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Role of Geographical Information System and Remote Sensing in disaster management

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Abstract
India is vulnerable to natural and manmade disasters that are spatial in nature. GIS techniques act as a decision support tool. Decision making can possible by analysis of different GIS layers. Currently socio-economic and geo-spatial data is useful for management and planning of disasters as well as handling of disastrous condition. Various departments and agencies who are stakeholders using GIS in the disaster management process. GIS, RS & GPS is useful in disaster management applications & for decision making. Evolution of computer technology and availability of hardware is helpful for rapid expansion of GIS in both disaster research and practice. GIS is useful for hazard zone mapping and during emergency conditions mitigation of people can easily possible using this maps. GIS and RS much beneficial in mitigation strategies and preparedness plans. Real time geographic data can improve the allocation of resources for response. GIS technologies are much useful in modeling of disaster risks and human adaptations to hazards. It is also provides decision support system in disaster management.

Keywords: disaster management, nature, GIS techniques act

Introduction

Disaster Management System

Following the enactment of the Disaster Management Act, 2005, (DM Act, 2005) the Government of India (GOI) constituted the National Disaster Management Authority (NDMA) with the mandate, for laying down policies and guidelines on DM. At the national level, there is to be a paradigm shift from the erstwhile relief centric and post-event syndrome to pro-active prevention-, mitigation- and preparedness-driven DM. These efforts will conserve developmental gains and also minimize loss of lives, livelihood systems and property. These Guidelines have been evolved by the NDMA, through a nine-step process. This approach ensures that all contemporary knowledge, experience and information are taken on board, clear destinations are identified, and road maps drawn with milestones duly marked off through a wide consultative process, involving all the stakeholders. Recognizing the gravity of the risk and vulnerability of India to floods, the NDMA, soon after its constitution initiated a series of consultations with the various stakeholders to develop Guidelines for strengthening the existing arrangements for flood preparedness, mitigation, and post-flood emergency response, relief, rehabilitation and reconstruction (figure 1). Senior representatives from the Central Ministries/ Departments and the state governments, related agencies, academics and professionals attended these meetings. The meetings acknowledged that, while several significant initiatives had been taken by government agencies in the past for addressing the risk and vulnerability of India to disasters, it is necessary to undertake measures for the evolution of a holistic and integrated strategy to address the critical factors that accentuate risk.

Fig 1: Disaster Management System

- **Mitigation:** Emergency is the discipline of dealing with and avoiding risks. It is a discipline that involves, steps taken to contain or reduce the effects of an anticipated or already occurred disastrous event.
- **Preparedness:** It is how we change behavior to limit the impact of disaster events on people.
- **Response:** An effective plan for public health and other personnel during a disaster would outline activities designed to minimize the effects of the catastrophe. These efforts can be summarized as closely situation analysis and response.
- **Disaster Recovery:** The aim of the recovery phase is to restore the affected area to its previous state. Recovery efforts are concerned with issues and decisions that must be made after immediate needs are addressed.

Remote Sensing Technology

The Earth observation using satellite remote sensing technique has made it possible to obtain 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 (Figure 3). The two main components of the space-based sub-system of the EOS, Polar Orbiting and Geostationary, continue 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.

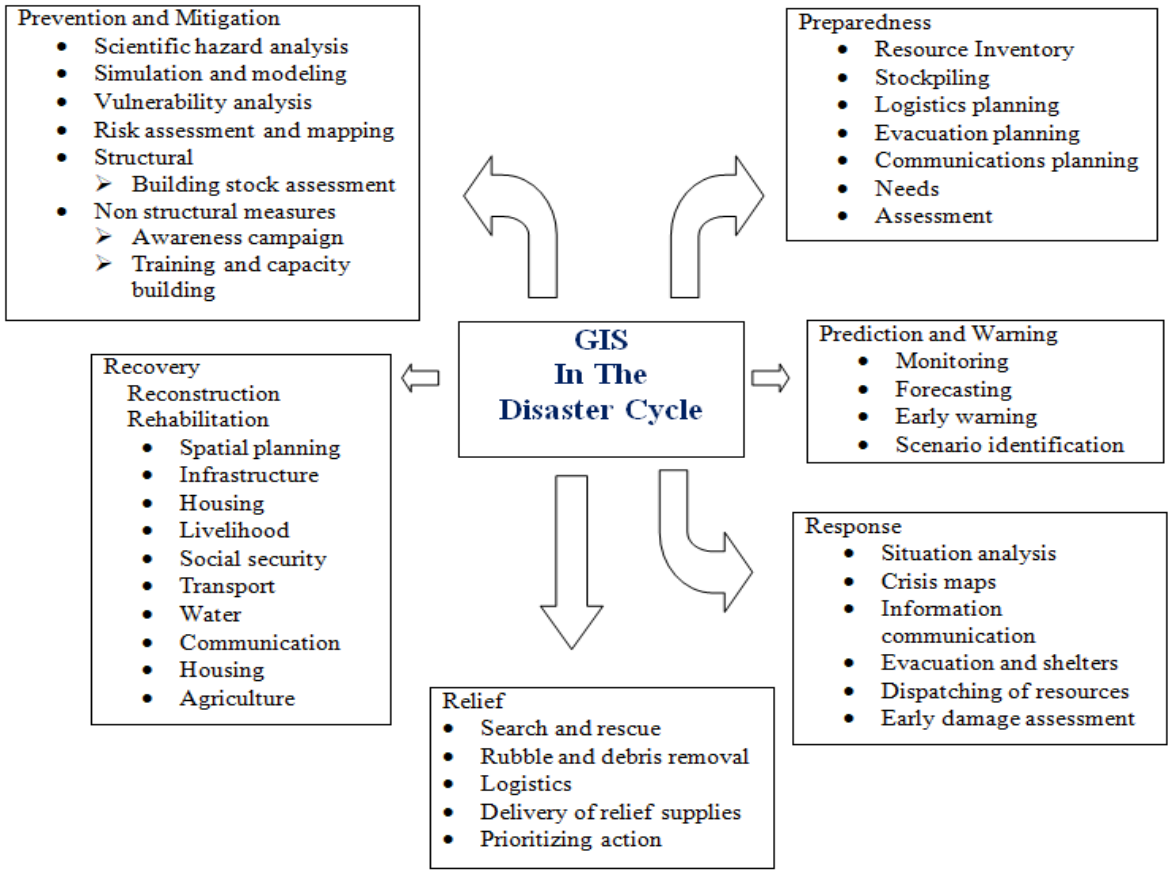

Fig 2: Application of GIS in disaster

Typical polar orbiting satellites are the NOAA-AVHRR, the French SPOT and the US LANDSAT and TM series. The data received from polar-orbiting satellites is very useful in understanding and monitoring the natural hazards. Also, the effect of the space and time distribution of water accompanied by phase changes on the water and energy budget at the earth surface from the point of view of understanding and control of the mechanism of environmental changes can be better evaluated with satellite data.

Disaster Management is done by following steps

1. Planning and Analysis
2. Situational Awareness
3. Data Management
4. Field Operations

Planning and Analysis

GIS is the most complete information system for modeling, analyzing spatial data and displaying community vulnerability. When we identify hazard locations with critical infrastructure. Processed GIS Models can be useful for determination of event impact and necessary mitigation requirement. Preparedness is important when disastrous event occurs. On analysis of risk and hazards is beneficial in Emergency management program

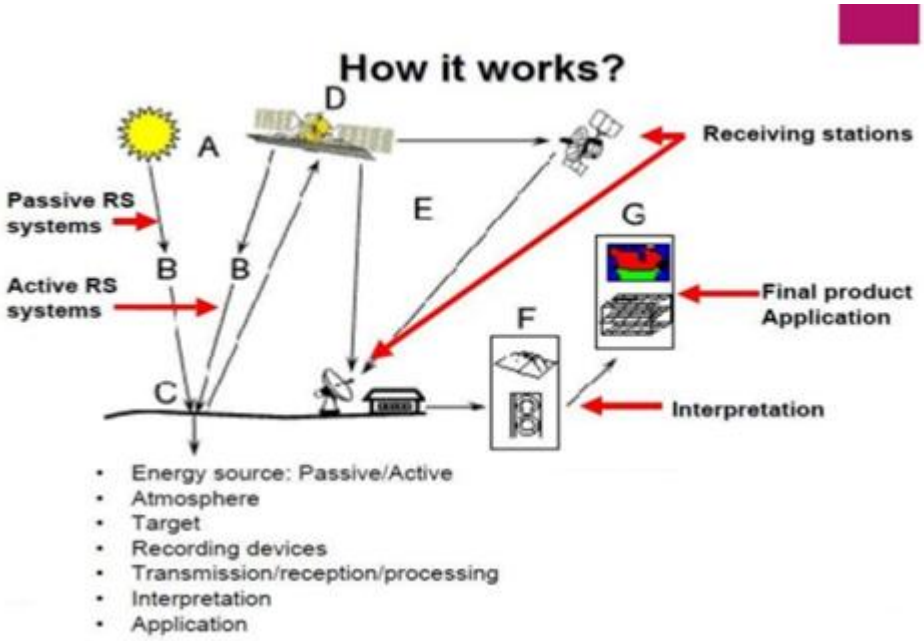

Fig 3: Stages of Remote Sensing

Situational Awareness

Disaster and emergency management in situational awareness is essential thing. GIS techniques plays vital role to provide locational information of the event, that is, where is the event happened and what happening exactly in real time. Also by linking people, processes spatial information situational awareness established. GIS map interface important in handling emergency condition.

Data Management

To achievement of preparedness, gathering of information and its advance data storing is important. In GIS, integration of information from other sources is possible. GIS solution is a standards-based. Accurate cataloging of GIS data provide useful information during emergency conditions.

Field Operations

Field data is very important in GIS applications and Mobile GIS provides crucial information. Field teams captures information and sent back to user. So ground information useful for recognizing actual event conditions. Then new data can be sent to operation teams in field (where disaster occur), so they have the information possible for protecting lives and providing safety to people. Whether its response or recovery phase, Mobile GIS provides right information

Important objectives of GIS database generation are,

Disaster managers from different state, city, village level using GIS database for disaster planning.

- Preparedness and planning of disasters
- Forecasting and early warning of disastrous event
- For relief management, rescue operations

GIS database with various themes is helpful to disaster managers in decision making process when catastrophic event occur.

GIS database include following information which is beneficial in disaster management

1. Use of different satellite imageries (Remote Sensing data) ex. Quickbird, SPOT, IKONOS for GIS data creation.
2. Preparation of base map of different themes using satellite imageries.
3. Thematic maps such as hydro geomorphologic map, slope map, terrain map, and DEM generation in GIS. It is used for disaster planning.
4. Macro and micro level maps used for identifying vulnerability and threat condition
5. Identification of safe locations and zones for rehabilitation
6. Road and location maps used for finding alternate routes, shelters and locations
7. Planning of evacuation and operation
8. Management of Rehabilitation and post-disaster reconstruction.
9. Suitable locations identifying scientifically for construction of houses and shelters
10. No construction areas identified and rehabilitation of existing people can be done.
11. Hospitals and medical facilities identification for injured people.

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