Paper Title:

Geographical Information System for Natural Disaster Management.

Paper Abstract:

Natural disasters are inevitable, and it is almost impossible to fully recoup the damage caused by the disasters. But it is possible to minimize the potential risk by developing disaster early warning strategies, preparing and implementing developmental plans to provide resilience to such disasters, and helping in rehabilitation and post disaster reduction. Space technology plays a crucial role in efficient mitigation and management of disasters. This paper describe the role of remote sensing and Geographical Information System (GIS) in evolving a suitable strategy for disaster management and occupational framework for their monitoring, assessment and mitigation, identifies gap areas and recommends appropriate strategies for disaster management using these technologies.

Introduction:

With the tropical climate and unstable landforms, coupled with high population density, poverty, illiteracy and lack of adequate infrastructure, India is one of the most vulnerable developing countries to suffer very often from various Natural Disasters, viz. flood, cyclone, earthquake, forest fire, drought, etc. Asia tops the list of casualties due to natural disasters. Space technology plays a crucial role in efficient mitigation of disasters. Communication satellite provides disaster warning and relief mobilization, Earth observation satellite provides required database for pre-disaster preparedness programmes and post-disaster preparedness programmes. They provide comprehensive, synoptic and multi temporal coverage of large areas in real time and at frequent intervals

Forest fire has deadly threatened human lives, fortune and ecosystem. The main reason for this is limitation of traditional method and no more scientific way to predict these disasters. We present that the fatal damage by forest fire could be reduced if there are suitable predictions and rapid provision against forest fire using GIS. This GIS is most perfect way for forest fire forecasting as Forest fire had a movement in both spatial and temporal.

GIMS (*Geographical Information and Modeling System, Kessell* -1990) was installed for a management of Forest Fire, which could assign a part by telling the shape of forest fire in real time and help managers of forest fire to take best decision against these disasters.

The study strategies are as follows, the investigation of actual forest fire area was first carried out and secondly constructed into GIS DB. Danger index of forest fire was computed based on topographic and meteorological factor in this area an evaluated the relationship between these factors and forest fire.

GIS has created opportunities for a more detailed and rapid analysis of natural hazards. GIS database can be used to create elaborate and effective *Disaster Management Information System (DMIS).*

Natural Disasters are inevitable, and Indian subcontinents is prone to all types of Natural Disaster either it is flood, drought, cyclone, earthquakes or *forest fires* etc.

Natural Hazard information should be included routinely in developmental planning and investment projects preparation. They should include cost/benefit analysis of investing in hazard mitigation measures, and weigh them against the losses that are likely to occur if these measures are not taken. GIS can play a role at the following levels:

a. National level-
b. Regional level-
c. Medium level-
d. Local level-
e. Site investigation scale-

Disasters can be classified in several ways. A possible sub-division of disasters is:

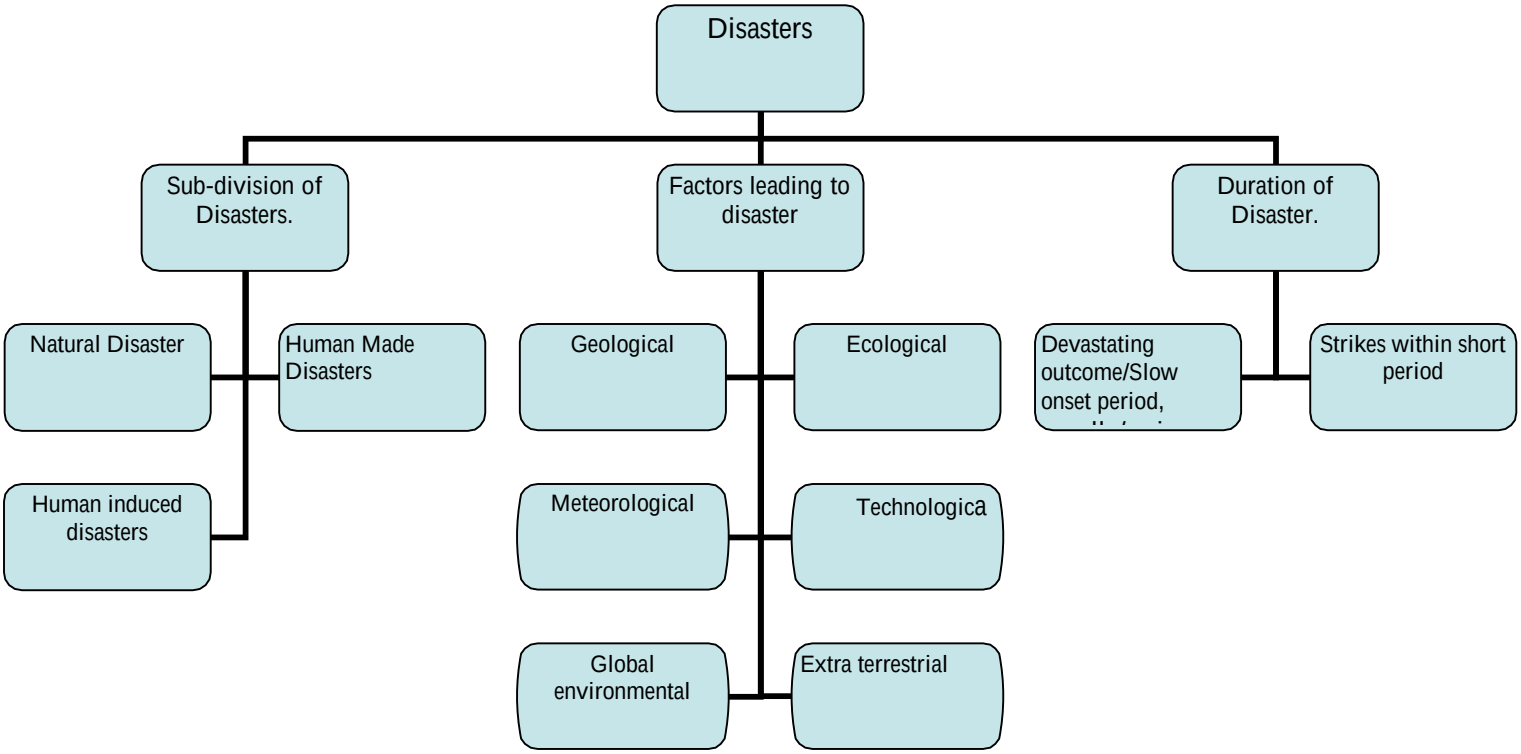
1. Natural Disasters
2. Human Made disasters.
3. Human induced disasters.

The main controlling factor leading to disaster may be

1. meteorologically
2. geomorphologic/geological
3. ecological
4. technological
5. global environmental
6. Extra terrestrial.

Duration of impact and time of forewarning:

1. Strikes within short period ,devastating outcome
2. Slow onset period, equally/serious repercussions.



(SAR) Search, rescue and evacuation processes are carried out immediately after the disaster has struck a certain area or zone. It is the process of identifying the location of disaster victims. The basic aim is to ensure the survival of the maximum possible number of victims. It generally involves local people who are well versed with local terrain and can be instrumental also.

Traditionally, due to lack of technology and scientific approach, it was difficult to carry out the SAR operation. There are techniques available, like remote sensing thro' satellite imagery and GIS , which help to identify areas that are disaster prone, zoning them according to risk magnitudes, inventory populations and assets at risk, and simulating damage scenarios as they provide instant access to information required for management decision.

Definition of GIS:-

Geographical Information System is a computer based information system that enables capturing, modeling, manipulation, retrieval, analysis, and presentation of geographically referenced data, It is a facility for preparing, presenting, and interpreting facts that pertain to the surface of the earth.

GIS is defined as a "powerful set of tool for collecting, storing, retrieving at will, transforming and displaying spatial data from a real world for a particular set of purpose"

GIS based Decision Support System (DSS) provides an advanced modeling system for environmentalists so that they can reliably generate and simulate more information about environmental parameters. One of the key components in spatial DSS is the Data Warehousing and analysis.

GIS operates as a front – end with disaster management database, providing it flexibility to respond to user queries regarding specific details of availability of infrastructure.

GIS allows the combination of different kinds of spatial data with non-spatial data, attribute data and use them as useful information in the various stages of disaster management.

Remote sensing and GIS in disaster management Mitigation of natural disaster management can be successful only when detailed knowledge is obtained about the expected frequency, character, and magnitude of the hazards events in an area.

Remote sensing and GIS provides a database from which the evidence left behind by disasters that have occurred before can be interpreted, and combined with the other information to arrive at hazard maps, indicating which area is potentially dangerous. Using remote sensing data, such as satellite imageries and Ariel photos, allows us to map the variabilities of terrain properties, such as water, vegetation, geology, forest etc.

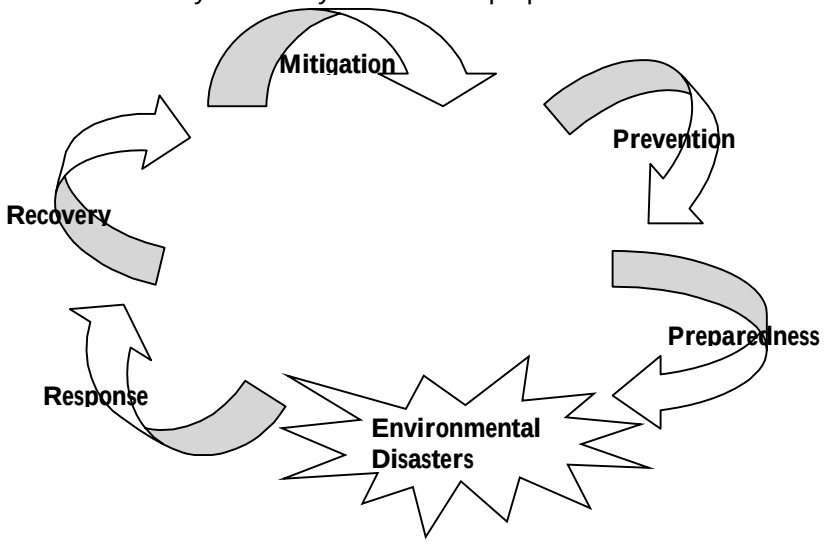
Diagrammatic representation of a typical disaster management cycle- (page 12)

GIS software applications are extensively used for emergency preparedness and response planning by city administrators in such cases.

Disaster management consists of two phases that takes place before disaster occurs, disaster prevention and disaster relief, rehabilitation and reconstruction.

In a typical disaster management cycle, disaster prevention, disaster mitigation, and disaster preparedness constitute the pre-disaster planning phase i.e. before disaster occurs and response, recovery and mitigation as the post-disaster planning phase i.e. disaster prevention phase.(Pearson et al.,1991)

Use of GIS would be a necessity in these cases, in view of the spatial nature of the input as well as output data, and the software-based analysis engines would provide the abilities for fast and accurate analysis of the possible scenarios. Hence, robust GIS software ERM application can be very effectively used for this purpose.



It would comprise of a set of smaller sub-systems for

1. Displaying the past hazard and loss data.
2. Displaying the human, property and ecological exposure data.
3. Storing emergency management related departments' locations, contact details and capacity.
4. Linkages with real time, online systems for tracking and communication of the hazard and damage spread.
5. Models for risk analysis and resource mobilization based on the available data.

Conclusions

In conclusion, due to the need for displaying and analyzing a huge volume of the spatial as well as non-spatial environmental hazards and exposure data in a fast and accurate way, and also due to the progressive increase in the g-Readiness of the users, GIS based software applications would continue to serve as powerful tools for effective environmental risk assessment and management.

Analysis of hazard is a complex task, as many factors can play important role in the occurrence of the disastrous event. Therefore, analysis requires a large number of input parameters, and techniques of analysis may be very costly and time consuming. The increase availability of Remote Sensing data and GIS during the last decades has created opportunities for a more detailed and rapid analysis of natural hazard. The proper structure of information system for disaster management should be present to tackle the disaster and to manage it. 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. Moreover there should be a national policy for natural disaster management.

Appendix 1 References

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A p p e n d i x 2 N o t a t i o n s

GIS Geographical Information System