhand falls in the highest seismic risk zone of the country, with upper reaches being in zone V (very high damage risk zone). It therefore falls in the highest seismic risk zone of the country. Uttarakhand is a mountainous state and witnesses widespread natural disasters and calamities every year, mainly during the rainy season on account of landslides, cloudburst, falling of rocks and flooding of rivers and water sources. The project specifically signifies the need of Information Technology in disaster mitigation plan. It may be observed that advancement of information technology can help a great deal in planning and implementation of hazards reduction measures. In this project an attempt has been made to highlight the role of information communication and technology in management of natural disasters. Disasters strike countries causing tremendous destruction creating number of human problems and producing negative impacts on national economy. It can be minimized with the help of ICT.

CHAPTER 1:UTTRAKHAND STATE PROFILE

Uttarakhand which came into existence on 9th November 2000 is the 27th Indian state and the 10th in Himalayan region. It lies between 280 43□ and 310 27□N Latitude and 770 34□ and 810 02□E Longitude. The total geographical area of the state is 53,483 sq. Km., of which approximately 89% is mountainous. Of the total geographical area, about 19% is under permanent snow cover, glaciers and steep slopes. The total population of the state is 8.48 million (Census 2001) of which over 5 million people live in the mountainous parts of the state. Below Poverty Line population in hills is 44% and in the plains is 19%, thus, making the State average BPL population 36.5%. Uttarakhand is a part of the North-Western Himalayas bounded by Nepal in the East and Himachal Pradesh in the West. The Northern boundary goes upto Tibet/China whereas southern boundary extends into Indo-Gangetic Plains. The major North Indian Rivers the Ganga and the Yamuna, originate from this region.

Uttarakhand state covers **over 53000 sq.km**. of geographical area, it is split into
13 districts within two revenue divisions.
1. Garhwal Revenue Division includes following **7 districts**
i.Dehradun
ii. Tehri
iii. Pauri Garhwal
iv. Uttarkashi
v. Chamoli
vi. Rudra Prayag
vii. Haridwar
2. Kumaon Revenue Division includes **6 districts**
i. Nainital
ii. Almora
iii. Pithoragarh
iv. Champawat
v. Bageshwar
vi. Udham Singh Nagar
These thirteen districts include 49 Tehsil, 95 Development Blocks and 16,826 revenue villages within their administrative boundaries. Almost 65% (34,662 sq.km.) of the total geographical area of the state (53,662 sq.km.) is under forests with 12 Protected Areas covering an area of 6,479 sq.km


UTTARAKHAND
established 9 November 2000
27th state of the Indian Union
Total Area: 53,485 km²
© 1997-2010 Rajiv Rawat
Uttarakhand
Jharkhand
Chhatisgarh
Three new states created
by act of Parliament
in 2000
DISTRICT DISTRIBUTION
1998- Present
UTTARKASHI
RUDRAPRAYAG
GARHWAL
CHAMOLI
DEHRADUN
TEHRI
PITHORAGARH
BAGESHWAR
HARDWAR
PAURI
KUMAON
ALMORA
NAINITAL
CHAMPAWAT
UDHAM SINGH NAGAR
TERRITORIAL CHANGES TO UTTARAKHAND THROUGH LAST TWO CENTURIES
HUNDESH
Doon Valley
GARHWAL
Hardwar
KUMAON
TIBET
TEHRI
STATE
Dehradun
District
KUMAON
DIVISION
NEPAL
UNITED
PROVINCES
TIBET
NEPAL
UTTAR
PRADESH

CHAPTER 2: INTRODUCTION

Due to unique geo-climatic conditions prevailing in the Indian land mass and its geophysical nature, India has been witnessing different types of devastating natural disasters like floods, cyclones, earthquakes, landslides, droughts, tsunami etc at regular intervals, causing huge loss of life, property and damage to the environment and hence, considered as one of the most disaster prone country in the world. During the last four to five decades, vulnerability to disasters, both natural as well as man-made, have been increasing due to rising population, haphazard urbanization, structural development in high risk zones, environmental degradation, climate change etc.

The aim of this project is to set up a one point information source for all the efforts related to use of ICT for disaster management in Uttrakhand state. Uttarakhand, an abode blessed with Himalayan peaks, glaciers and dense forests and referred as Land of Gods (Devbhoomi) has transformed into a 'land of disaster'. Each year hundreds of locals fall victim to natural disasters in the hill state. The state of Uttarakhand falls in the highest seismic risk zone of the country, with upper reaches being in zone V (very high damage risk zone). It therefore falls in the highest seismic risk zone of the country. This report is intended to inform federal, state, and local policy makers and public safety and emergency management professionals of uttarakhand about future opportunities for the application of IT to disaster management. It is not intended as a comprehensive look at the complex, highly multidisciplinary topic of disaster management. Nor do the committee's findings and recommendations explicitly address tradeoffs between investments in information technology and other capabilities for disaster management or offer advice about levels of funding for IT or other disaster management activities.

This report provides a brief overview of challenges confronted in disaster management, focusing particularly on the use and role of IT presents several different ways of thinking about information and communication needs in disasters, which together provide a framework for understanding the various roles that IT plays in disaster management; and places the issue of IT use into the broader social context of disasters and disaster management.

Since its earliest days, communication has played an important role in Disaster Management (DM), in providing information to all the stakeholders, particularly in rescue and emergency relief operations to the disaster affected victims. Advances in Information and Communication Technology (ICT) have madeit possible to not only forecast some of the disasters but also to have made available means, for quick and effective rescue and relief operation, thereby minimizing the deadly impacts of some of the worst disasters. For instance, compared to more than 10,000 killed during the cyclone that hit Andhra Pradesh in 1979, improved communication techniques limited the loss to less than 1000 during the May 1990 cyclone of similar intensity in the same state.

About Disaster Management

The term "disaster management " encompasses the complete realm of disaster-related activities. Traditionally people tend to think of disaster management only in terms of the post-disaster actions taken by relief and reconstruction officials; yet disaster management covers a much broader scope, and many modern disaster activities than in post disaster response.

Definition: "Disaster management" can be defined as the range of activities designed to main tain control over disaster and emergency situations and to provide a framework for helping at risk persons to avoid or recover from the impact of the disaster. Disaster management deals with situations that occur prior to, during, and after the disaster.

Disaster management is an enormous task. They are not confined to any particular location, neither do they disappear as quickly as they appear. Therefore, it is imperative that there is proper management to optimize efficiency of planning and response. Due to limited resources, collaborative efforts at the governmental, private and community levels are necessary. This level of collaboration requires a coordinated and organized effort to mitigate against, prepare for, respond to, and recover from emergencies and their effects in the shortest possible time.

Disaster management involves all levels of government. All government, nongovernmental and community-based organizations play a vital role in the process.

Modern disaster management goes beyond post-disaster assistance. It now includes predisaster planning and preparedness activities, organizational planning, training, information management and public relations.

The **objectives** of disaster management are :

- To reduce or avoid the human,physical, and economic losses suffered by individuals, by the society, and by the country or state at large;
- To reduce personal suffering;
- To speed recovery

When assisting refugees or displaced persons, a fourth objective is to provide protection to victims or persons whose lives or property are threatened by armed conflict, tribal animosity,religious precautions etc.

Natural Disasters cannot be prevented at the present level of Science & Technology (S&T) and community may have to live with certain level of risk – the level of risk depending on the level of S&T available for induction in Disaster Management(DM) and the resources made available by the Uttarakhand government for its actual induction, for holistic management of disaster in a proactive way. Holistic management of disaster calls for assigning priority in the prevention, mitigation & preparedness activities in the pre-disaster scenario of the DM continuum, while strengthening the efforts for faster and more efficient response through properly trained personnel equipped with advanced equipment/ instruments and building better recovery during rehabilitation and reconstruction period.

Disaster Management Cycle

Disaster management is a cyclical process; the end of one phase is the beginning of another (see diagram below), although one phase of the cycle does not necessarily have to be completed in order for the next to take place. Often several phases are taking place concurrently. Timely decision making during each phase results in greater preparedness, better warnings, reduced vulnerability and/or the prevention of future disasters. The complete disaster management cycle includes the shaping of public policies and plans that either addresses the causes of disasters or mitigates their effects on people, property, and infrastructure. The mitigation and preparedness phases occur asimprovements are made in anticipation of an event. By embracing development, a community's ability to mitigate against and prepare for a disaster is improved. As the event unfolds, disaster managers become involved in the immediate response and long-term recovery phases.

The diagram below shows the Disaster Management Cycle.

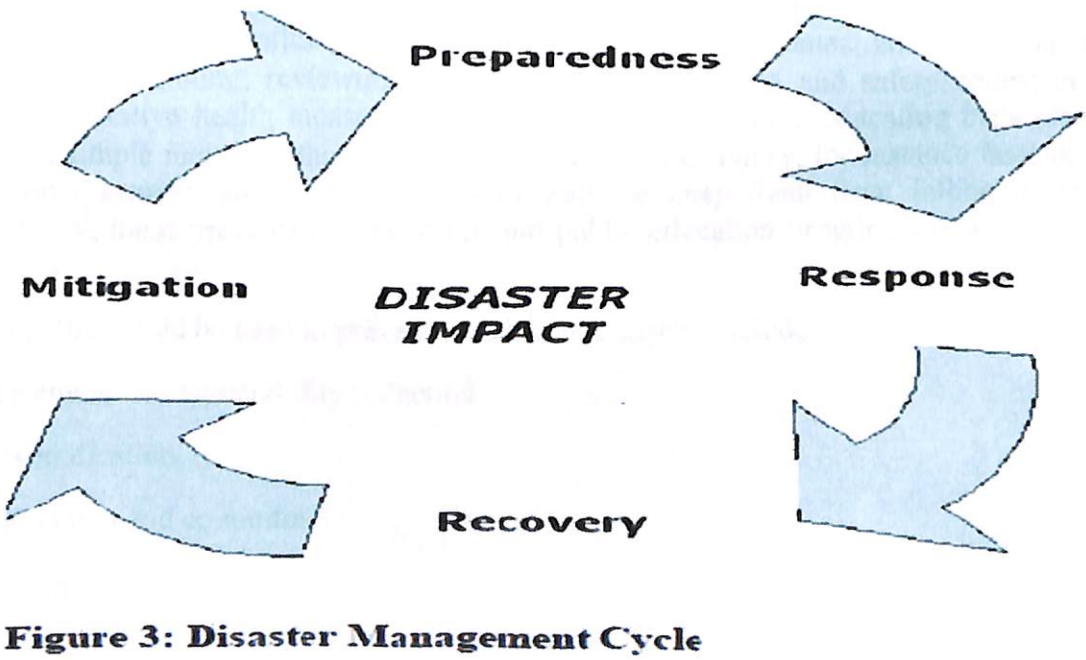


Figure 3: Disaster Management Cycle

Mitigation: Measures put in place to minimize the results from a disaster. Examples: building codes and zoning; vulnerability analyses; public education.

Preparedness: Planning how to respond. Examples: preparedness plans; emergency exercises/training; warning systems.

Response: Initial actions taken as the event takes place. It involves efforts to minimize the hazards created by a disaster. Examples: evacuation; search and rescue; emergency relief.

Recovery: Returning the community to normal. Ideally, the affected area should be put in a condition equal to or better than it was before the disaster took place. Examples: temporary housing; grants; medical care.

DisasterMitigation:

Mitigation refers to all actions taken before a disaster to reduce its impacts, including preparedness and long-term risk reduction measures. Mitigation activities fall broadly into two categories:

1 Structural mitigation – construction projects which reduce economic and social impacts

2 Non-structural activities – policies and practices which raise awareness of hazards or encourage developments to reduce the impact of disasters.

Mitigation includes reviewing building codes; vulnerability analysis updates; zoning and land-use management and planning; reviewing of building use regulations and safety codes; and implementing preventative health measures. Mitigation can also involve educating businesses and the public on simple measures they can take to reduce loss or injury, for instance fastening bookshelves, water heaters, and filing cabinets to walls to keep them from falling during earthquakes. Ideally, these preventative measures and public education programmes will occur before the disaster.

Four sets of tools that could be used to prevent or mitigate disasters include:

a Hazard management and vulnerability reduction

b Economic diversification

c Political intervention and commitment

d Public awareness

Disaster Preparedness:

Disaster preparedness is defined as a continuous and integrated process involving a wide range of activities and resources from multi-sectoral sources. (Disaster Preparedness Training Programme; International Federation of Red Cross and Red Crescent Societies, IFRCRCS, 2005). In order that disaster preparedness is undertaken with rewarding outcomes, those involved in the process must approach it from a mitigative, response, recovery and business continuity perspective. That is, when considering disaster preparedness the phases of emergency management must be looked at carefully. Disaster mitigation policies and measures will not stop a disaster especially a natural one from occurring and persisting. What mitigation policies and measures seek to do is reduce vulnerability to, or increase resilience to, the effects of the inevitable disasters to which a country is prone.

Basically disaster mitigation and preparedness go hand in hand. Disaster preparedness for example includes implementation of mitigation measures to ensure that existing infrastructure can withstand the forces of disasters or that people can respond in their communities and at the same time protect themselves. The collective capabilities of the country, people, and the government to deal with extreme hazards or adversities when they occur are measures of their cumulative preparedness. In local circumstances and because of historical proneness to disasters, mitigation is important, but preparedness is doubly important.

Disaster preparedness involves the preparation of people and essential service providers in their communities for the actions that they will take in case of disasters. If this is the case, consideration must be given to the manner in which the formal responders (Police and Fire Services, Emergency Medical Services personnel and the Military) prepare to respond to disasters.

Disaster Risk Reduction (DRR):

Disaster Risk Reduction (DRR) forms the pillar of disaster preparedness, that is, it forms the action plan to be implemented before, during and after disasters.

Examples of DRR measures that state or country can adopt into their planning and policy are listed below:

- Proper planning to mitigate flooding in flood prone areas and alternate infrastructure for the provision of food and potable water.
- Provision of raised flood shelters as those constructed in Bangladesh.
- The improvement of water supply systems in rural areas to provide sufficient potable water supply during floods or droughts.

The Emergency Operation Plan (EOP):

At the national level, an Emergency Operation Plan (EOP) needs to be established to set out the scope of activities required for community preparedness and response. It must declare what the community can
realistically do. The EOP allows the community to respond to threats and engages responders in the short-term recovery and must be flexible to be valuable in real and potential emergencies.

Structure of the EOP

The EOP is specific in its layout as follows:

i Statement of Purpose – This is what the Plan seeks to achieve for citizens.

ii Situation and assumptions – Statements of the emergency events, actual and potential, and describe the warning methods and any situations that may be peculiar/unusual to the community.

iii Organization and assignment of responsibilities – Dealing specifically with how the jurisdiction will assign the emergency functions to carry out the Plan by roles of local officials in the emergency management structure.

iv Concept of operations – This section describes the roles and relationships of government agencies, the private sector and how they interact with each other.

v Administration and logistics – The management of resources, general support requirements, and availability of services and support for all phases of emergency management and the policies set up to make these activities occur.

vi Plan development and maintenance – This involve activities to keep the plan current and reflect changes that result from actual experiences in emergency management, changing emergency situations and assumptions, and modifications in the community's profile.

vii Authorities and references – These authorities and references apply to those statutes, executive orders, regulations, and formal agreements that pertain to any type of emergency.

viii Definition of terms – This provides for a common understanding of the terms that will use in communication, directing and control in disasters.

Diaster Response:

The aim of emergency response is to provide immediate assistance to maintain life, improve health, and to support the morale of the affected population. Such assistance may range from providing specific but limited aid, such as assisting refugees with transportation, temporary shelter, and food, to establishing semi-permanent settlement in camps and other locations.
The overall aim of disaster response are:
To ensure the survival of the maximum possible number of victims, keeping them in the best possible health in the circumstances.

Disaster Response Activities:

The following are typical activities of emergency response:

1 Warning

Warning refers to information concerning the nature of the danger and imminent disaster threats. Warnings must be rapidly disseminated to government officials, institutions and the population at large in the areas at immediate risk so that appropriate actions may be taken, namely, either to evacuate or secure property and prevent further damage. The warning could be disseminated via radio, television, the written press, telephone system and cell phone.

2 Evacuation and migration

Evacuation involves the relocation of a population from zones at risk of an imminent disaster to a safer location. The primary concern is the protection of life of the community and immediate treatment of those who may be injured.

3 Search and rescue (SAR)

Search and rescue (SAR) is the process of identifying the location of disaster victims that may be trapped or isolated and bringing them to safety and medical attention. In the aftermath of tropical storms and

floods, SAR usually includes locating stranded flood victims, who may be threatened by rising water, and either bringing them to safety or providing them with food and first aid until they can be evacuated or returned to their homes. In the aftermath of earthquakes, SAR normally focuses on locating people who are trapped and/ or injured in collapsed buildings.

4 Post-disaster assessment

The primary objective of assessment is to provide a clear, concise picture of the post-disaster situation, to identify relief needs and to develop strategies for recovery. It determines options for humanitarian assistance, how best to utilize existing resources, or to develop requests for further assistance.

5 Response and relief

When a disaster has occurred response and relief have to take place immediately; there can be no delays. It is therefore important to have contingency plans in place.

Relief is the provision on a humanitarian basis of material aid and emergency medical care necessary to save and preserve human lives. It also enables families to meet their basic needs for medical and health care, shelter, clothing, water, and food (including the means to prepare food). Relief supplies or services are typically provided, free of charge, in the days and weeks immediately following a sudden disaster. In the case of deteriorating slow-onset emergency situations and population displacements (refugees, internally and externally displaced people), emergency relief may be needed for extended periods.

6 Logistics and supply

The delivery of emergency relief will require logistical facilities and capacity. A well-organized supply service is crucial for handling the procurement or receipt, storage, and dispatch of relief supplies for distribution to disaster victims.

7 Communication and information management
All of the above activities are dependent on communication. There are two aspects to communications in disasters. One is the equipment that is essential for information flow, such as radios, telephones and their
supporting systems of repeaters, satellites, and transmission lines.

Modern methods of disaster response:

New technologies can be very useful and powerful tool in disaster response, namely:

1 Cell phones: cell phones as warning devices can be very useful. Short messages can be sent to recipients warning of imminent threat of tropical storms, wind storms or any severe weather likely to cause damage.

2 Spatial information – use of satellite imagery. The emergency management community is keenly aware of the potential of mapping technologies such as geographic information systems (GIS), remote sensing (satellite imagery), and global positioning systems (GPS) in support of emergency response operations.

3 Social media and social networking – social media and social networking can be used as a tool to emergency response communications. Text messaging such as Twitter and the social networking system such as Face book can be used as a channel of communication in disaster response.

Rehabilitation
Rehabilitation is the exercise taken up after disaster response phase achieves its purpose. There is no distinct demarcation regarding end of response phase and beginning of rehabilitation phase. A rehabilitation project is usually a very long and slow process of taking the affected population back to
their old way of life. The activities below are typically taken up as a part of rehabilitation project:
1. Construction/repair of shelter
2. Initiation of various economic activities to create job opportunities
3. Construction/repair of infrastructure, public transport, etc
4. Disaster preparedness activities to reduce impact in case of a future disaster

Reconstruction
Reconstruction is the permanent construction or replacement of severely damaged physical structures, the full restoration of all services and local infrastructure, and the revitalization of the economy (including
agriculture). Reconstruction must be fully integrated into ongoing longterm development plans, taking account of future disaster risks. It must also consider the possibilities of reducing those risks by the incorporation of appropriate mitigation measures. Damaged structures and services may not necessarily be restored in their previous form or locations. It may include the replacement of any temporary arrangements established as apart of the emergency response or rehabilitation.

The information collected during the disaster assessment exercise helps a humanitarian assistance agency to decide whether it would intervene.
If the agency decides to intervene then an analysis exercise is taken up to identify root problem domains in the affected region. Such an analysis helps identify deficiency in which aspects among food, shelter, water, sanitation, public health, etc pose the highest risk to life in the affected region. This is followed by planning and implementation of the intervention.

Disaster Recovery
As the emergency is brought under control, the affected population is capable of undertaking a growing number of activities aimed at restoring their lives and the infrastructure that supports them. There is no distinct point at which immediate relief changes into recovery and then into longterm sustainable development. There will be many opportunities during the recovery period to enhance prevention and increase preparedness, thus reducing vulnerability. Ideally, there should be a smooth transition from recovery to on-going development.
Recovery activities continue until all systems return to normal or better. Recovery measures, both short and long term, include returning vital life support systems to minimum operating standards; temporary housing; public information; health and safety education; reconstruction; counselling programmes; and economic impact studies. Information resources and services include data collection related to rebuilding, and documentation of lessons learned. Additionally, there may be a need to provide food and shelter for those displaced by the disaster.

The Recovery Plan
The recovery process should be understood clearly and it is important to have a general plan for recovery which should be appended to emergency operation plans.
The primary purpose of the plan is to spell out the major steps for managing successful recovery. For each step you will also designate key partners and their roles and steps to mobilize them. The plan should have
at least the following seven steps:
1 Gathering basic information
2 Organizing recovery
3 Mobilizing resources for recovery
4 Administering recovery
5 Regulating recovery
6 Coordinating recovery activities
7 Evaluating recovery

CHAPTER 3:PROBLEM IDENTIFICATION & OBJECTIVE

Problem in the existing system:

A recent disaster during August 2012 in Uttarakashi district of Uttarakhand where hundreds of houses were washed away and thousands of families were affected due to flash flood in river Ganges, the surveying reports say that 'despite repeated incidents, the pace of finding long term solutions by the disaster mitigation and management department seems to be very slow. No mechanism for early warnings has been developed in the state..! "Disaster management is lip service in this state" said one of the head of CSO based in the capital Dehradun. The research intended to find that 'while the situation exposes the lack of a proper disaster management system, it is also a pointer to environmental challenges.'

During research I have seen abysmal disaster preparedness measures given that we have national disaster management authority at national level, a disaster mitigation and management center at Dehradun and similar cell at district level in Rudraprayag!

There are no early warning systems in place nor the small townships and low lying areas get any information on swelling rivers in up-stream sides.

Proposed solution

The aim of this project is to set up a one point information source for all the efforts related to use of ICT for disaster management in Uttrakhand state. The research intended to propose a solution that ICT has the potential to play major role in making the disaster management related processes more efficient and more effective.

It may be observed that advancement of information technology can help a great deal in planning and implementation of hazards reduction measures. In this project an attempt has been made to highlight the role of information communication and technology in management of natural disasters.

This project is an effort towards popularizing use of ICT in disaster management activities.

Objective

- To study the various region of uttrakhand in reference to different disasters.
- To study Rudryaprayag,Uttarkashi,Pithoragarh as a difficult and challenging region.
- To calculate the exposure, resistance, resilience, vulnerability, risk, management status of the region.
- To create the awareness about the role of Information Communication & technology in disaster managememt & mitigation activities

CHAPTER4:RESEARCH METHODOLOGY

Methodology:

- Collection of primary data by using PRA tools and conducting interviews for ground reality.
- Secondary data collected from different books, institutes & organizations websites, articles etc, for analyzing, explaining, and combining the information from the primary source with auxiliary information.
- Interpret data analysis and document information.
- GPS, Ilwis 3.7, and Statistica 8 were also used for geo referencing, mapping and clustering and other purposes.

UTTARAKHAND AND DISASTERS

Uttarakhand is located in the northern part of India, extending from 28° 43' N to 31° 27' N latitude and 77° 34' east to 81° 02' E longitude, is the 27th state of the Republic of India and was carved out of Uttar Pradesh on 9th Nov 2000. The state is bordering, Nepal in the East, Himachal Pradesh in the west, China in the North, Uttar Pradesh in the South.

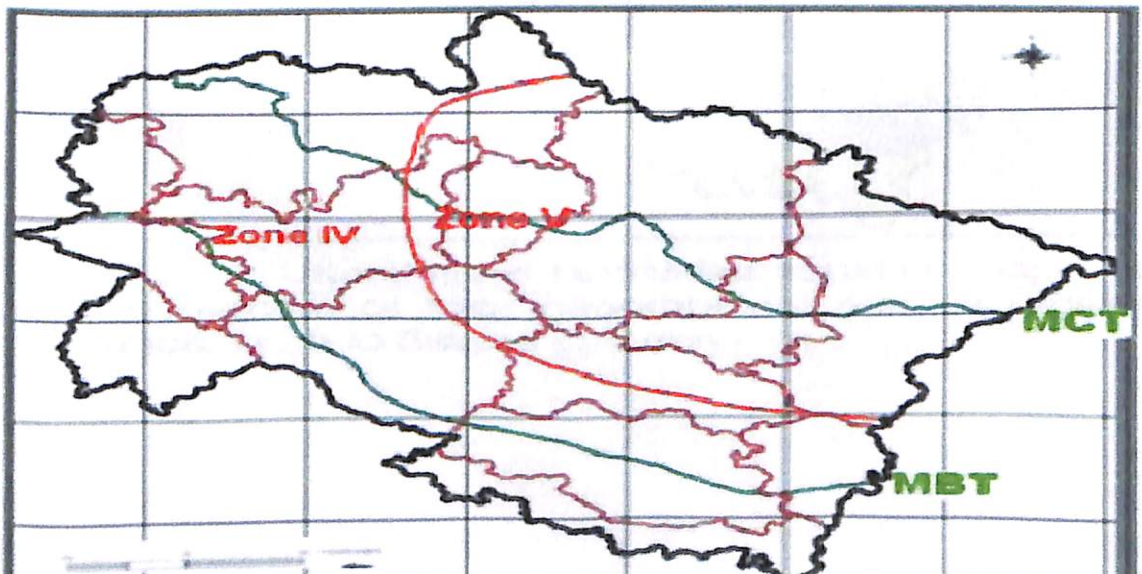


Fig 1 : Uttarakhand map with MCT, MBT and seismic zones V (Very High Damage Risk Zone) and IV(High Damage Risk Zone).

Almost every year Uttarakhand experiences various disasters e.g. earthquake, landslides, forest fire, cloud burst etc.

a)Landslides

Landslide disaster in the state of Uttarakhand in India has a very long and old history. Landslide and mass movements are recurring phenomena in Himalayan region. The consequences in recent times have become more severe in terms of casualties and extensive damage to the roads, buildings, forests, plantation, and agriculture fields. Some of the infamous major landslides of the region are _The Karmi landslide‘, Landslides in Alaknanda Valley‘, _Berinag Landslide‘. Malpa Landslide‘, _Ukhimath Landslide‘ and Varunavat Landslide‘.

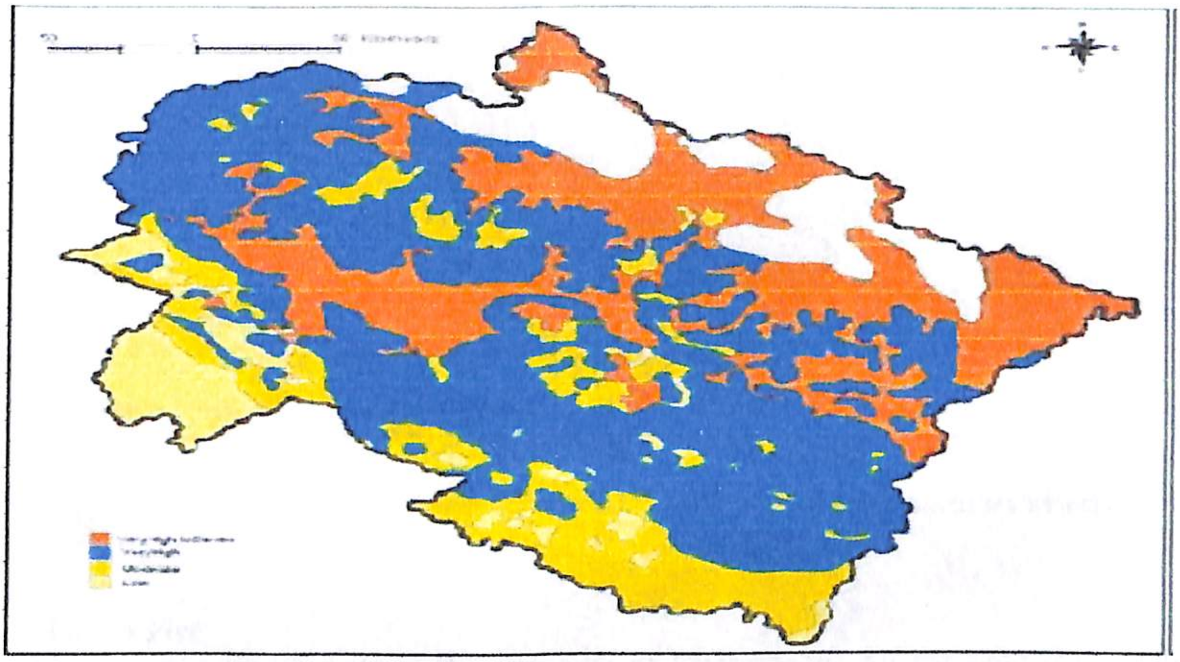


Fig 2 : **Uttarakhand landslides zonation map (About 70 percent of total geographical area is registered under High to Severe category)**

b)Earthquake

This is evident from geotectonic activities exhibited by almost the entire Himalayan province, but more conspicuously by the belts of intracrustal boundary thrusts and tear faults. Recurrent seismicity in the faulted areas indicates tectonic restlessness of the Himalaya. The north-eastern part of the U.P. Himalaya (Dharchula-Kapkot belt) and adjoining north-western Nepal (Bajang) are frequently rocked by earthquakes of minor to moderate magnitudes.

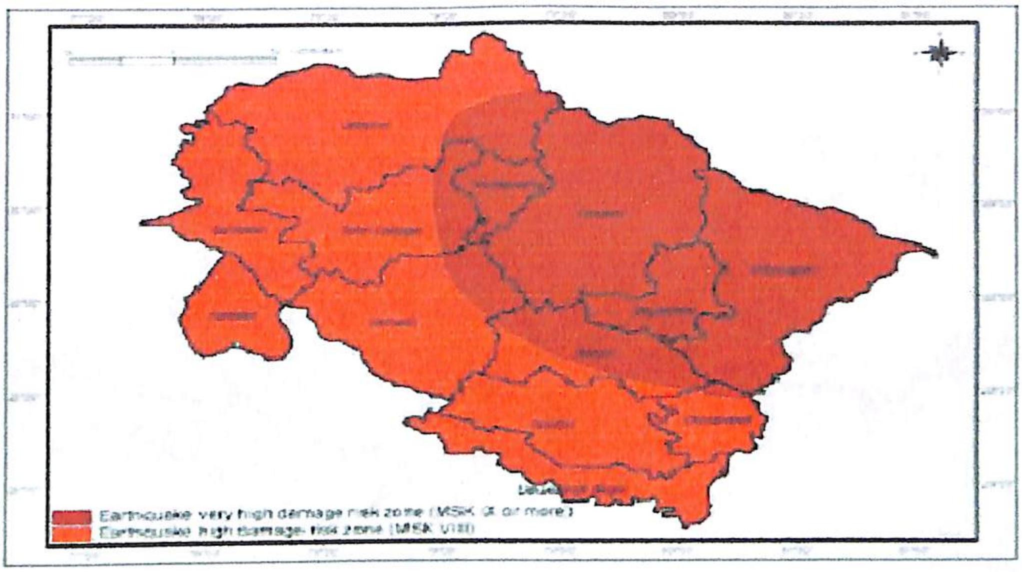


Fig 3 : **Uttarakhand seismic damage risk zonation map**

c) Forest Fire

Forest plays a pivotal role in the economy of Uttarakhand. All the hilly districts of Uttarakhand have more than 60 percent of the area under forest. However, forest fire, natural or manmade, has always remained a cause of concern for the people as well as for the government. Every year, in summers, the state is losing precious forest due to fire.

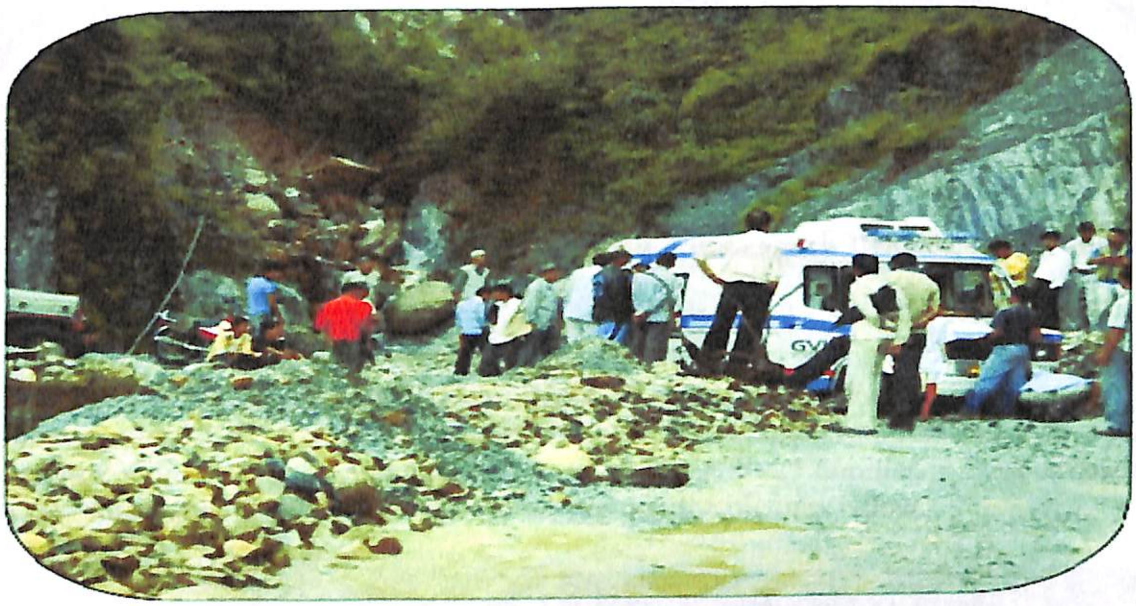
d) Other Disasters

Besides these other disasters of Uttarakhand are flash Flood, cloud burst, drought, avalanches, Hailstorms etc.

Most disaster prone areas of Uttrakhand

Being a hill state, Uttarakhand is more sensitive to and probably more affected by climate change. It is also highly vulnerable to natural disasters, especially the hydro-meteorological ones, apart from earthquakes. Along with the increase in the global temperatures, changes in the climate at the local level in Uttarakhand could also be observed. Some of the major disaster prone areas are:

Bageshwar:
District bageshwar comes under main central thrust zone (MCT zone) of Uttrakhand state.
The recent tragedy in Bageshwar district in which 18 children were killed when landslide hit their school has once again brought in focus the extreme vulnerability of our State to disasters.



A tragic Cloud Burst in Shumgarh village of Kapkot Block, District Bageshwar

Shumgarh village is situated at a distance of 15 Kms towards north direction from Kapkot, Block Head Quarter, and 37 km. from District Head Quarter Bageshwar, There is a Sarswati Shishu Mandir located at eastern side of the river Sarau, which was connected with a bridle road and a steel girder bridge. It is just beyond the Tapt Kund. On 18th August, 2010 at 0925 hrs. under heavy rain, a major landslide occurred just behind the school building hillock. The debris hit the back side wall of the school building, smashing it, entered inside the rooms and filled up to varandah. Those who were studying in the rooms were buried alive. 18 child students under the age of 04 to 10 years buried under the debris.

Pithoragarh

The landslide disaster on 8 August 2009 near Kuity village in Pithoragarh district of Uttarakhand State buried two villages and took 43 lives. The landslide, triggered by cloud burst resulted in massive debris flow along a stream channel. The site is still in danger as shown by the presence of huge quantity of debris and ground cracks on the slope.

Landslide disaster on BerinagMunsiyari Road, Pithoragarh District, Uttarakhand

Rudryaprayag

On 13th September 2012 night in Chwanni, Mangoli and Kimana villages of Okhimath block in Rudraprayag district of Uttarakhand (India), heavy rains completely inundated over 4 villages and eroded 2 more villages, while there are no clues about 20-25 families in these villages. One can see the aftermath of erratic rainfall over the night in the pictures below.

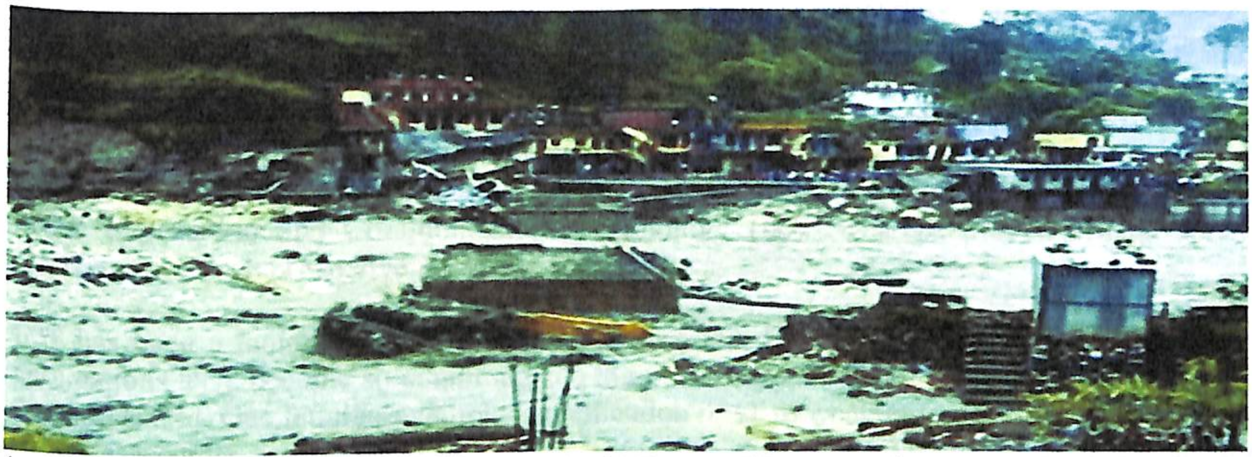
Ukhimath area in Rudraprayag district was the worst hit as a cloudburst in the wee hours flattened dozens of homes in eight villages killing at least 29 people in their sleep.

Uttarkashi

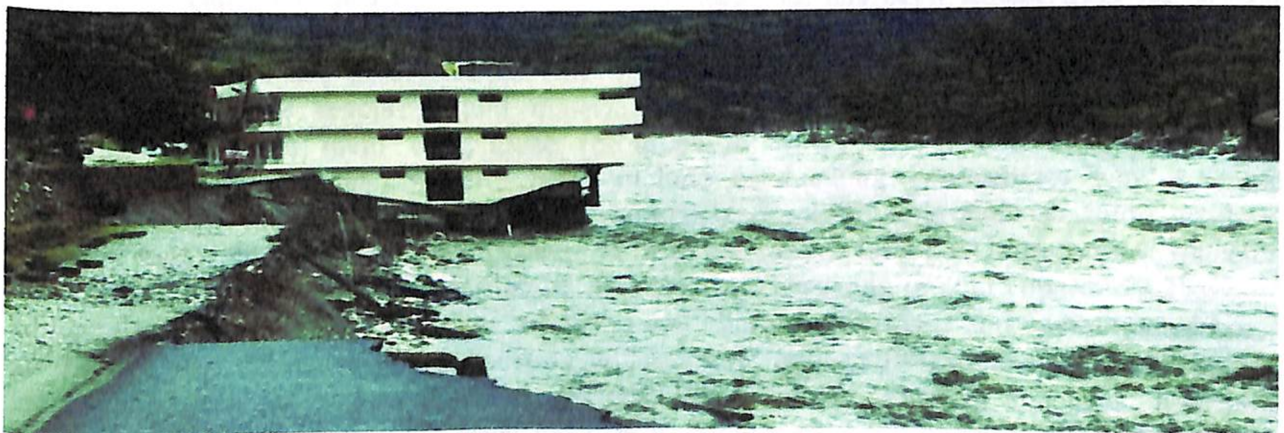
It is the district headquarter of Uttarkashi district. Uttarkashi is situated on the banks of river Bhagirathi at an altitude of 1352 m above sea level. Uttarkashi is home to a number of ashrams and temples.

On Friday, August 3rd 2012 torrential rain falls wiped away signs of human development in the area that seemed to be a specific target while all around drought conditions continued. The event vividly demonstrates – as in other cases where nature has restated or regained her hold – the need for thoughtful care and to educate people to be more attuned to nature. Sacred sites should be left in their natural states.

The floods caused heavy landslides in the state, washing away a stretch of the national highway. Families were evacuated from low lying regions of Uttarkashi to higher ground.



A recent disaster during August 20102 in Uttarakashi district of Uttarakhand where hundreds of houses were washed away and thousands of families were affected due to flash flood in river Ganges



Part of a three-storey building washed away in flash floods in the Uttarkashi district of Uttarakhand state.

CHAPTER5: ICT IN DISASTER MANAGEMENT

ICT is changing every aspect of human life. it enhances the quality and effectiveness of trade, manufacturing, services , other aspects of human life such as education, research , culture, entertainment, communication, national security, etc. Disaster management needs drastic improvements in its sources to decrease damage and save the life of people.

To achieve this main object, disaster management has to face challenges for data collection, data management, translation integration and communication. ICT plays crucial role in this respect the advanced techniques of information technology such as remote sensing, satellite communication, GIS, etc. can help in planning and implementation of disaster management.

The unique geo-climatic conditions have made India highly vulnerable to natural disasters. In India, 54% of landmass is prone to earthquakes, 40 million hectares of landmass is prone to floods, 8000 km of coastline is prone to cyclones and almost 68% of total geographical area is vulnerable to droughts. Though complete prevention of natural disasters is beyond human capabilities, the adverse impact of any disaster on human lives and their livelihoods can be minimized by taking adequate early warning, preparedness and mitigation measures. The state-of-art Information and Communication Technology (ICT) systems play a crucial role for implementing such preventive measures.

ICT has been a major contributor to the progress that has been made. Indeed, some of these applications have become so commonplace that it is easy to forget the improvements made over recent decades. One familiar example is application of IT to weather forecasting that has resulted in more accurate and timely warnings of hurricanes and floods. IT has the potential for even greater impact on enhancing disaster management practice across all of its phases—mitigation, preparedness, response, and recovery—provided it is used consistent with the knowledge of hazards, disasters, and disaster management practices that has been gained from the diverse range of disciplines that contribute to that knowledge base.

Responding to disasters involves such information- and communication-intensive activities as marshaling available resources and materiel, mobilizing and organizing sufficient skilled personnel, deploying them with those resources to where they are needed, and finally coordinating their actions. Specific tasks include establishing connectivity with potential resource providers, authorizing the use of resources and coordinating their use into something akin to a supply chain, integrating information from diverse (including ad hoc) sources, reducing the volume of data to relevant information for recipients, directing ongoing operations based on an overall awareness of the situation, adjusting and altering prior plans and commitments based on the evolving situation, and supporting collaboration and distributed decision making. The mitigation process is similarly complex and can involve many situation- and location-specific details, and it relies heavily on tools such as predictive models of the impacts of particular disasters. It is thus not surprising that IT has become a critical tool for facilitating the communications and information-processing activities in managing disasters.

The dimensions of information communication and technology needs in disaster management

Information and communications needs for disaster management are highly diverse in nature, reflecting the multiple purposes for information and communication and the different activities and information and communications requirements that occur at different times and locations with respect to a disaster.12 Communications and information processing requirements in a disaster are very heterogeneous, varying according to context, use, time, latency, distance, and bandwidth. There are also many ypes of information that can be communicated from many information sources. Indeed, the types of information available continue to grow with ongoing advances in IT. There is also a broad range of information actors and organizations involved in managing disasters; their ability to make appropriate decisions and function effectively can be greatly enhanced by IT and may depend on it for dealing with increasingly complex situations.

Given the heterogeneity of the information, the dynamics of the situation, and the diversity of actors, it is not surprising that there are a number of tensions that arise between more centralized, top-down, and planned disaster management activities and more decentralized, bottom-up, and ad hoc activities. For example, consider the following:

- The needs of "official" first responders versus those of emergent groups of people,
- Command-and-control decision making versus distributed decision making,
- The needs of first responders in the field versus the needs of higher-level decision makers, and
- The need for security and privacy protection versus the benefits of broadened access to information.

There are also inherent tensions between local governments and among federal, state, and local levels of government.

In each of these cases, the design and deployment of an IT system can make the tensions more acute and more visible. Moreover, IT cannot be used to paper over organizational problems—but itsg appropriate use may enable disaster managers to successfully accommodate a wider spectrum of disaster management activities, and do so more effectively and efficiently.

Examples of the Kinds of Information Useful in Disaster Management

The first applications of IT to disasters were in the form of voice communications. Advances since then have led to many additional forms of information that have been included in disaster management practices to varying degrees, including text, geospatial data, video, sensor data, and collections of these and other types of data in databases or other electronic forms.

The number of available information sources has expanded considerably in recent years to include surveillance cameras; ground, air, and satellite sensors; telemetry from assets and personnel; unmanned vehicles; and eye witnesses with more technology.

Special features of ICT in different hazards

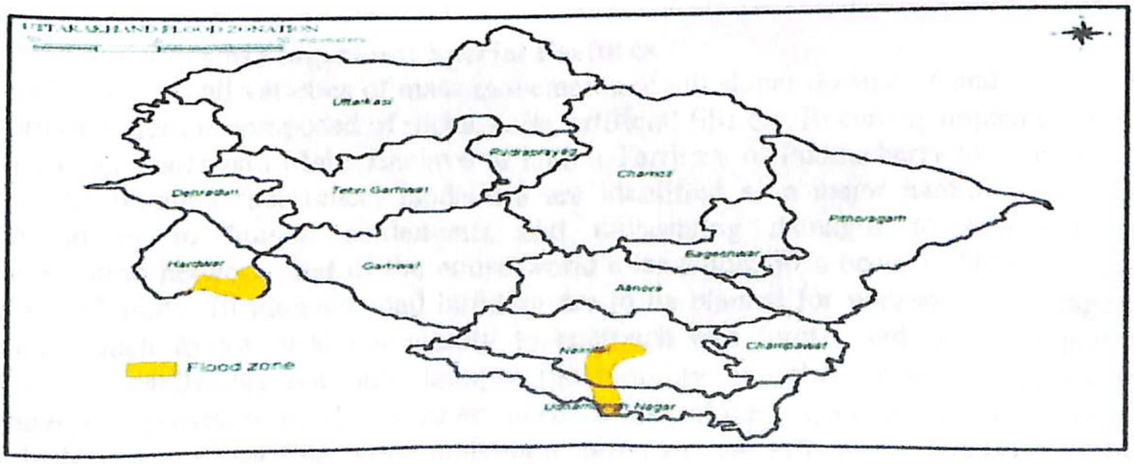
Floods, cyclones, droughts, earthquakes, landslides and other hazardous events like tsunami are a recurrent phenomena in our country, causing a very huge loss of life, property and damage to the environment (because of which India is considered as one of the most disaster prone country in the world). Nearly 58.6% of the Indian land mass is prone to earthquakes of various intensities; about 12 % of the Indian land mass covering over 50 million hectares is prone to floods and resultant land erosion approximately 8% of the total area is prone to cyclones and 68% of the area is susceptible to drought. Out of India's long coastline of approximately 7516 kms, approximately 5700 kms is prone to cyclones and Tsunamis.

ICT for Flood Management : Special Features

India has a large number of catchment areas, rivers and related river basins. Floods have been a recurrent phenomena with concomitant loss of lives, properties, infrastructure and public utilities. In fact, floods in some of the states like Uttranchal Assam and Bihar are a cyclic phenomena.

Another issue on effective disaster management (DM) during floods is the fact that some of the causes of floods and consequent damages in India originate in neighbouring countries that adds new dimension to the complexities involved in early warning (EW), forecasting mitigation and preparedness activities in theDM continuum. India is regularly affected by floods due to the high discharges in the Ganga-Brahmaputra- Meghna river system. The main causes of floods are widespread heavy rainfall in the catchment areas and inadequate capacity of the river channel to contain the flood flow within the banks of these rivers.

National Remote Sensing Center (NRSC) Satellite data can be used very effectively for mapping and monitoring the flood inundated areas,flood damage assessment, flood hazard zoning and past flood survey of river configuration and protection works.

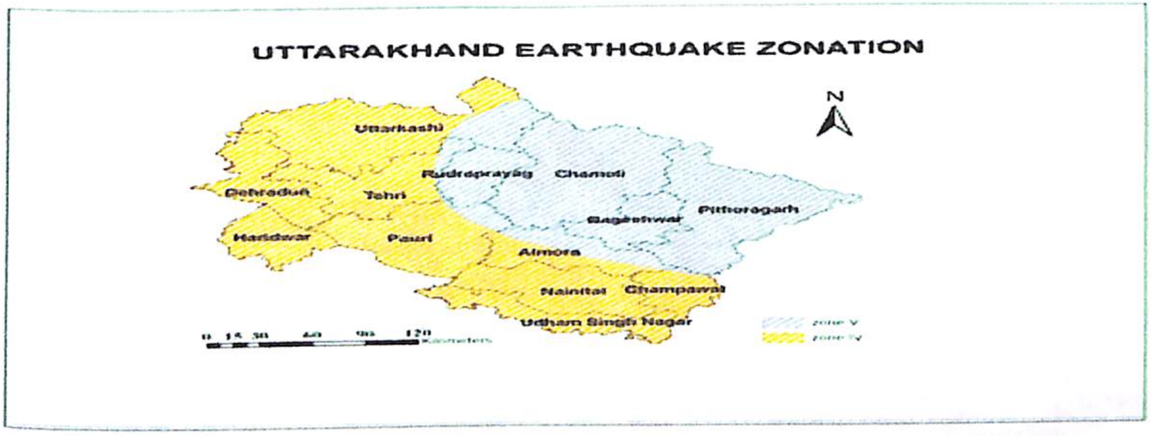


Flood hazard map of Uttrakhand

ICT for Earthquake Management: Special Features

The damage potential of earthquakes covering nearly 59% of Indian landmass has major impact on ICT infrastructure, because of the very vast geographical spread as also difficult terrain such as that of Jammu & Kashmir, Uttranchal, Himachal Pradesh and so The ICT requirements, therefore, have to cater for requisite support in a very short span of time, since the earthquake related disasters very rarely gives any early warning indicators.

Earthquakes also affects the mobility of the ICT main elements, in addition to causing considerable damage to the existing infrastructure resources; whether public or private in the affected areas. It is, therefore, imperative and effective that these backdrop issues are taken into account while planning for earthquake related ICT support for the activities involved in the complete disaster continuum.

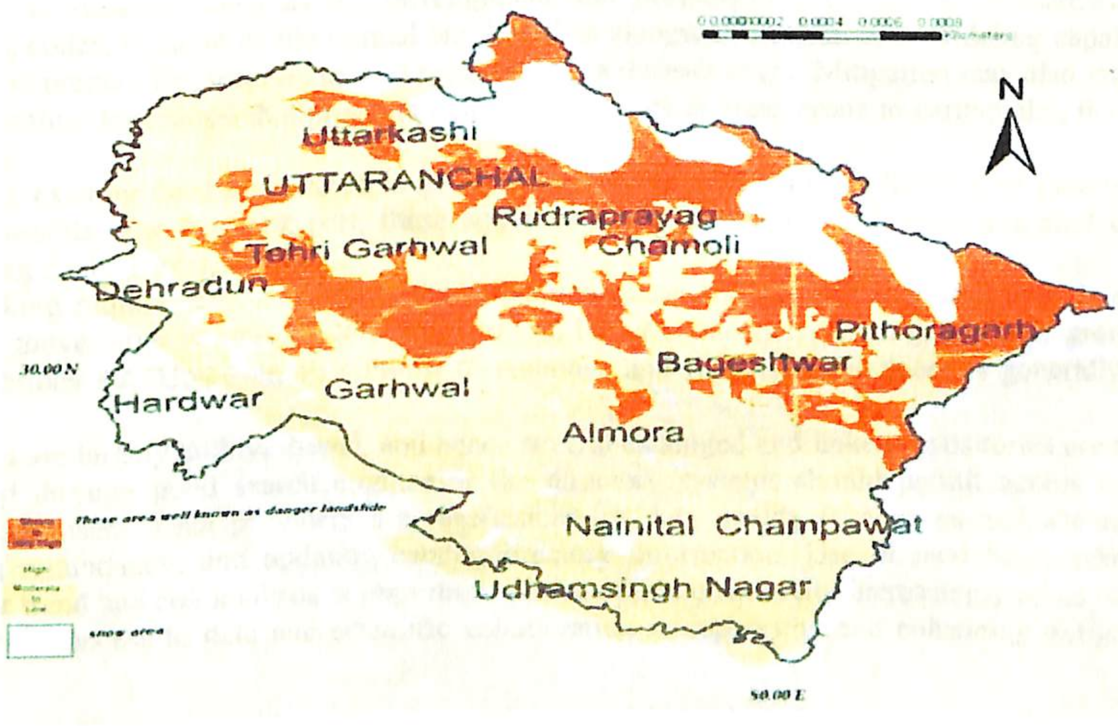


Earthquake hazard map of Uttrakhand

ICT for Landslides Management: Special Features

Landslide includes all varieties of mass movements of hill slopes downward and outward of materials composed of rocks, soils, artificial fills etc. Recurring impact of these is felt in twenty-one states and Mahe Enclave of Union Territory of Pudducherry to a variable extent. Due to the frequent recurrence, landslides are identified as a major natural hazard bringing untold misery to human settlements and devastating damages to transportation and communication network. Out of the entire world's landslide, 30% occur in Himalayas, indicate the SAARC study. Ill planned road building are to be blamed for widespread wastage of land resources,which forces rural community to encroach into forests and further aggravate soil erosion. The landslides not only hamper the mobility but also cause damage to the ICT structures.The provision of ICT systems needs a special care, considering the terrain and the hazard. ICT using satellite communication provides an effective solution to establish connectivity in case of such devastating situations

However, natural processes like monsoon and cyclone induced rainfall play a greater role than the human induced ones. Even though landslides are mainly triggered by earthquakes, many other factors contribute to slides, viz geology, gravity, weather, groundwater and wave action, and human actions like indiscriminate tree felling, construction, mining and quarrying combined with heavy rainfall have increased the fragility ofthe Himalayan Mountains, leading to an increase in the incidence of landslides in the region. Landslide disaster in the state of Uttarakhand in India has a very long and old history. Landslide and mass movements are recurring phenomena in Himalayan region. The consequences in recent times have become more severe in terms of casualties and extensive damage to the roads, buildings, forests, plantation, and agriculture fields. Some of the infamous major landslides of the region are _The Karmi landslide', Landslides in Alaknanda Valley', Berinag Landslide'. Malpa Landslide', _Ukhimath Landslide' and Varunavat Landslide'.



Landslide hazard zone of Uttrakhand

Requirement of ICT Network During Various Phases of Disaster Continuum

A knowledge -based information infrastructure for DM cycle needs to provide balanced support to each phase of these activities to reduce the level of accepted risk in the society.

Disaster information management has traditionally been adapted in an insular environment because of which interaction between the Stakeholders & disaster manager involved in the four stages of DM cited above has been minimum and, the DM-tools that have been developed to support the various disaster phases being improper and non-uniform in nature. A holistic approach calls for a seamless flow of various information products developed whereby the product used in the response stage can be fed back into the mitigation programme to incorporate the changes required on a common platform. The requirements peculiar to each phase of disaster management and the implications to information systems and components employed are discussed below.

ICT for Mitigation Phase

Consists of pre-disaster activities necessary to be implemented in advance for reducing the impacts of disasters such as the development and promulgation of zoning ordinances and building codes, creation of the critical baseline data alongwith analysis and modeling capability needed to prepare for, respond to, and recover from a disaster event. Mitigation may also include implementing legislation that prevents building structures in areas prone to earthquake, flood or tsunami.

Utilizing existing databases linked to geographic features in GIS makes the task of monitoring these possible. For the most part, these activities are not time critical but are essential while designing the ICT infrastructure.

Networking requirements to support the mitigation phase should meet key attributes, like the need to move large volume of data/ information, broad connectivity among a diverse group of organizations etc. However, in contrast to response and recovery, timeliness is generally not critical.

The data are largely archive-based, and hence several cataloged and linked repositories are to be accessed through good search engines or the directory systems should permit access to the distributed users. Data providers are responsible for data quality (timeliness and accuracy), limiting redundancy, and updating catalog/directory information. Use of modeling/prediction tools for trend and risk analysis is important. The scientific community increasingly relies on the Internet for access to data and scientific collaboration in supporting and enhancing mitigation efforts.

ICT for Preparedness Phase

Preparedness activities range from early warning, community development, training of the first responders and the community, logistical support, supply, and resource systems needed for disaster response to early warning and monitoring activities preceding the disasters. Distribution of warning data through a dedicated network during the preparedness phase is intense, and timeliness becomes a critical factor for some types of information dissemination. Although disaster prediction accuracy and warning lead-times are improving at pace,storm and earthquake alerts still require wide distribution in minutes/seconds.

In remote areas, for example, full national coverage is still a concern to be addressed to, through adoption of various technologies. Public awareness through broadcast announcements and access to disaster web pages are the key issues. Distance learning and other training activities making use of interactive video also fit into this category.

ICT for Response Phase

Response to disaster events is time critical. Logistical support option for providing relief materials, damage surveys, baseline maps, equipment, human resources, and funds all need to be accessible. Communications among response teams and to the general public become most vital. Rapid, reliable, configurable, controlled access communication is vital to efficient disaster response operations. Major challenges are presented by extreme conditions of infrastructure destruction, communication traffic peaks, mobile users, and sensitive information contained data. Management of property and casualty status, resource information, and response priorities require special access capabilities beyond normal commercial telephone/ Internet services.

ICT for Recovery Phase

Bulk of the data needs during recovery include significant onsite data collection related to rebuilding, claims processing, and documentation of lessons learnt. Feedback on the mitigation process and historical databases that are important to prevent the same mistakes in the future. Timeliness concerns are relaxed in favor of efficiency, and internet is often ideal for such transfers. It is, therefore clear that the requirement for access, privacy, and bandwidth varies among disaster phases. Today's disaster information infrastructure should offer an appropriate mix of component technologies to respond to diverse requirements. The Internet is suitable ICT support to the recovery and mitigation phases, but urgent and life-critical communications during the preparation and response phases call for systems that are more robust now a days. Establishing a robust National Disaster Communication Network (NDCN) will meet the ICT requirement with assured response and without failure. Wireless media using mobile system communication such as portable satellite communications, wireless systems, etc as part of NDCN would meet the requirements during emergencies. ICT networks should use various technologies to provide a network meeting the requirement during all phases of disaster. Creative applications of broadcast technologies are also to be explored for warning and advisory systems. Internet can be overloaded, leading to an extra burden on response time. Although through the addition of mirrored servers and similar approaches, a larger share of users can be expeditiously served, it may not be reliable for time-sensitive traffic such as warnings and interactive resource management, unless Internet traffic can be prioritized..

GIS platform Inevitable for Holistic Disaster Management

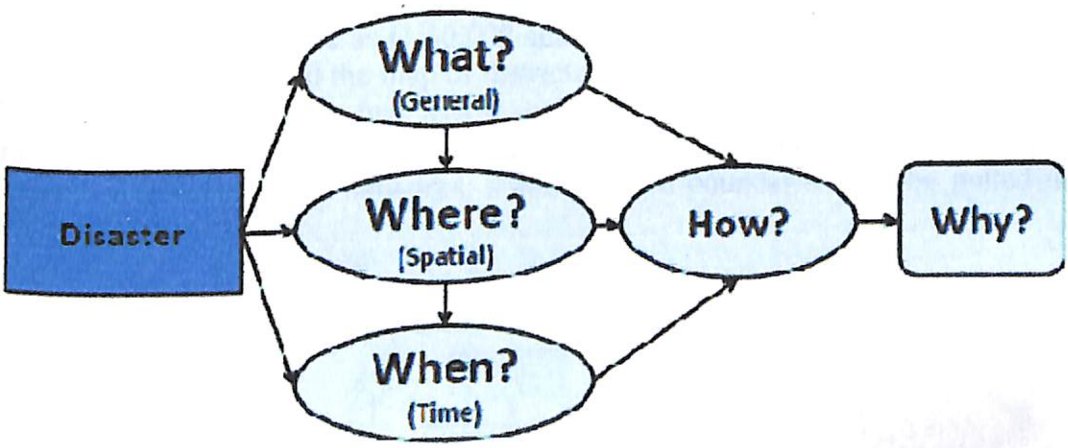
What is GIS?

GIS is an information system to input,retrieve,process,analyze and output geographically referenced data or geospatial data in order to support decision making for planning and management of natural resources and environment.

Problems to Solve in Disaster Management

The occurrence, development, and impact of disasters possess spatial characteristics

The command and dispatch, disaster relief, site search in disaster rapid response are carried out within a certain spatial extent



Where + How →Geographic position. distribution. impact → Measures

GIS can be loosely defined as a system of hardware and software used for storage, retrieval, mapping and analysis of geographic data. Spatial features are stored in a coordinate system (latitude, longitude, state, plane, etc.) that references a particular place on the earth.Descriptive attributes in tabular form are associated with spatial features. Spatial data and associated attributes in the same coordinate system can then be layered together for mapping and analysis. GIS is used in scientific investigations, resource management and development planning.

SYSTEM ARCHITECTURE

The entire system architecture will be composed of two basic building blocks incorporated with front end GIS map of uttarakhand

- Spatial data
- Non Spatial data

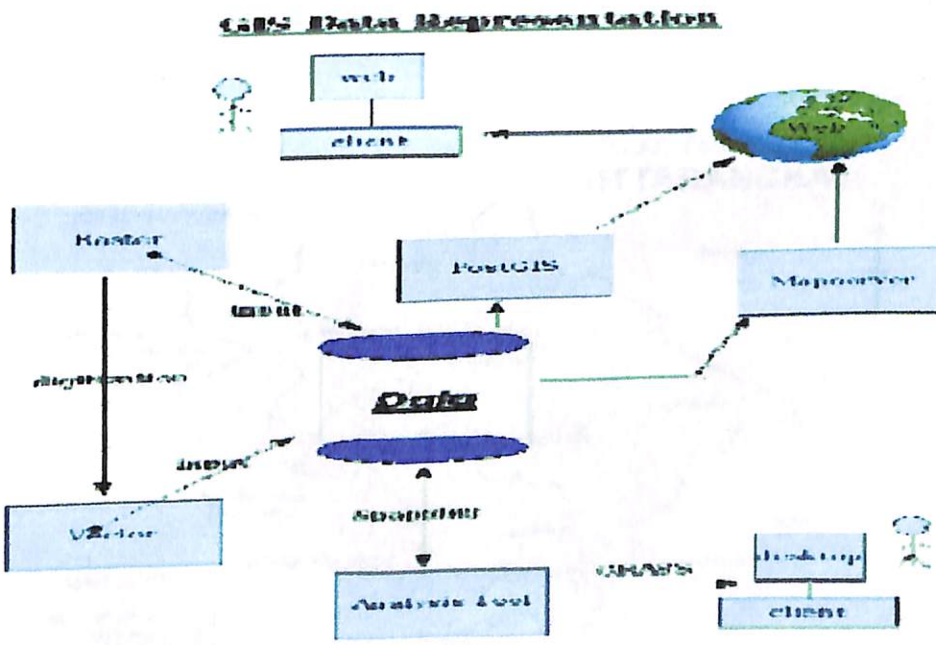
Spatial data

Spatial data may be defined as geospatial data orgeographic information .it is the data or information that identifies the geographic location of features and boundaries on Earth, such as natural or constructed features. Spatial data is usually stored in the form of coordinates and topology, and is data that can be mapped. Spatial data is often accessed, manipulated or analyzed through Geographic Information Systems.

In case of uttarakhand the source of raw data for digital spatial data is:

- Thematic map of road transportation network of uttarakhand state
- Detailed thematic transportation network map of all 13 district
- Thematic (political) maps of all 13 districts
- Detailed thematic political maps of all different 13 districts.

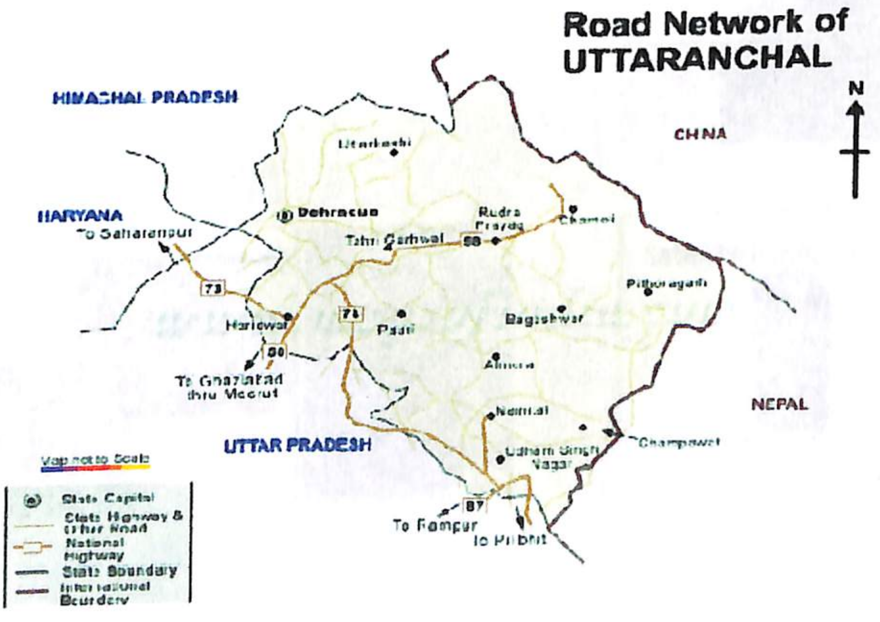
These different thematic maps will be created with the help of toposheets and survey data of government data. Updation of this digitized raw data will be done with the help of open source tool –QGIS (Quantum GIS). For the final thematic map with all required updated spatial layers, all the basic maps will be processed with the help of QGIS. For this process all the selected SOI maps should be of same scale as (1:50,000 scale) and projection. State map of uttarakhand will be choosen as basic map and the map of districts having lesser physical geographical boundaries will be overlayed with the base map as a spatial layer. The final resulted map interface will be generated as a single dynamic thematic map of uttarakhand state. The updated digitized spatial data layers will include road networks, administrative boundaries will be putted into GIS for further processing.



Non spatial data
Attributes that are required to be attached to the spatial data layers, and were thought of considerable significance while monitoring, planning and decision taking in emergency cases, can be identified by exhaustive discussion with different involved government and non government experts. These attributes will be considered as the non spatial data for the system like length, width, crust, connectivity with villages, non- connected villages in surrounding e.t.c

Integration of spatial and non- spatial data: A proper integration of spatial data and non spatial data in GIS environment through backend postgress SQL, care will be taken to ensure that attribute database remains dynamic, in the sense that , whenever there is a change in attribute database , it gets reflected in the GIS. GIS interface will be customized with the help of QGIS.

Customized GIS application
An intuitive and user friendly GUI(graphical user interface) with customized PHP () based query and search and shortest distance toolbar in addition to built in tools and buttons of OPENLAYERS makes it to perform all required tasks for decision making, monitoring and planning for case as disaster 2010. Customized queries enables the user to generate complex queries for affected area statistics, latitude longitude situation and other real life experiences at the place for disaster management. Queries of this sort are possible in detailed hierarchy at all levels of administrative boundaries like districts, tahsils and villages etc.
In cases like disaster 2010, due to dynamic nature of system data regarding road network could be embedded into the system in spatial as well as non spatial form with the help of back end POSTGRESS SQL, data regarding damaged and effected portion of road network in the state could be inserted into the system and viewed with the help of user friendly front end interface for planning and decision making.



How to get GIS data?

In the event of an earthquake or other natural hazard (a landslide that has caused a river to dam up, for instance) being reported by monitoring agencies, a simple algorithm can be implemented to suggest the likely area of effect of the natural disaster. Common GIS functions can then be employed to estimate the number of people who may have been affected. A more reliable estimate can then be made at an early stage as to the quantum of assistance required. The advent of cheaper and reliable portable satellite phones will allow hitherto fragile telecommunications to be bypassed for requests for outside assistance to be relayed to those who can co-ordinate at a state and national levels

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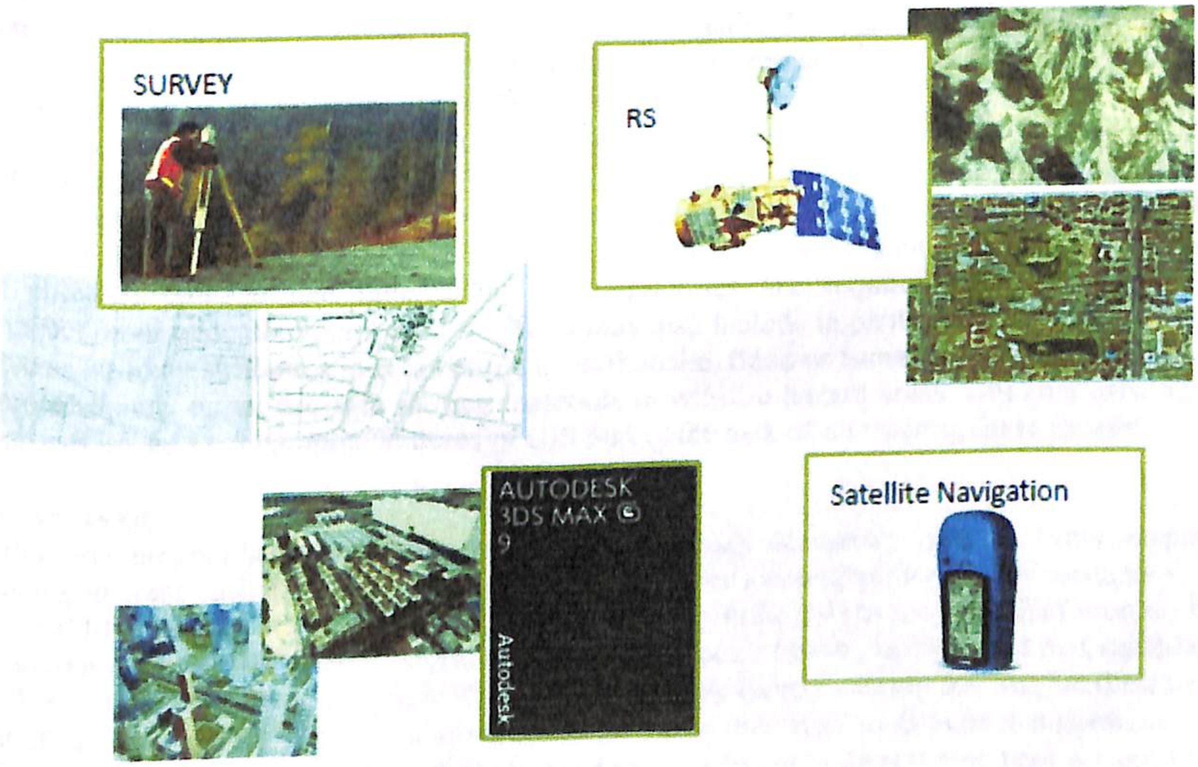
GIS Databases

The advancement in the last decade with respect to computer-based Geographical Information Systems (GIS) and their associated databases open great possibilities for disaster management in countries like India. Now it is possible for District Magistrates to have the same quality of information at their finger tips as those in the state and national emergency operations rooms. The DMMC has been trialling such a system that would allow all levels of the emergency control chain to have access to quick estimates of the size of the natural disaster soon after its occurrence is reported.



GIS in Various phases of disaster continuum

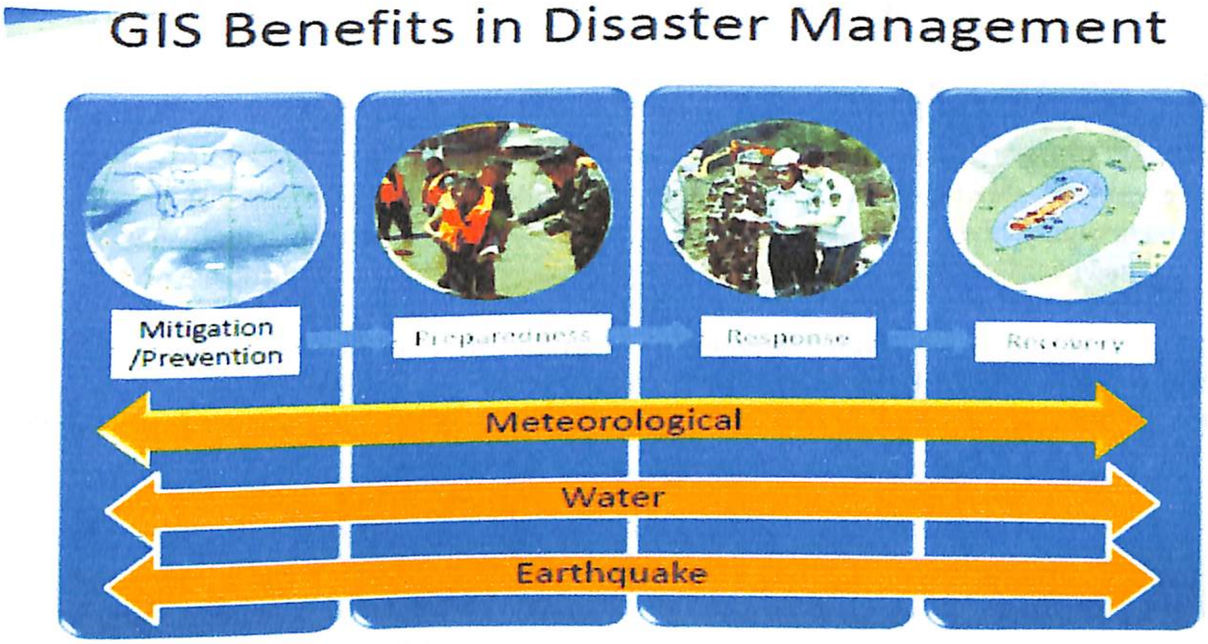
All phases of emergency management depend on data from a variety of sources. The appropriate data has to be gathered, organized, and displayed logically to determine the size and scope of emergency management programs. During an actual emergency it is critical to have the right data, at the right time, displayed logically, to respond and take an appropriate action.
The use of GIS in different phases can be illustrated as follows:

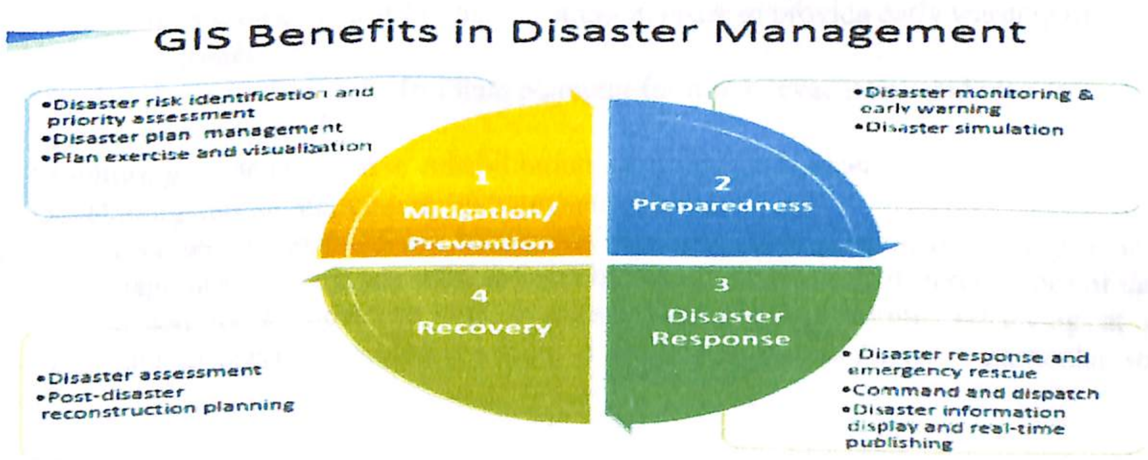
Planning
Locating and identifying potential problems is a core requirement in disaster management. GIS can be used effectively to achieve this objective. Using a GIS, it is possible to pinpoint hazard trends and start to evaluate the consequences of potential emergencies or disasters. When hazards are viewed with other map data, such as buildings, residential areas, rivers and waterways, streets, pipelines, power lines, storage facilities, forests, etc., disaster management officials can formulate mitigation, preparedness, response and possible recovery needs.
Information derived from remote sensing and satellite imagery plays an important role in disaster management and crisis prevention. Their effective application depends not solely on technical specifications, but is influenced by factors such as data collection, distribution and processing , capacity building, institutional development and information sharing. Earth observation satellites could be used to view the same area over long periods of time and, as a result make it possible to monitor environmental changes, human impact and natural processes. This would facilitate scientists and planners in creating models that would simulate trends observed in the past, present and also assist with projections for the future.

Mitigation
After potential emergency situations are identified, mitigation needs can be addressed. This process involves analysing the developments in the immediate aftermath of a disaster, evaluating the potential damage and determining what facilities are required to be reinforced for construction or relocation purposes.Mitigation may also include implementing legislation that prevents building structures in areas prone to earthquake, flood or tsunami. Other mitigation approaches may target fire-safe roofing materials in wildfire hazard areas. Utilizing existing are databases linked to geographic features in GIS makes the task of monitoring these possible.

Preparedness
During the preparedness and response phases, GIS can accurately support better response planning in areas such as determining evacuation routes or locating vulnerable infrastructure and vital lifelines, etc. It also supports logistical planning to be able to provide relief supplies by displaying previously available information on brid, roads, airports, railway and port conditions and limitations.Apart from this, activities such as evacuee camp planning can also be done using GIS. It can also provide answers to some of the questions important to disaster management officers, such as the exact location of the fire stations if a five-minute response time is expected or the number and locations of paramedic units required in a specific emergency. Based on the information provided by GIS, it is also possible to estimate what quantity of food supplies, bed space, clothes and medicine will be required at each shelter based on the number of expected evacuees.

In addition, GIS can display real-time monitoring for emergency early warning(EW). Remote weather stations can provide current weather indexes based on location and surrounding areas.Wind direction, temperature and relative humidity can be displayed by the reporting weather station. Wind information is vital in predicting the movement of a chemical cloud release or anticipating the direction of wildfire spread upon early report. Earth movements (earthquake), reservoir level at dam sights, radiation monitors, etc. can all be monitored and displayed by putting location in GIS. If necessary, this type of information and geographic display can be delivered over the Internet to the public.





Role of remote sensing in Disaster Continuum

The use of remote sensing data, such as satellite imageries and aerial photos, allows us to map the variabilities of terrain properties, such as vegetation, water, geology, both in space and time. Satellite images give a synoptic overview and provide very useful environmental information, for a wide range of scales, from entire continents to detail of a few meters. Many types of disaster, such as floods, droughts, earthquakes, etc. will have certain precursors that satellite can detect. Remote sensing also allows monitoring the event as it occurs. From the vantage point of satellite we can consider, plan for and operationally monitor the event.

Remote sensing or Earth Observation System (EOS) and GIS are among many tools available to disaster management professionals today making the effective project planning very much possible and more accurate now than ever before. Although none of the existing satellites and their sensors has been designed solely for the purpose of observing natural hazards, the variety of spectral bands in VIS (visible), NIR (near infrared), IR (infrared), SWIR (short wave infrared), TIR (thermal infrared) and SAR (Synthetic Aperture Radar) provide adequate spectral coverage and allow computer of the data for this purpose. Repetitive or multi-temporal coverage is justified on the basis of the need to study various dynamic phenomena of whose changes can be identified over time. These include natural hazard events, changing land usepatterns,thematic conditions and hydrologic and geologic characteristics of the region.

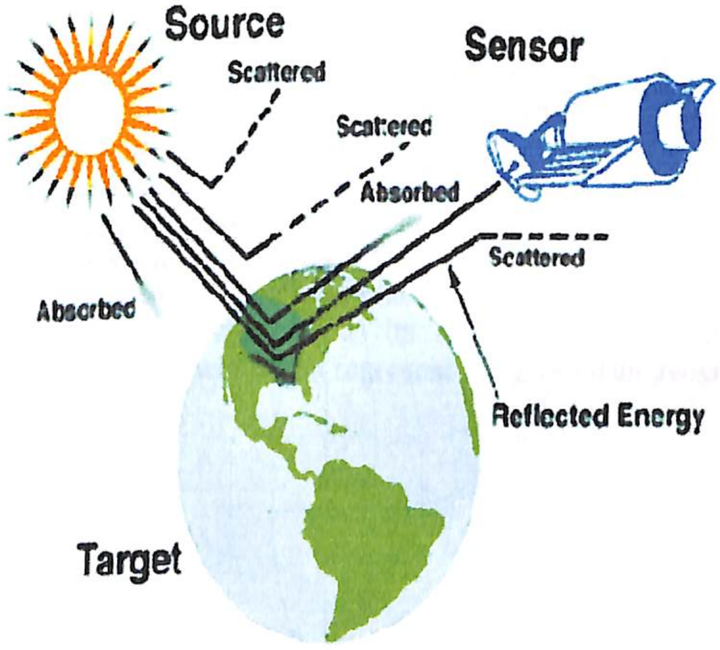
From the inherent characteristics, namely, spatial continuity, uniform accuracy and precision, multi-temporal coverage and complete coverage regardless of site location, the remotely sensed data can be used very effectively, for:

- Quickly assessing severity and impact of damage due to flooding, earthquakes, oil spills and other disasters;
- Planning efficient escape routes from coastal areas during hurricane season;
- Charting quickest routes for ambulances to reach victims;
- Locating places for shelter for victims or refugees;
- Calculating population density in disaster-prone areas;
- Rapidly identifying hardest-hit disaster areas in order to provide early warning of potential disasters;
- Pre-disaster assessments to facilitate planning for timely evacuation and recovery operations during a crisis;
- Monitoring reconstruction or rehabilitation after a major disaster;
- Developing and maintaining or updating accurate base maps.

The use of remote sensing and GIS has become an integrated, well developed and successful tool in disaster management. A very powerful tool in combination with these different types of data is GIS. It is defined as a "powerful set of tools for collecting, storing, retrieving at will, transforming and displaying spatial data from a real world prospects for a particular set of purposes".

Remote sensing mechanism:

The Earth observation using satellite remote sensing technique has made it possible toachieve a uniform data covering the whole globe in a relatively short time, and has also made it possible for these observations to be continued for a long time in the future. The two main components of the space-based sub-system of the EOS, Polar- Orbiting and Geostationary, continues to improve with every new launch. Geostationary satellites orbit the earth with the earth's rotation so that they observe the same point on the Earth continuously, but from a much higher altitude approaching 36,000 km. Geostationary satellites are the primary meteorological observation platforms and provide continuous but somewhat coarser spatial data. Polar orbiting satellites generally fly in a low Earth orbit (hundreds of km) and provide relatively high resolution measurements with repeat times of days to tens of days. Remote sensing data are acquired in predetermined spectral bands (wave lengths). Visible and near infrared spectral band are chosen to amplify or separate specific earth features such as vegetation, rocks, urban area, snow and water. This way one can separate a chosen land feature from other land features by choice of the wavelength.



Concept of a satellite sensing the globe through on-board sensors

RESULTS AND BENEFITS

Customized view interface facilities unique visualization and querying of the road network with respect to all different levels of administrative units. Customized menu - bar and drop downs enables user to easy access and retrieval of information .for selected road information like surface condition , damages, base type, location , shortest distance, village connectivity status, unconnected villages, other possible alternative for damaged part of road and other required information can be obtained. Preparation and printing of thematic maps of desired scale will also possible n set up. Such an application is very beneficial for the situation like disaster 2010 for monitoring situation and managing road network in after disaster situation.

During any emergency situation, the role of a reliable Decision Support System is very crucial for effective response and recovery. Geographic Information System (GIS) provide most versatile platform for Decision Support by furnishing multilayer geo-referenced information which includes hazard zoning, incident mapping, natural resources and critical infrastructure at risk, available resources for response, real time satellite imagery etc. GIS-based information tools allow disaster managers to quickly assess the impact of the disaster/emergency on geographic platform and plan adequate resource mobilization in most efficient way. Thus, a reliable GIS-based database will ensure the mobilization of right resources to right locations within least response time. Such database would also play a fundamental role in planning and implementation of large scale preparedness and mitigation initiatives.

As GIS technology integrates common database operations such as query and statistical analysis with the unique visualization and geographic analysis benefits offered by maps. These abilities distinguish GIS from other information systems and make it valuable to a wide range of public and private enterprises for explaining events, predicting outcomes, and planning strategies.

A GIS is a computer based system which is used to digitally reproduce and analyse the feature present on earth surface and the events that take place on it. In the light of the fact that almost 70% of the data has geographical reference as its denominator, it becomes imperative to underline the importance of a system which can represent the given data geographically.

CHAPTER 6: DISASTER RISK ANALYSIS

In this section we have selected the main central thrust zone of uttrakhand. The MCT is an imaginary line which separates greater and lesser Himalayas. Uttarakhand's five districts fall in the MCT zone. Authors have taken all the five districts (Pithoragarh, Bageshwar, Uttarkashi, Rudraprayag, Chamoli), and with the help of Statistica 8 have prepared the clusters and selected five blocks from every district (Dharchula, Kapkot, Naugaun, Ukhimath and Dhasoli) and five village from each block (Pothing, Dhari, Barsundhi and Mandal). The selected villages and their location are shown in table 1 and their basic information in table 2.

Table 1 Selected villages and their geo references

S.No	Village Name	Block Name	District Name	Lat/Long of the Village
1	LUMTI	Dharchula	Pithoragarh	80°19'27.023"E 29°53'01.792"N
2	POTHING	Kapkot	Bageshwar	79°51'54.803"E 29°58'36.135"N
3	DHARI	Naugaun	Uttarkashi	78°08'51.777"E 30°44'28.158"N
4	BARSUNDHI	Agastyamuni	Rudraprayag	79°07'08.746"E 30°26'05.232"N
5	MANDAL	Dhasoli	Chamoli	79°16'13.922"E 30°27'51.743"N

Table 2 Basic information of the selected villages.

Village Name	Total Population	Household Number	Transportation Medium	Main Crops	Hazards
LUMTI	355	76	Private Jeeps	Paddy, Wheat	Landslide, Earthquake, Forest fire.
POTHING	5439	578	Bus, Private Jeeps	Wheat, Paddy, Barley, Maize, Maduva	Landslide, Earthquake, Forest fire.
DHARI	102	22	Bridle path to village only	Wheat, Paddy	Landslide, Earthquake, Forest fire, Flash Flood.
BARSUNDHI	120	25	Bridle path to village only	Wheat, Paddy, Maduva, Soybean	Landslide, Earthquake.
MANDAL	630	135	Private Jeeps	Wheat, Paddy, Maduva	Landslide, Earthquake, Forest Fire, Drought.

Village Data Analysis:

Data related to vulnerability (exposure,resistance and resilience), Hazard (F requency and severity), Management echelon (Prevention,preparedness,mitigation,search, rescue and evacuation) of the selected villages have been calculated from the given data collected through PRA (Participatory Rural Appraisal) and interviews (Table 3).

Table 3 Vulnerability, Hazard and Management scores of the selected villages

Village Name	Exposure (a)	Resistance (b)	Resilience (c)	Vulnerability (a + b + c) /3	Hazard	Management
LUMTI	76.92	73.68	56.81	69.13	22.16	10
POTHING	84.61	84.21	45.45	71.42	20.16	10
DHARI	84.61	84.73	72.72	80.68	19.83	10
BARSUNDHI	76.92	100	84.09	87	20	10
MANDAL	69.23	78.94	34.09	60.75	24.16	10

Vulnerability is a product of three dimensions: (i) Exposure, which is a largely a product of physical location and the character of the surrounding built and natural environment. (ii) Resistance, which reflects socio-economic, psychological and physical health and their systems of maintenance, and represents the capacity of an individual or group to withstand the impact of a hazard.(iii) Resilience, to natural hazard is the ability of an actor to cope with or adapt to hazard stress. The above table show that the exposure (69.23) and resilience (34.07) level of the Mandal village is extremely low amongst all, with the score of 73.68 and resistance level of Lumti village is low. In total vulnerability of Mandal village with 60.75 score is the lowest and Barsundhi village with 87 score is the highest.

Disaster Risk Analysis: Disaster Risk Analysis of the selected villages is done using the following formula:
$R = (H*V) / M$

Table 4 : Village risk analysis

Village Name	R – (H*V)/M
LUMTI	153 19
POTHING	143 98
DHARI	159 98
BARSUNDHI	174
MANDAL	146 77

Where:
R = Risk
H = Hazard
V = Vulnerability
M= Management

The above table shows that the risk level of Mandal village is the lowest (146.77) and the Barsundhi village is highest (174). With the help of this obtained risk result we can easily prepare the disaster management plan for the region.

Household Management Analysis:

The household management analysis principally needs three categories of data i.e. Pre-disaster data, during disaster data, post disaster data. For the present study we have selected villages household data has been collected through PRA during field visit (Table 5).

Table 5 Household managemen: anaysis

Vilage Name	Pre-Disaster Data (In %)			During Disaster Data (In %)			Pcst Disaster Data (In %)		
	Frevention	Preparedness.	Mitigation	Response.	Community Partciaton	Rescue & Relief.	Damage Assessmen:	Communty Health	Rehabilitation & Restructuring
LUMTI	38.94	12.76	30.30	24	13	41.42	29.99	33.22	22.85
POTHING	29.46	21.27	23.71	24	17	59.99	66.66	33.81	21.90
DHARI	56.83	21.27	29.99	0	68	35.71	100	30.76	47.61
BARSUNDHI	24.20	4.26	37.60	0	5	21.42	100	12.30	19.04
MANDAL	78.94	19.14	15.62	20	80	50	100	32.30	42.85

The above table shows that the prevention level of all the villages fluctuates from 78.94% of Mandal village to 24.20% of Barsundhi village. It is because Mandal is connected with a town. Preparedness level of all the villages is below 22 % and the mitigation conditions are also very poor below 40%.Therefore it can be assessed that pre disaster scenario of all the selected villages is very gloomy and glorious. In during disaster section response level varies from 0 to 24% means, community participation level varies from 5 to 80%, and rescue and relief scores between 21.42% to 59.89%. In post disaster section damage assessment is 29.98% in Lumti village because of inaccessibity while in Barsundhi and Dhari damge assessment registers 100% score. Community health related score is below 35% and rehabilitation and restructuring is also below 50%, so it can be said that disaster management planning is in a very poor condition in all the phases of disasters.

CHAPTER 7: RECOMMENDATIONS

Introduction to DMIS (Disaster management Information System) in Uttrakhand

The Disaster Management Information System (DMIS) is a web-based working tool. It is a system from which users will be able to access:

- real time information on disaster trends
- online internal and external resources
- tools and databases

The DMIS project started in February 2001 as a follow up to Strategy 2010 and in response to the need for informed decisions, speed and efficient operational readiness. DMIS is the result of a major effort made by the Federation in addressing the complexity of information exchange in the humanitarian community and to support an efficient disaster preparedness and response for the whole Federation's Red Cross and Crescent network at a global level. DMIS continues in the same vein with the successor Strategy 2020.

The system was launched by SRISTI, http://www.sristi.org (Society for Research & Initiatives for Sustainable Technologies and Institutions) on the 18th of January 2002 at Indian Institute of Management, Ahmedabad, Gujarat, India.

The applications of these systems range from emergency response planning to short range early warning to long range mitigation and prevention planning.

Requirement of AFAYBIS kind e-government initiative

AFAYBIS is designed as a minor project of e-Government. Turkey is situated on an important earthquake zone. (North Anatolian Fault Line) (Alkis , 2003) Moreover; it faces many disasters such as floods, fires, avalanches, etc. each year. Financial and social payback is a big deal for the country. Thus the importance of the Disaster and Emergency Management System can not be ignored. Disaster and Emergency Management System is basically to benefit modern technology to standardize, organize and manage the data and information about disaster management. To realize this, it aims at making it possible to reach the data quickly during or before a disaster, to create the maps and statistical information, to present the data in different multi user media and on internet.

Organizational Structure of AFAYBIS

This system is designed, containing the relationships about data and information access, disaster management communication, risk reducing and preparation, post-disaster problems between prime ministry, governorship and other institutions. The service and duty of the institutions are taken into consideration and adapted to the system, without making crucial modifications in their existent organizational structures.

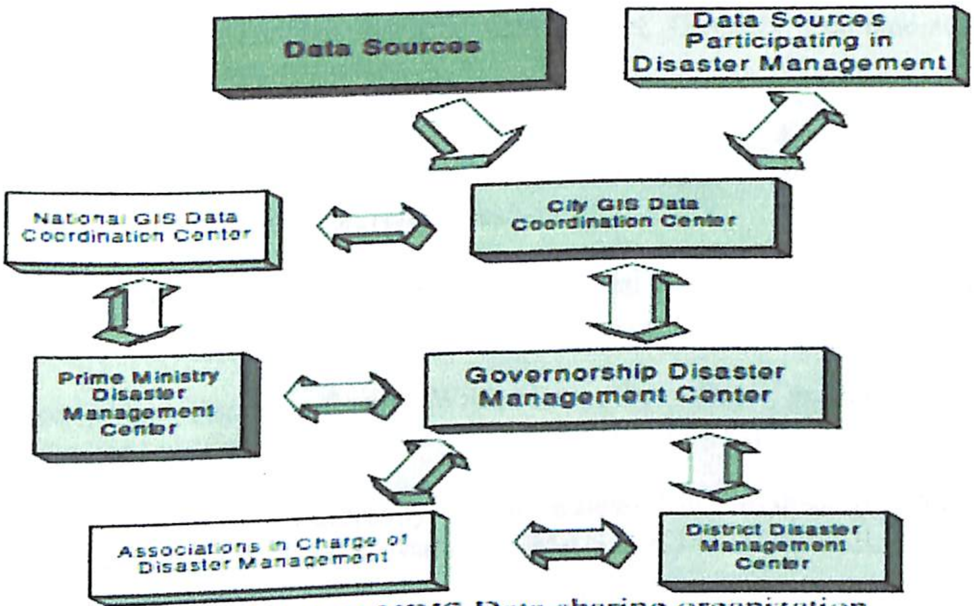


Figure 3.1 AFAYBIS Data sharing organization

Disaster and emergency management is vertical application from the view of GIS, that is to say, it is connected to the several institution and data. It is determined that there are 3 data groups as base for disaster and emergency management. These are:

1. **Natural hazards information**, which denotes the presence and effect of natural phenomena.

2.Information on natural ecosystems,which provides the basis for estimating the effect natural hazards can have on the goods and services these systems offer and also determines the factors or conditions that create, modify, accelerate, and/or retard the occurrence of a natural event.

3. Information on population and infrastructure, which is the basis for quantifying the impact natural events, can have on existing and planned development activities.

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Work Flow and Process Design

This part is considered as the chain of duties before, during and after the disaster that will reduce the risk taken. On the other hand, to manage the work flow and process design on the electronic media, the question of which institution will be renewing which data is answered. (Table 3.1 and Table 3.2)

	Process	Content Of Process	Methodology	Input for AFAYBİS	Produced in AFAYBİS
Mitigation	Spatial determination of risks	Earthquake, Flood, Fire, Landslide, Storm, Diseases, Tsunami, Thunderbolt, pollution, accidents, others	Creation of simulations and determination of risky areas with GIS	Possible risk areas and allocation of these areas	Maps about hazardous areas.
	Determination of risks for buildings.	Examination of public buildings, critical institutions, houses and other buildings.	Examination on the project or at survey and deciding at the office depending on zoning	Buildings that need precautions	Risk zones determined after examination and geoprocessing of the data
	Determination of risks for infrastructures and transportation	Electricity Water Gas Sewers Telecommunication Transportation	Examination on the project or at survey and deciding at the office depending on zoning	Technical Infrastructure lines and insutitions, transportation data. Technical infrasructures and transportation elements that needs strengthening	Buildings, critical instutions and technical infrastructures such as bridges tunnels etc. that needs precaution
	Damage Mitigation	Plans and permits	Control	New buildings and data	
		Education Announcements		Criteria's	Education Materials
		Mitigation and announcements of risks	Suggestions, Notices	Precautions that are already been taken	Reduced risk areas

Table 3.1 Process' before the disaster

Task definition	Content	Data	Produced in AFAYBİS
Personnel, vehicle, tools, supplies	Associations agreed to participate in with their personnel, vehicle, tools, supplies etc	Alarm Level Risk Zones Service groups	
Areas	Shelters Waste disposal zones Helicopter ,airlines sea lines, railroad transportation areas Supply depots, supply distribution points Morgues and burial zones Hospitals, portable hospitals, blood centres, ambulances Buildings in which chemical, nuclear, biological, explosive, flammable, materials are produced and sold Public buildings that needs to be protected and secured Historical signs, banks, shopping centres Planning of distribution of exterior aids Alternate communication ways Determination of radio stations, radios and broadcasts of security, rescue, first aid teams Planning of alternate transportation and public transport Planning of alternate seaports and harbours Determination of alternative railroad stations and vehicles Planning of alternate aerial transportation Determination of alternate fuel-oil stations Traffic Control Points	Criteria's (depending on alarm zones and scenarios) Sources (Building, Land usage, human, tools, supply) Content and location of protocols with private sector Properties lines and instutions of technical infrastructures Critical instutions that need electricity, water, gas, communication. Communication power supplies. Capacities of radio and broadcasting stations Highway lines, properties and instutions. Roads that needs to be held open Important bus lines Harbour, sea transportation, metro and railroad lines, aerial transportation vehicles, capacities and instutions of vehicles.	Plan assignments and informing Plan assignments depending on examination of Location + capacity + needs + average fullness ratios + alarm level Teams: Personnel, vehicles, tools, supplies Team - location Location- technical substrucure –transportation Team - technical substrucure -transportation

Table 3.2 Process' during and after the disaster

CONCLUSION

Information and Communication Technologies in form of Internet, GIS, Remote Sensing, Satellite communication etc. are indispensable in planning and successful implementation of most Disaster Risk Reduction initiatives. However, the potential of most advanced technologies is required to be harnessed in a way of early warning, preparedness and response systems along with adequate emphasis on building human capacities to use these tools and technologies. Disaster management activities depend on large volumes of accurate, relevant, on-time geoinformation that various organizations systematically create and maintain. The Advanced sources of information technology can be used to minimize the effects of disasters. Remote sensing on other hand, as a tool which can contribute very effectively towards identification of hazardous areas, monitor the planet for its change on a real time basis and gives early warning to many impending disasters. Communications satellite have become vital for providing emergency communication and timely relief measures. Integration of space technology inputs into natural disaster monitoring and mitigation mechanisms is critical for hazard detection. The increased availability of Remote Sensing data and GIS during recent decades has created opportunities for a more detailed and rapid analysis of natural hazards. The proper structure of information system for disaster management should be present to tackle the disaster and to manage it.

At such a general level, the objective is to give an inventory of disasters and the areas affected or threatened for an entire country. The following types of information should be included:

- Hazard free regions for development.
- Regions with severe hazards where most development should be avoided.
- Regions with hazards where development has already taken place and where measures are needed to reduce the venerability.

The remote sensing and GIS database can be used to create elaborate and effective Disaster Management Information System (DMIS). An integrated approach using scientific and technological advances should be adopted to mitigate and to manage natural hazards.

Disaster and Emergency Management System is basically to benefit modern technology to standardize, organize and manage the data and information about disaster management. To realize this, it aims at making it possible to reach the data quickly during or before a disaster, to create the maps and statistical information, to present the data in different multi user media and on internet.

This efficient and rapid share of data between and among the institutions will in turn enable the decisions to be made more accurately and more quickly. This will eventually positively affect the development of our country.