CHAPTER 5

Application of Geospatial Technology (GT)

Learning Objectives

By the end of this chapter students can understand some of the case studies related to:

5.1 Introduction about application of Geospitial Technology (GT)
5.2 Watershed studies
5.3 Flood studies
5.4 Health Issues
5.5 Utility studies
5.6 Security and Defense studies
5.7 Urban and infrastructure development studies
5.8 Disaster Relief / management

5.1 Introduction

Geospatial Technology is commonly known as geomatics. The technology is used for visualization, measurement, and analysis of features or phenomena that occur on the earth. Geospatial technology is used in various organizations such as civilian, business, government and military.

The advancement of these technologies helps in effective management of natural resources. These Technologies helps in many applications like soil, geomorphology, hydrogeology, land use, agriculture, land records, urban, infrastructure development, water resources, watershed management, disaster management, health, education, security and defense etc . In this chapter we are discussing some of the case studies are discussed below

> Geospatial is a term widely used to describe the combination of spatial software and analytical methods with geographic datasets.

5.2 Watershed Studies

Watershed management is an integration of technologies within the natural boundaries of a drainage area for optimal development of land, water and plant resources to meet the basic needs of people in sustainable manner. Watershed management refers to balanced utilization of land water resources for best possible production with minimum risk to natural resources. Due to increased demand on water resources and its utilization the management is essential.

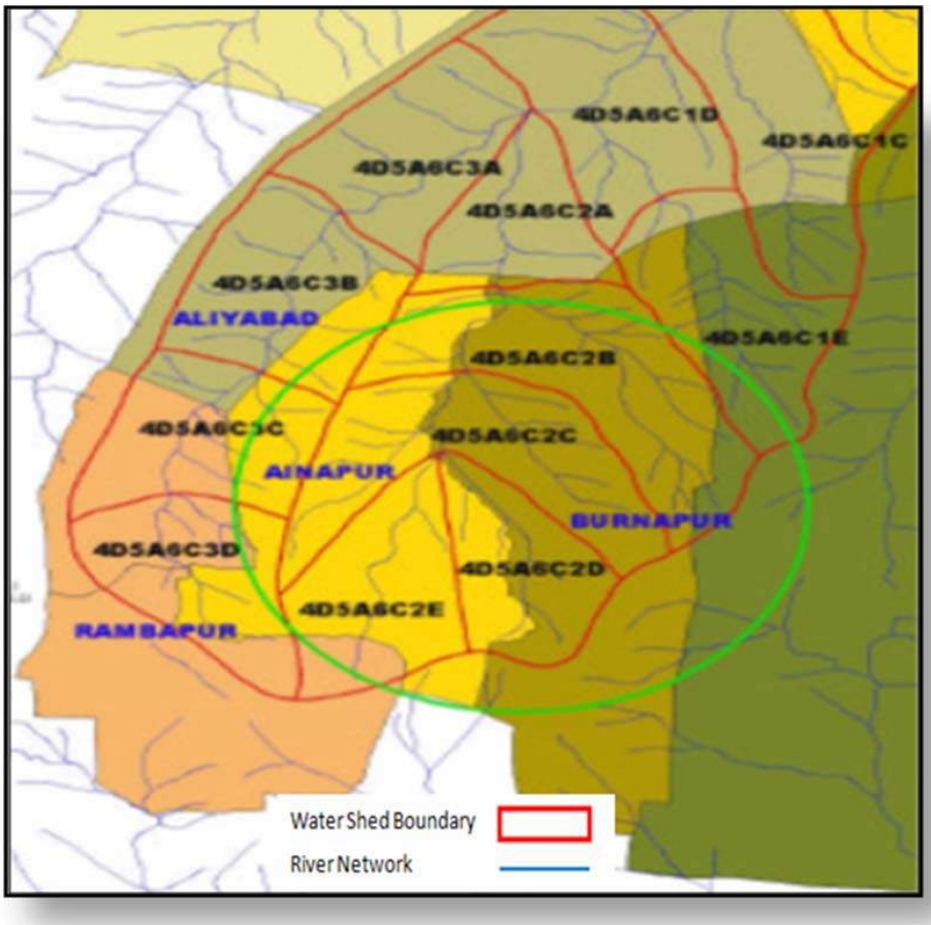


Fig. 142

Doddahalla watershed and village Boundaries

Keeping this in view the study entitled "GIS-based technologies for watershed Management" by Mr. A. K. Gosain & Ms. Sandhya Rao (Current Science, Vol. 87, No. 7, 10 October 2004). This study demonstrates the use of GIS-based modeling framework for local-level planning, incorporating the sustainability aspects of watershed development. The study has been conducted in Bijapur district, Karnataka to demonstrate the implementation and use of Geospatial technology for watershed prioritization. This study has been developed on the Doddahalla watershed, wherein micro-watershed prioritization has been carried out using hydrological, demographic and socio-economic parameters. The Doddahalla watershed in Bijapur district, northern Karnataka, with an area of about 61,000 hectare has been modeled. This is a chronically drought-prone district with a large agrarian population predominantly depending on rain fed agriculture. Upstream watershed with an area of 31,000 hectare is being treated and the remaining 30,000 hectare area belonging to the downstream watershed

has been used for detailed analysis in the present study. This part of the watershed covers 30 villages of Indi and Bijapur taluks.Watershed prioritization is an important aspect of planning for implementation of the watershed management program. Implementation of the hydrological model estimates of water and sediment yield at the micro-watershed level which is being used in the planning process. The spatial tool helps in estimating the related parameters such as water spread area and available water storage capacity at that location. This application is also useful to help the watershed managers in prioritizing the watersheds with respect to the predetermined norms. The application was also be used for monitoring and evaluation of the watershed programs.

5.3 Flood Studies

Floods are the most recurring, widespread, disastrous and frequent natural hazards of the world. India is one of the worst flood-affected countries. In India about 40 million hectares of geographical area falls under flood-prone. The plains of north Bihar are some of the most flood prone areas in India. Flood Hazard Mapping is a vital component for appropriate land use planning in flood-prone areas. It creates easily-read, rapidly-accessible charts and maps which facilitates the administrators and planners to identify areas of risk and prioritize their mitigation/ response efforts.

Fig. 143

Effects of Kosi River (Bihar) Flood in 2008

- Over 2.5 million people affected
- Over a million rendered homeless
- Approx. 80 deceased
- Loss of 4000 acres of fertile land
- Railway tracks submerged
- Electricity disrupted
- Roads damaged
- Loss of cattle

The study entitled "GIS in Flood Hazard Mapping of Kosi River Basin, India" by G.Venkata Bapalu & Rajiv Sinha, GISdevelopment.net This Case study presents an efficient methodology to accurate delineate the flood-hazard areas in the Kosi River Basin, North Bihar, using Remote sensing GIS technology. One of the multi-criteria decision-making techniques, Analytical Hierarchical Process (AHP) were used to assess and integrating the impact of various factors. The study presents novel methodology for computing a composite index of flood hazard, derived from various factors such as topographical, land cover, geomorphic and population related data. All data are finally integrated in a GIS environment to prepare a final Flood Hazard map. This flood hazard index computed from AHP method for all flood prone area. It has also considered of various factors that are inherently related to flood emergency management. Below figures shows the overview of the methodology and flood hazard map of the study area.

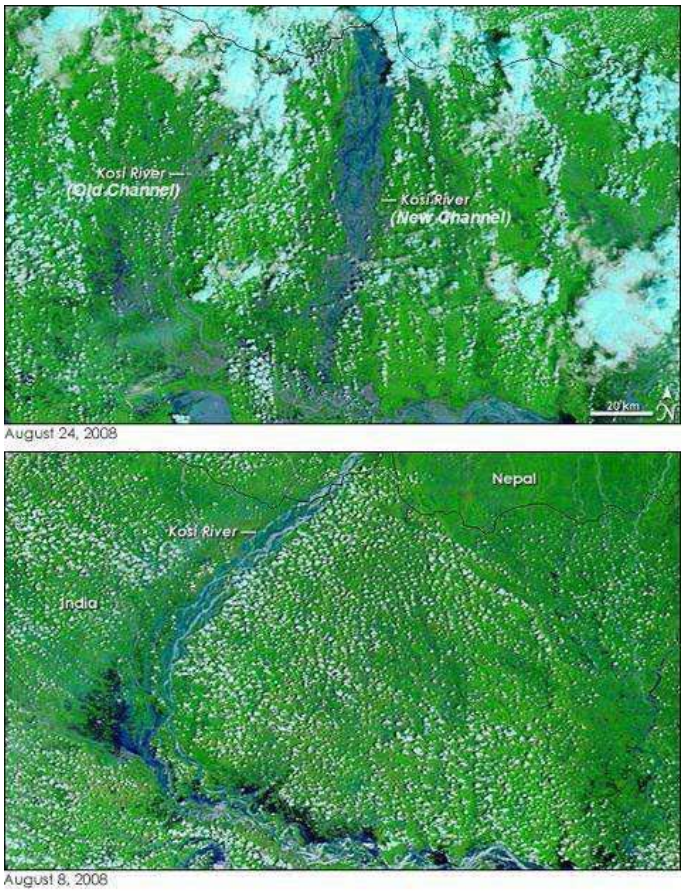


Fig. 144

Significant portion of the Kosi (75%) is flowing through embankment. Around 25% flowing through in the main channel. The Current flow of the river after the embankment breach is following the old course of 1926 Source: Dr. S.K Srivastav, ISRO

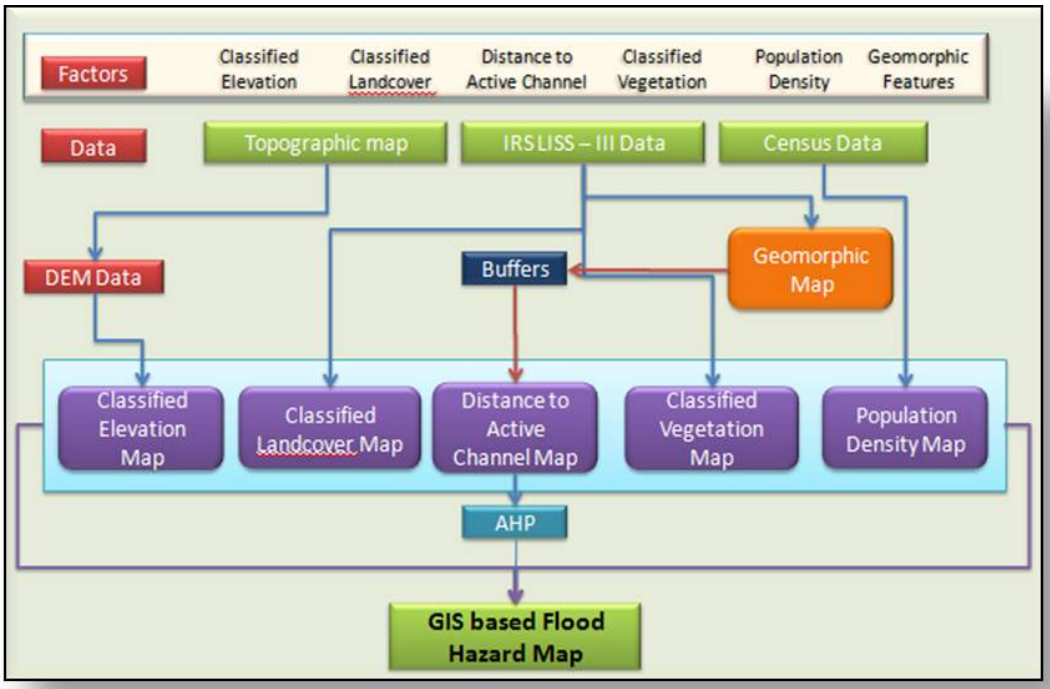


Fig. 145

Methodology followed by the Flood Hazard Mapping

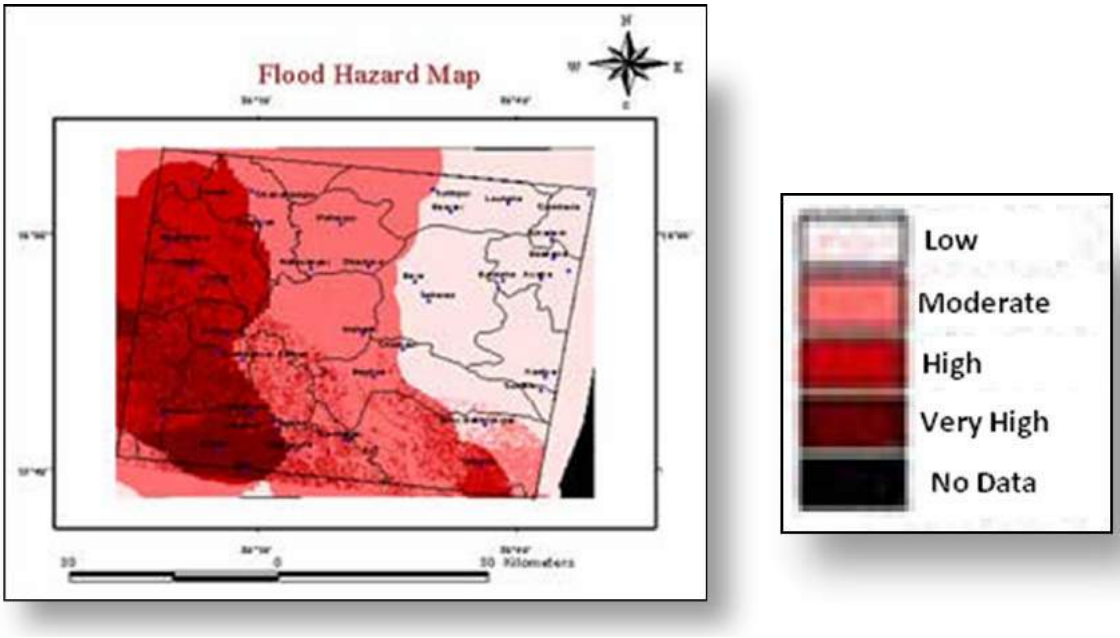


Fig. 146

Flood Hazard Map of Kosi River Basin

The study represents some exploratory steps towards developing a new methodology which is inexpensive and easily accessible charts and maps of flood hazard based on morphological, topographical, demographical related data? The study has also focused on the identification of factors controlling flood hazard in the study area to reduce short term and long-term damages. The basic merit of this methodology is its simplicity and low cost.

5.4 Health issues

Dengue fever (DF) associated with dengue hemorrhagic fever/dengue shock syndrome DHF/ DSS) has emerged as an important public health problem in the countries of the South-East Asia and Western Pacific regions. In India dengue fever has been known since the 19th century and epidemics have been reported from almost all part of the country. The study entitled "Application of GIS in Modeling of Dengue Risk Based on Socio-cultural Data: Case of Jalore, Rajasthan, India" by Alpana Bohra & Haja Andrianasolo, (Dengue Bulletin – Vol 25, 2001).

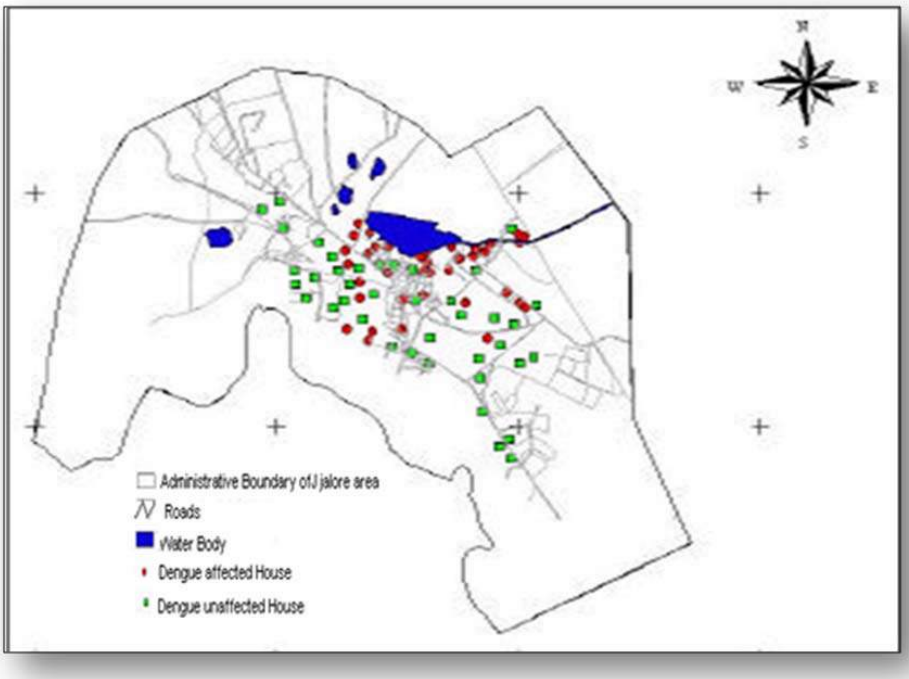


Fig. 147

Spatial location of dengue affected and unaffected houses in Jalore

The data collected through personal interviews from both dengue –affected samples (DAS) and unaffected samples (UAS). Findings indicated that out of sixty socioeconomic and socio-cultural variables, only sixteen were co-related significantly with Dengue. These sixteen

variables were used in the stepwise regression model; only eight variables, namely, frequency of days of cleaning of water storage containers, housing pattern, use of evaporation cooler, frequency of cleaning of evaporation cooler, protection of water storage containers, mosquito protection measures, frequency of water supply and waste disposal made a significant contribution to the incidences of DF/DHF/DSS. The geographical information system (GIS) has been used to link the spatial and significant socio-cultural indicators with the disease data. Using factorial discriminate analysis and spatial modeling with these eight socio-cultural indicators, five classes of risk categories ranging from "very low" to "very high" were identified based on the analysis of socio-cultural practices adopted by DAS and UAS and from the application of GIS. Below figure shows the affected and non- affected household and Dengue risk levels associated with social and cultural parameters in Jalore

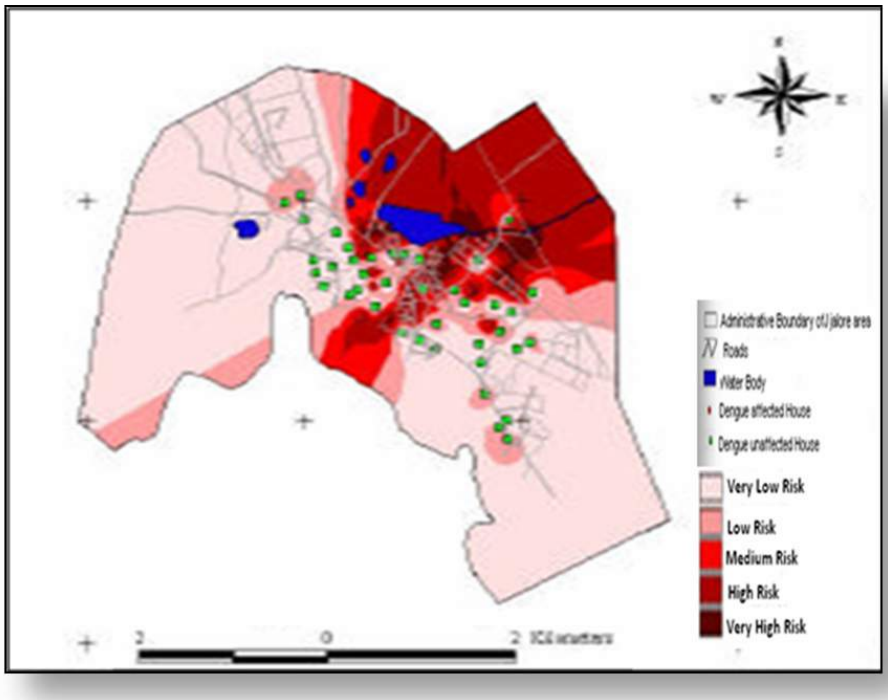


Fig. 148

Dengue risk levels associated with social and cultural parameters in Jalore

5.5 Utility Studies

Utility departments are responsible for maintaining, updating & storage of land base map and Electric network for operations area. For effectively carrying out the maintenance and updating related drawings the various sections carrying out different activities such as preparing layout plan, route plan, substation details, extension sketch, service cards, validation schemes. Utility departments follow the manual drafting method which is time consuming and Inherent human errors. These Paper based drawings have a limitation of providing details for small area. Paper based drawings are perishable and deteriorate over a period of time. It requires

Fig. 149

continuous re-work to maintain data legibility & condition. At the same time data sharing is difficult. It requires laborious methods like tracing etc for data sharing. Data storage and retrieval is cumbersome & are prone to deterioration. Due to the manual drafting method other works are pending because it takes time. Editing of paper maps are cumbersome & lengthy process. Remote sensing and GIS helps in atomization of these activities. GIS helps to convert the paper maps into digital maps. Remote sensing helps to updating the land and electrical database. GIS integrated with utility department helps to Measure the Cable length Locate Block, Pole, Transformer, location of distribution substation etc as shown in below figure. This type of study was implemented and entitled "Digitization & Automation of Drawings for Facility Management" at Mumbai, Maharashtra by Brihan Mumbai Electric Supply & Transport Undertaking (BEST, 2010-2011). Study involves automate the Drawing & Planning Department activities.

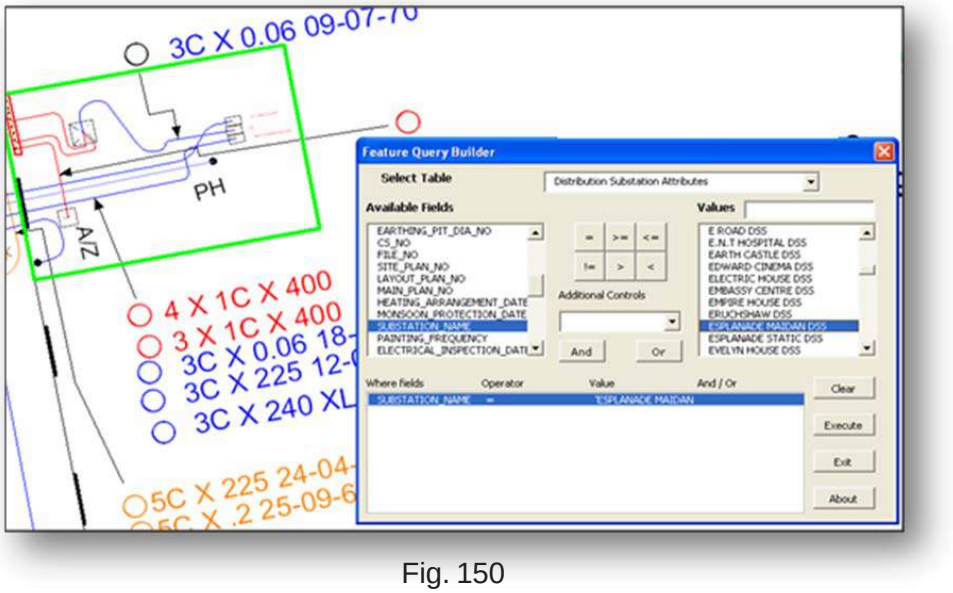


Fig. 150

GIS helps in identifying the location of Distribution Substation

Use of GIS & RS in Utility projects is very significant. It offers tangible and intangible benefits. Some of the benefits are listed below

- Significant improvement in time.
- Laborious task of edge matching of drawings are eliminated, Re-work for various drawing office activities are eliminated
- Enhanced outputs & Prints
- Easy updating of various drawings
- Process of generation blue prints & coloring of blue prints is eliminated
- Tangible Benefits includes, productivity enhancements, capability developments, quick response to unanticipated events or emergencies, possibility to interface with ERP & other business systems in the organization
- Some of Intangibles benefits are revenue generation through improved productivity and less operating costs.

5.6 Security and Defense Studies

Geospatial technology uses latest computer technology to assist the police in responding faster to distress calls with greater accuracy. It would improve the quality of services to the public. Using this new technology Police force will now able to quickly identify the location of a fixed line Dial 100 distress call within seconds on a map of area. The study entitled "Dial 100/103 Distress Call Management with GIS/GPS based Vehicle Tracking & Dispatch" is operational in Maharashtra. The system records related information of any emergency event. While the distress call details are being registered, operators can quickly locate the nearest police patrol vehicle to the reported site of crime/ incident with help of GPS and GIS. This would help

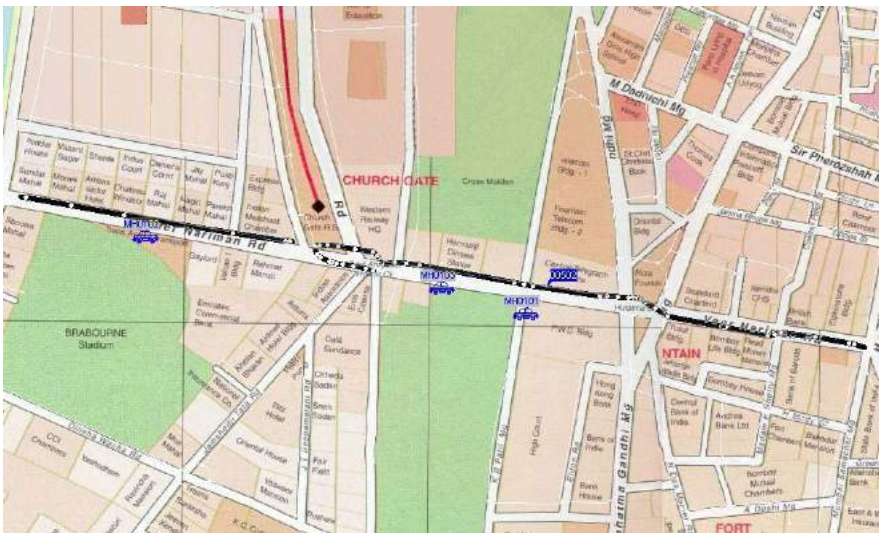


Fig. 151

Finding the location of nearby police vehicle by GIS Maps

the control room officials to immediately alert the patrol teams on field. This high-end technology improves its reaction time to any emergency incident and betters services to the common public. With the introduction of this system, the Call taker will have immediate access to address and map data, allowing them to accurately verify the incident location. Once the Call taker has accepted the incident, an icon is placed on the map view which represents location of the incident. The incident details are recorded in the central database and the information automatically forwarded it to the Dispatcher for action. The map view provides a real-time display of the location of the police vehicles (AVL) and the location. GPS unit is installed in each police vehicle so the location of the vehicle is available in the digital map as shown in above figure. Therefore Dispatcher can quickly assign a police vehicle to attend an incident using all the information collected by the Call taker. All decisions made by the Dispatcher are also time-stamped and recorded in the central database to confirm the response to distressed call. Similar types of studies are operational in Chandigarh, Punjab, and in Rajasthan police. By implementing this system the police force can provide Quick response to Public Distress Calls. Earlier to this system there was no real time tracking for nearby patrolling vehicle. So the quick response was not possible. It was slow. Police force also struggling a lot to collect the information about the distressed call. By enabling this system the resource management in police department is improved. Police could do the effective crime analysis of certain area. Traffic planning is improved. Multi Emergency & Security agency support such as Police, Fire, Medical, and Municipal can be achieved. Below figure shows the work flow of dispatch call tracking.

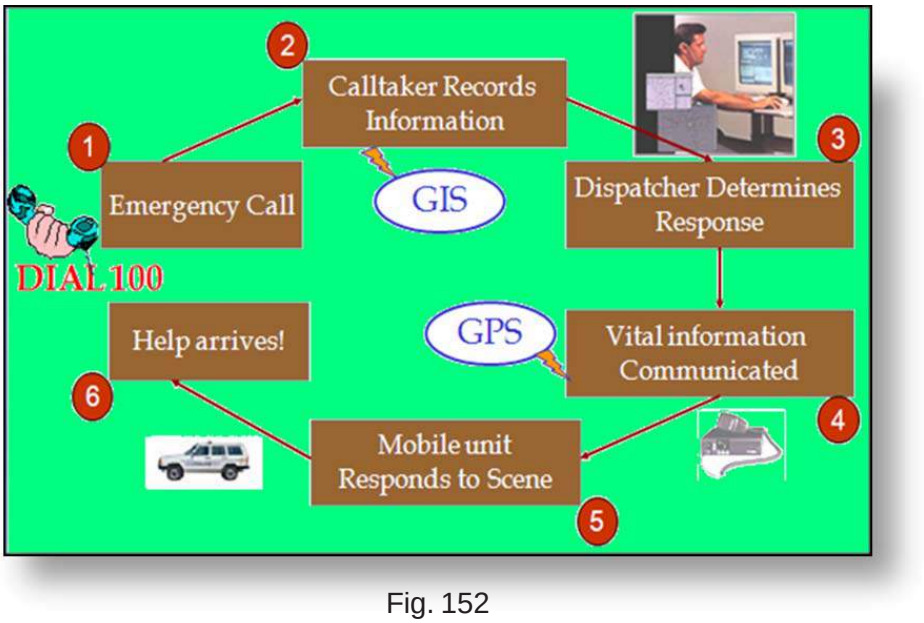


Fig. 152

Dispatch call tracking Work Flow

5.7 Urban and Infrastructure Studies

The urban development authorities need the automation of the day-to-day functioning requirements of the civic body. Remote sensing and GIS is required for the effective working of the Municipalities and facilitating the local public with the best of their services. These technologies help for efficient, economical and meaningful municipal administration, including the tax administration (house tax, water tax, sewerage tax etc.) Satellite data helps in creating large scale maps using ground truthing and attribute data collection of property and utility taxes. GIS based urban planning system can be Implementation both desktop and Web based platform. This study entitled "Urban Planning for Municipalities /Urban Development" is functioning in Nasik Municipal Corporation. Similar type of projects also implemented in Town & Country Planning Dept., Haryana State & Authorities Using such system municipalities are have access to large scale maps with latest information, GIS / MIS tools help in day- to-day administration and maintenance. System provides the customized tools for Assets inventory for best possible resources. System increases revenue of the department. GIS tools also helps in visualization for future growth in different areas such as road network, water supply, public health, sanitation, and solid waste management, slum improvement and up-gradation, public amenities including ,parks, gardens, and playgrounds, street lighting, parking lots.

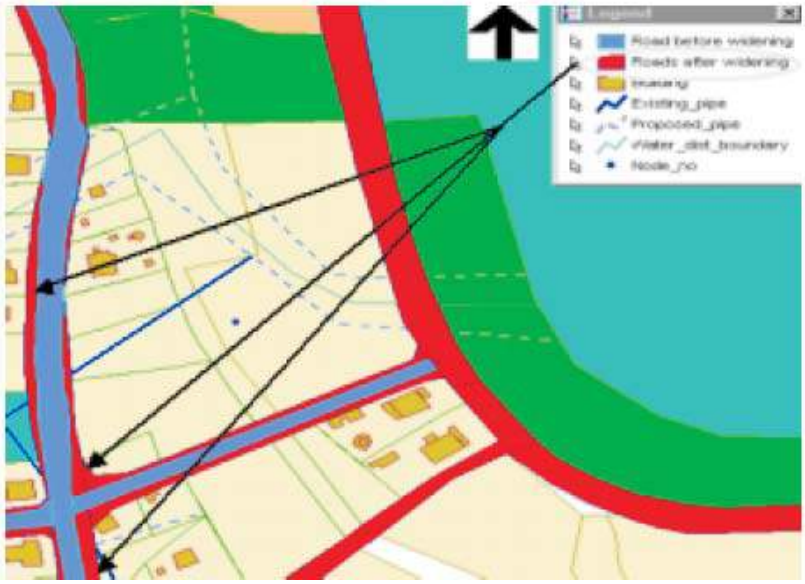


Fig. 153

Urban and Infrastructure Planning thru GIS

5.8 Disaster Relief / management

Satellites help to identify disaster prone areas like droughts, floods and landslides. Satellite communications can be used for early warning of people at risk, when other communication network fails. Satellite images may be used to assess damage resulting from earthquake, landslides, floods, oil spill and other disaster.

Fig. 154

Role of Geospatial Technology in disaster management

Fig. 155

Effects of Tsunami in Sumatra Indonesia - 2004

The earthquake 8.9 magnitude recorded in Japan (March - 2011) the satellite Imagery shows the Tsunami affected areas

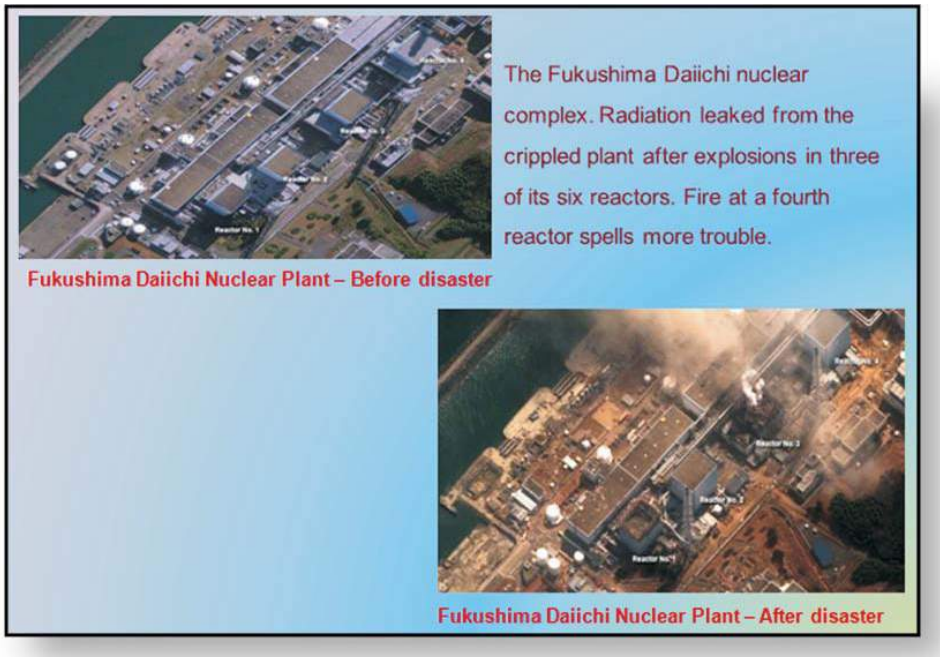


Fig. 156

Effects of Earthquake in Japan – 2011

Souce: Newyork Times 15 March 2011

Whole neighborhoods were in ruin and cars and debris were piled high around Iwaki.

Fig. 157

Before

Fig. 158

After

Effects of Earthquake in Iwaki area Japan – March 2011

Souce: Newyork Times 15 March 2011

Let us wrap up what we covered in this chapter

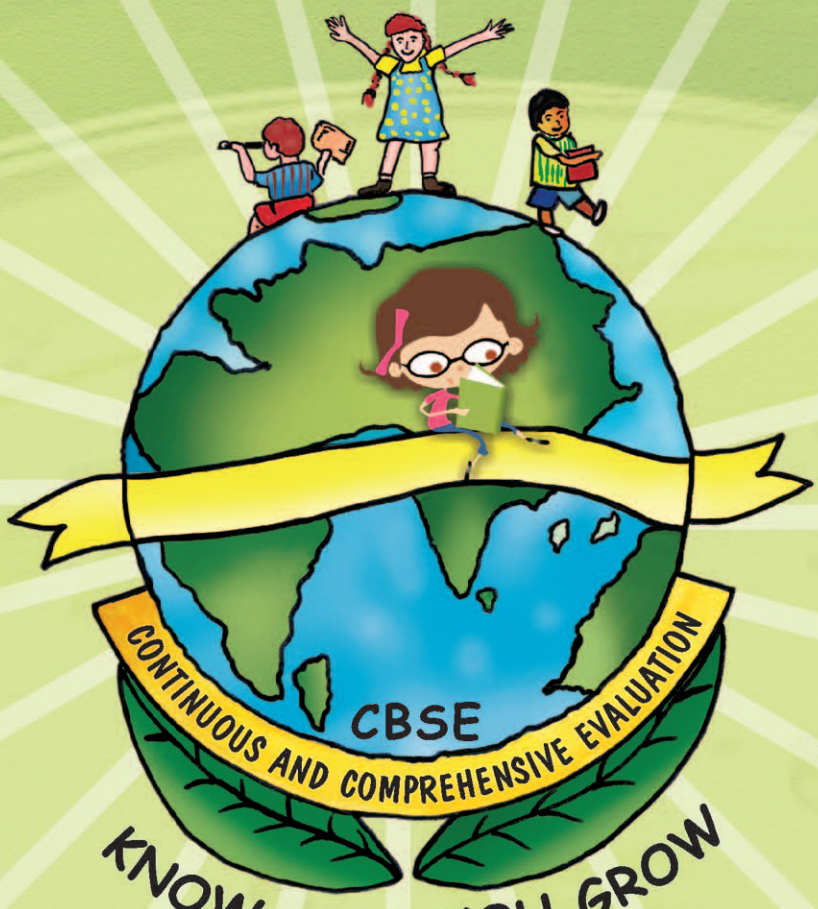
- The Geospatial Technology helps in many applications like soil, geomorphology, hydrogeology, land use, agriculture, land records, urban and infrastructure development, water resources and watershed management, disaster management, health and education, security and defense.
- Watershed management is an integration of technologies within the natural boundaries for optimum development of land, water and plant resources to meet basic needs of the people
- The watershed management can also be used for monitoring and evaluation of watershed programs
- Flood hazard mapping is a vital component for appropriate land use planning in flood prone area.
- Flood hazard mapping creates easy reach, rapidly accessible charts and maps which facilitate for the administrator and planers to indentify the areas for risk and prioritize their mitigation and response efforts.

- Flood hazard mapping in identification of factors controlling flood hazard in the study area.
- The objective of spatial modeling in Health management system was to create linkage between household, socio-cultural practices and dengue incidents. This model is capable of indentifying different risk levels.
- Uses of GIS and Remote Sensing in utility projects very significant. It offers tangible and intangible benefits.
- Geospatial technology uses latest computer technology to assist the police in responding faster to distress call with greater accuracy. It improves the quality of services to the public
- GIS, MIS tools helps in urban planning for municipalities and urban development authorities. It automates day to day functioning requirements of civic body
- These technology helps for efficient ,economical, and meaningful municipal administration including Tax administration

Review

Very Long Questions

1. Explain how Geospatial Technology helps in following area
    a) Watershed management
    b) Flood Hazard Mapping
    c) Groundwater Management
    d) Health Management
    e) Utility Mapping
    f) Security and Defense
    g) Urban and infrastructure development
    h) Disaster and relief management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