

# **M.Sc. Remote Sensing and GIS**

## **RT-402**

### **Remote Sensing in Environment**

#### **Unit-IV**

#### **4.3 Disaster detection/mitigation through RS**

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# Satellites Used

- ▣ LANDSAT(Earth Resources Technology Satellite)
- ▣ IRS(Indian Remote Sensing Satellite)
- ▣ SPOT(Système Pour l'Observation de la Terre)
- ▣ RADARSAT
- ▣ ERS1,ERS2(European Remote Sensing Satellite)
- ▣ ENVISAT(Environmental Satellite)
- ▣ GOES(Geostationary Operational Environmental Satellites )
- ▣ LIDAR(Light Detection And Ranging)

## Applications of Some Current Satellite Sensors for Disaster Management

Satellite	Sensor	Spatial Res	Type of Disaster
METEOSAT	VIS	2.5 km, Day & Night obs	Cyclones, volcanic eruptions, floods
NOAA	AVHRR	1.1 km	LC detection, fires, drought Volcanoes
LANDSAT	MSS TM	30 & 80 M	Land use, flood extent, landslide, fire, drought
SPOT	PAN HRV	10 & 20M	3Dmapping, Floods, landslide

Satellite	Sensor	Spatial Res	Type of Disaster
IRS	PAN LISS WIFS	6,23,188M	3Dmapping,Flo ods,landslide
ERS	SAR	25-500M(All Weather)	Earthquake,Fire, landslides,night coverage,floods, 3D Mapping
RADARSAT	SAR	10 - 100M(All Weather)	Earthquake,Fire, landslides,night coverage,floods, 3D Mapping
IKONOS	PAN MSS	1 & 4M	High res mapping, Infrastructure identification, terrain analysis, property damage assessment.

# GIS Applications

- ❖ **To create hazard inventory maps:** At this level GIS can be used for the pre-feasibility study of developmental projects, at all inter-municipal or district level.
- ❖ **Locate critical facilities:** The GIS system is quite useful in providing information on the physical location of shelters, drains and other physical facilities
- ❖ The use of GIS for disaster management is intended for planners in the early phase of regional development projects or large engineering projects
- ❖ It is used to investigate where hazards can be a constraint on the development of rural, urban or infrastructural projects



- ❖ **Create and manage associated database:** The use of GIS at this level is intended for planners to formulate projects at feasibility levels, but it is also used to generate hazard and risk maps for existing settlements and cities, and in the planning of disaster preparedness and disaster relief activities.
- ❖ **Vulnerability assessment:** GIS can provide useful information to boost disaster awareness with government and the public, so that (on a national level) decisions can be taken to establish or expand disaster management organizations. At such a general level, the objective is to give an inventory of disasters and simultaneously identify “high-risk” or vulnerable areas within the country

# GIS and the Disaster Management Cycle

## Planning

GIS is useful in helping with forward planning. It provides the framework for planners and disaster managers to view spatial data by way of computer based maps

## Mitigation

- ❖ The use of GIS in disaster management can help with structural and non-structural mitigation
- ❖ GIS allows you to spatially represent areas at risk and the level of risk associated with a particular hazard, which can be a guide in decision making
- ❖ It will facilitate the implementation of necessary mechanisms to lessen the impact of a potential emergency
- ❖ With GIS, disaster managers are in a better position to determine the level of mitigative structures that should be in place given the vulnerability of an area or population

## Preparedness

- ❖ GIS can help with the identification and location of resources and “at risk” areas
- ❖ It establishes a link between partners and critical agencies, which allow disaster managers to know where relevant partner agencies are stationed
- ❖ GIS maps can provide information on the human resources present in an Emergency Operation Centre as well as on the ground personnel such as security, health providers and other key responders.
- ❖ This is particularly useful since the technology can help with strategic placement of emergency personnel where it matters most
- ❖ GIS helps to answer the question of who is to be based where and at what phase during the emergency
- ❖ It can help to determine whether or not road infrastructure and communications networks are capable of handling the effects of disaster and, if necessary, guide in the placement of resources



## Response

- ❖ GIS technology can provide the user with accurate information on the exact location of an emergency situation. This would prove useful as less time is spent trying to determine where the trouble areas are.
- ❖ Ideally, GIS technology can help to provide quick response to an affected area once issues (such as routes to the area) are known. In the case of a chlorine explosion for example, GIS can indicate the unsafe area as well as point rescue workers to resources that are closest to the affected areas.
- ❖ GIS can be used as a floor guide for emergency response to point out evacuation routes, assembly points and other evacuation matters

## Recovery

- ❖ Mapping and geo-spatial data will provide a comprehensive display on the level of damage or disruption that was sustained as a result of the emergency.
- ❖ GIS can provide a synopsis of what has been damaged, where, and the number of persons or institutions that were affected. This kind of information is quite useful to the recovery process

# RS & GIS FOR FLOODS

## Information required for flood manager

S.No	Phase	Required Information
1	Flood preparedness (Before Flood)	<ul style="list-style-type: none"><li>– Chronically flood prone areas</li><li>– Prior information on probable flood affected areas with considerable lead time</li><li>– Optimum evacuation plans</li></ul>
2	Relief and Rescue (During flood)	<ul style="list-style-type: none"><li>– Flood affected areas</li><li>– Flood damage statistics</li><li>– Updation of the flood condition in terms of flood recedence and persistence etc.</li></ul>
3	Flood Mitigation (After Flood)	<ul style="list-style-type: none"><li>– Changes in the river course</li><li>– The status of flood control works</li><li>– River bank erosion</li><li>– Drainage congestion</li><li>– Flood Risk zones</li></ul>

## During Preparation Phase

- ▣ Using historic satellite data acquired during floods, it is possible to provide the chronically flood prone areas in form of a map showing severely affected, occasionally affected etc.
- ▣ Prior information on probable flood affected areas using hydrological models can be provided
- ▣ Using flood inundation models in GIS environment, optimum evacuation plans can be generated for carrying out rescue operations

## During Floods

- ▣ A flood map showing spatial extent of the flood affected areas
- ▣ Flood damage statistics like district wise flood affected area, submerged crop, marooned villages and length of submerged road/rail can be provided
- ▣ Satellite data can be used at regular intervals for updation of the flood condition on the ground in terms of flood progression, recedence and persistence



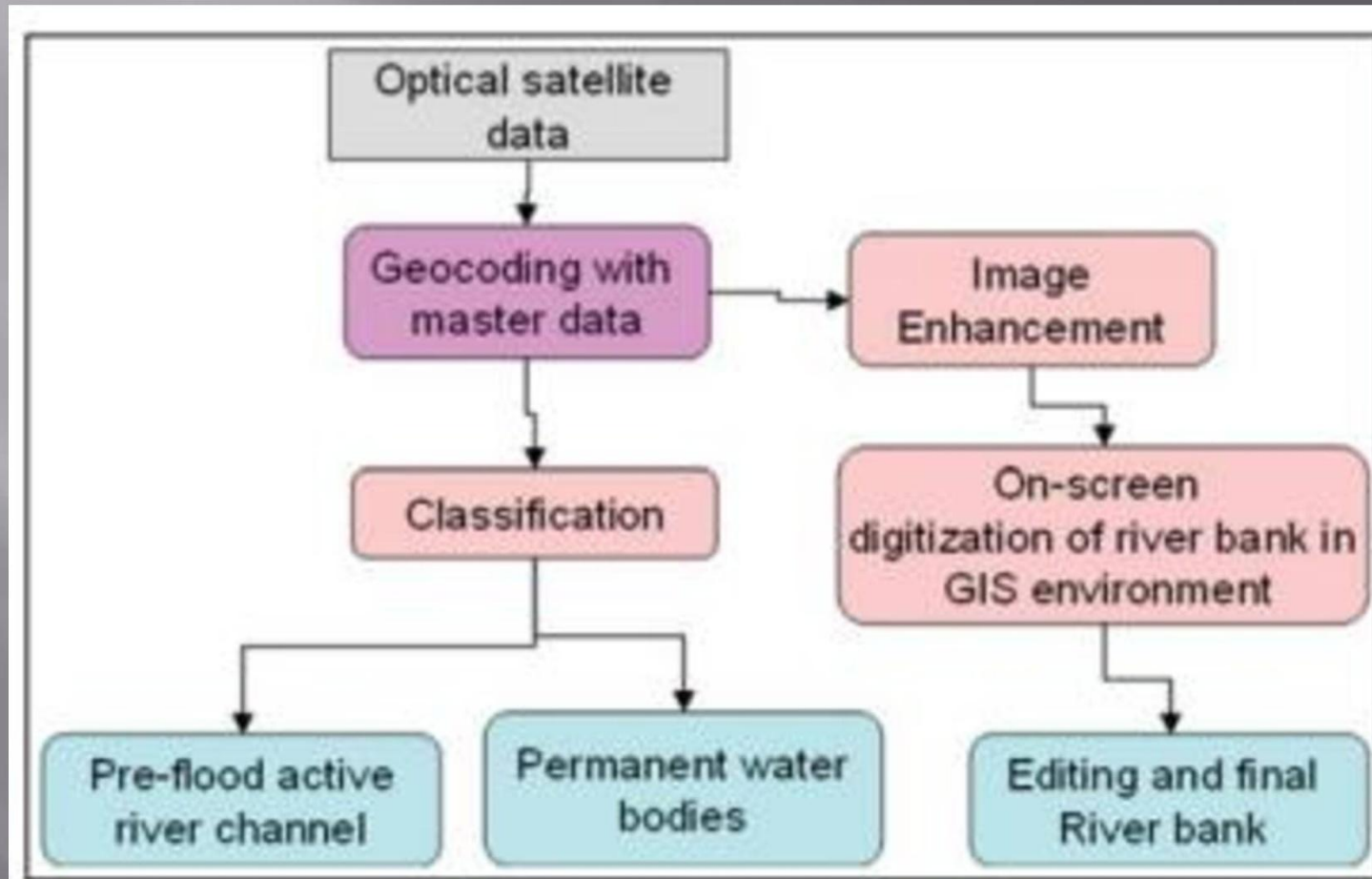
## During Mitigation phase

- ▣ Using high resolution satellite data ,mapping of river configuration and flood control works, changes in river configuration and studies on bank erosion / deposition can be carried out
- ▣ Demarcate the drainage congestion areas in chronic flood prone areas
- ▣ Flood hazard and risk zone maps can be generated using multi year satellite data acquired during floods

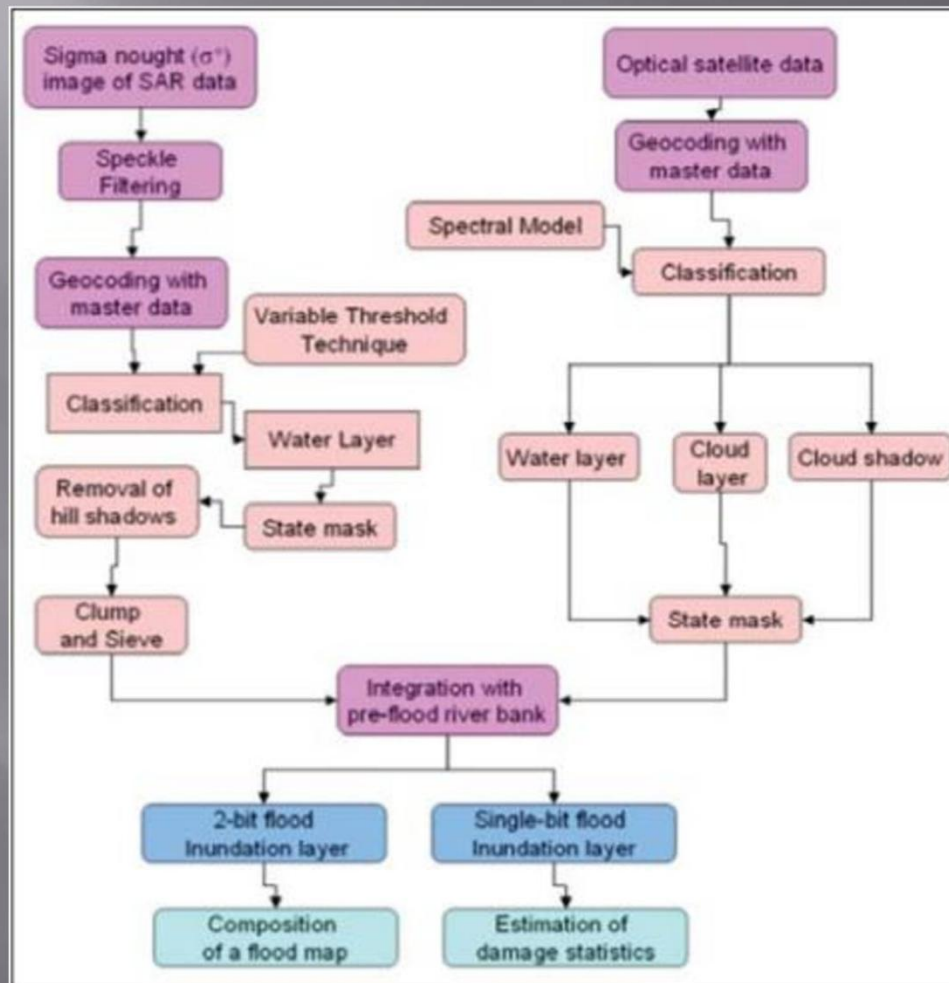
## IPS - P6,IRS-P4,NOAA & TERRA/AQUA RADARSAT satellites are used flood analysis studies

Satellite	Sensor	Spatial resolution	Use
IRS-P6	AWIFS	56	Regional Level flood mapping
IRS-P6	LISS-III	23.5	District Level mapping
IRS-P6	LISS-IV	5.8	Detailed mapping
IRS-1D	WIFS	188	Regional Level mapping
RADARSAT 1	SAR	100	Regional Level mapping

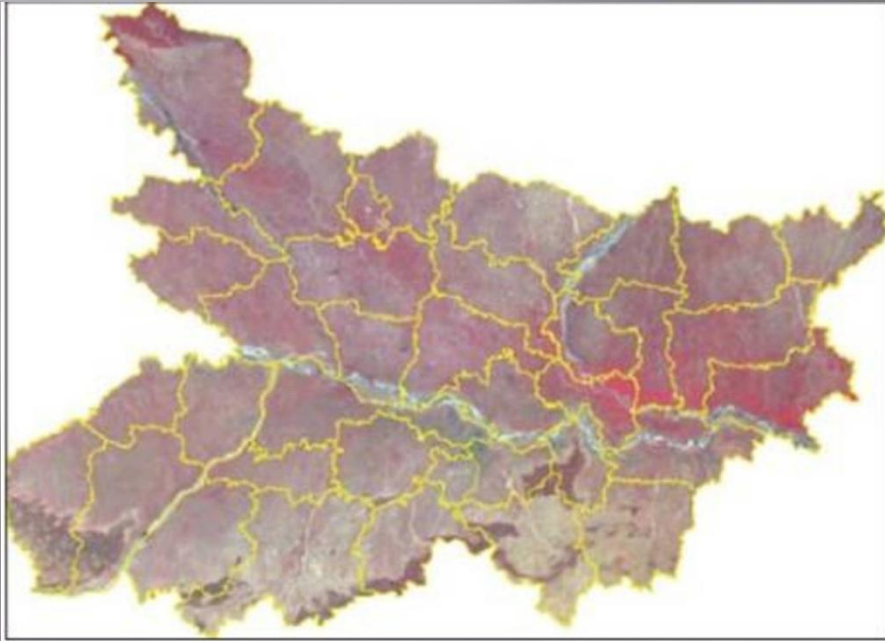
## Flow chart for pre flood analysis of optical data



# Methodology for analysis of satellite data during floods

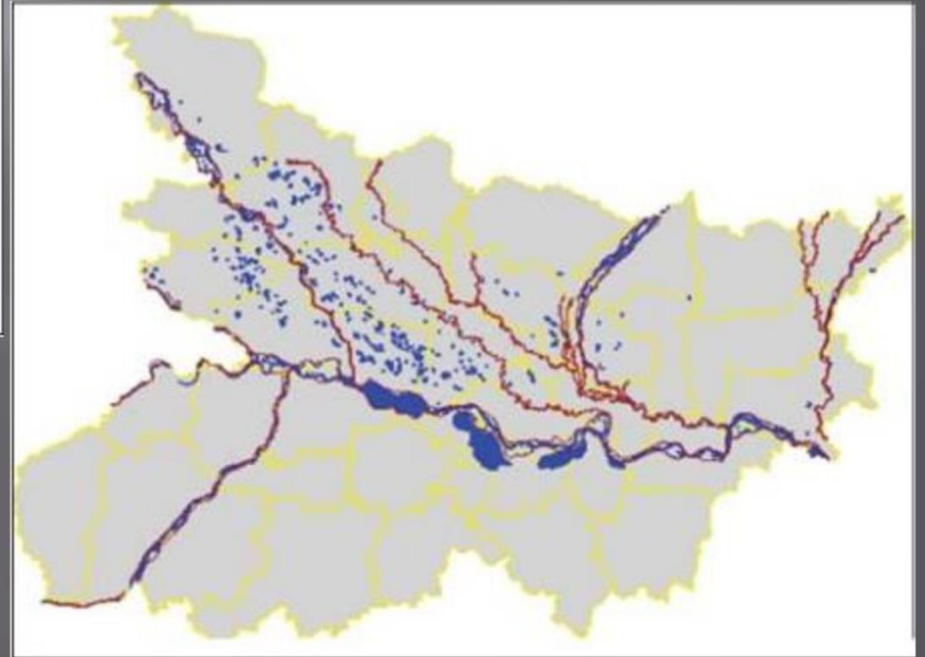


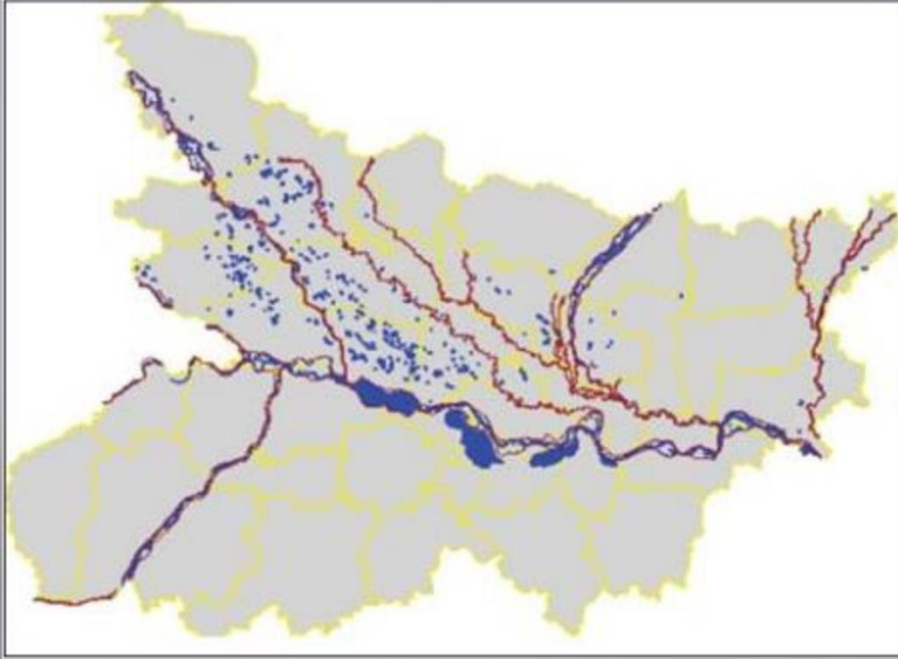




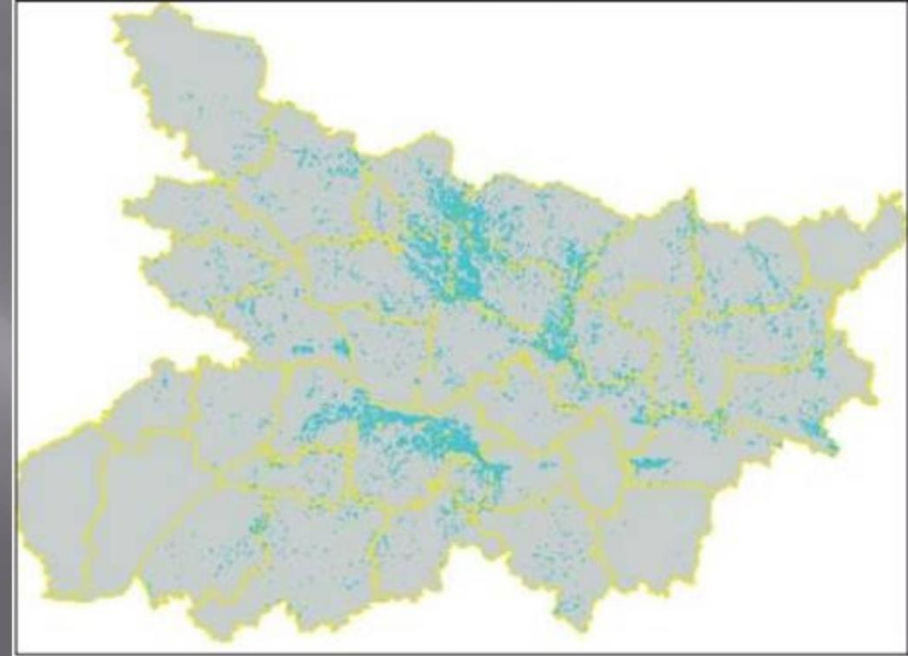
Pre flood AWIFS image of Bihar

River bank and permanent  
water bodies

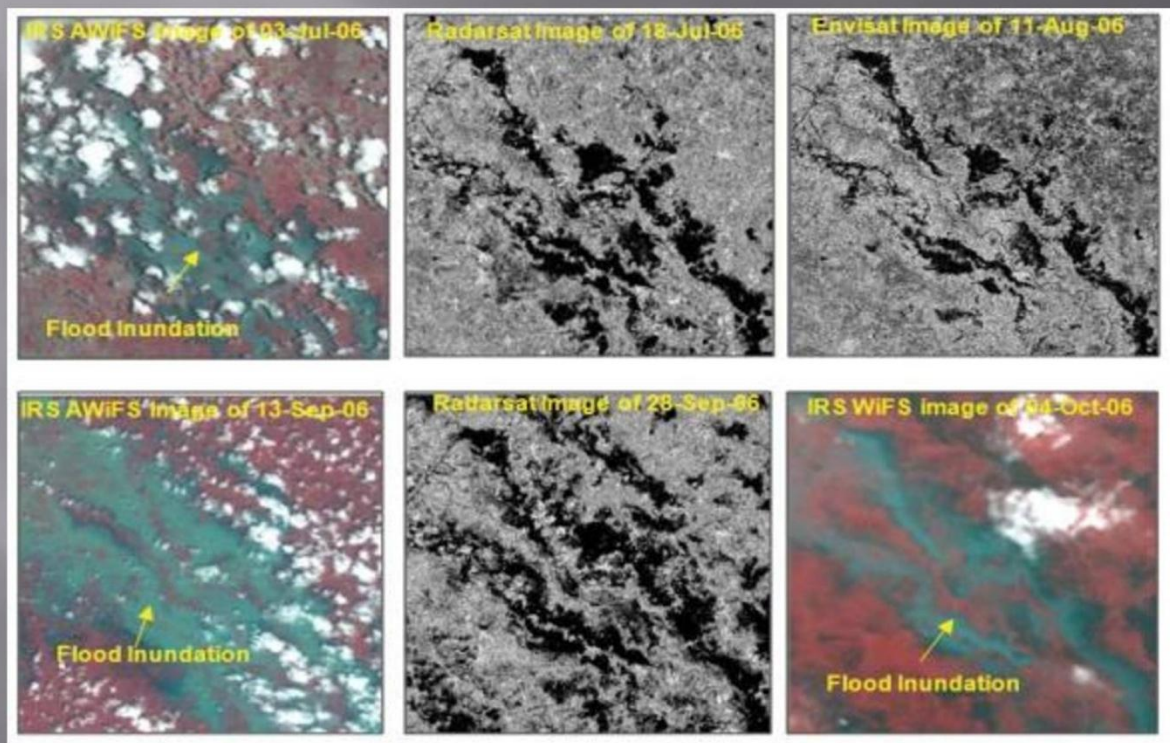




River bank and permanent  
water bodies



Extracted Single bit Flood inundated  
layer



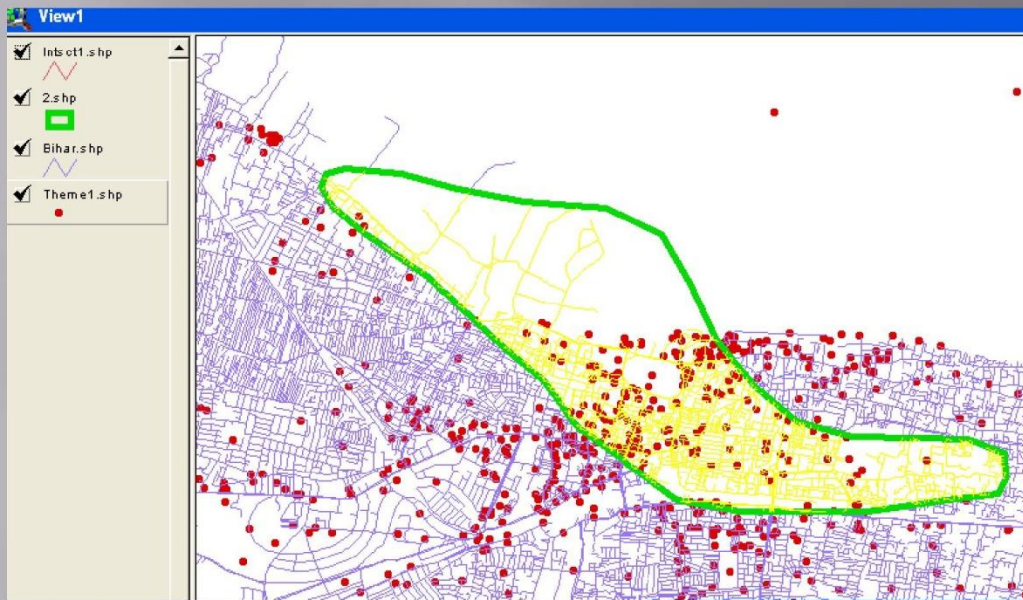
Continuous monitoring from July to October







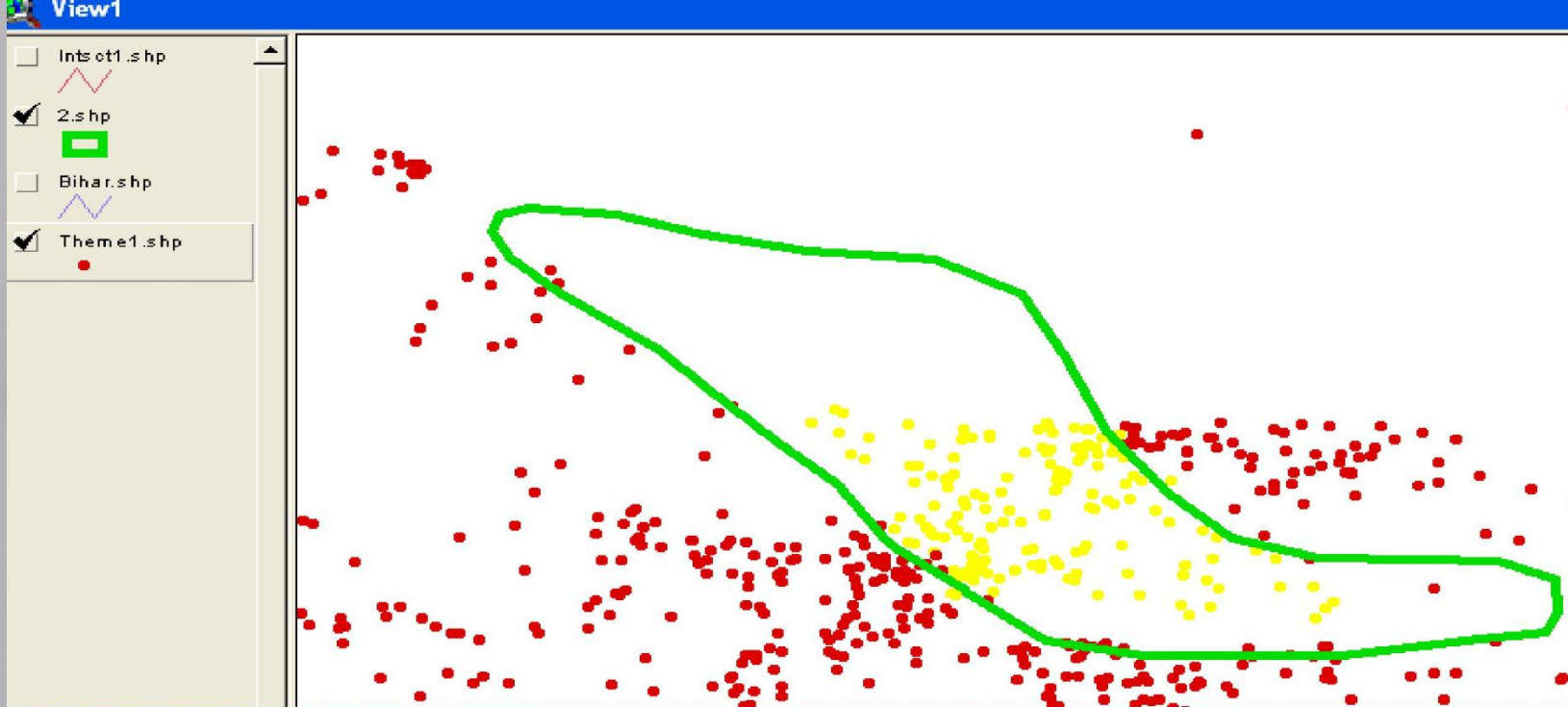




Attributes of Intsct1.shp									
<i>Intsct1</i>	<i>Intsct1_id</i>	<i>Category</i>	<i>Code</i>	<i>Direction</i>	<i>Fhgt</i>	<i>Thgt</i>	<i>Movement</i>	<i>Name</i>	
1526643	1894982	ROAD	2000	0	0	0	0	TWO WAY	Bakarganj Rd
1526571	1894919	ROAD	2000	0	0	0	0	TWO WAY	Bakarganj Rd
1526540	1894894	ROAD	2000	0	0	0	0	TWO WAY	Bakarganj Rd
1526533	1894888	ROAD	2000	0	0	0	0	TWO WAY	Bakarganj Rd
1526367	1894733	ROAD	2000	0	0	0	0	TWO WAY	Bakarganj Rd
1526186	1894574	ROAD	2000	0	0	0	0	TWO WAY	Bakarganj Rd
1526163	1894553	ROAD	2000	0	0	0	0	TWO WAY	Bakarganj Rd
1526126	1894521	ROAD	2000	0	0	0	0	TWO WAY	Bakarganj Rd
1526059	1894463	ROAD	2000	0	0	0	0	TWO WAY	Bakarganj Rd
1525992	1894399	ROAD	2000	0	0	0	0	TWO WAY	Bakarganj Rd
1526727	1895059	ROAD	2000	0	0	0	0	TWO WAY	Bakarganj Rd
1526726	1895058	ROAD	2000	0	0	0	0	TWO WAY	Birba Mandir Rd
1525555	1894013	ROAD	2000	0	0	0	0	TWO WAY	Birba Mandir Rd
1524831	1893360	ROAD	2000	0	0	0	0	TWO WAY	Birba Mandir Rd
1525803	1894235	ROAD	2000	0	0	0	0	TWO WAY	Birba Mandir Rd
1525366	1893842	ROAD	2000	0	0	0	0	TWO WAY	Birba Mandir Rd
1526418	1894782	ROAD	2000	0	0	0	0	TWO WAY	Birba Mandir Rd
1530221	1898294	ROAD	1000	0	0	0	0	TWO WAY	Dak Bunglow Hwy(NH-30)
1530249	1898320	ROAD	1000	2	0	0	0	ONE WAY	Dak Bunglow Hwy(NH-30)
1529971	1898061	ROAD	1000	0	0	0	0	TWO WAY	Dak Bunglow Hwy(NH-30)
1530071	1898152	ROAD	1000	0	0	0	0	TWO WAY	Dak Bunglow Hwy(NH-30)
1530025	1898114	ROAD	1000	0	0	0	0	TWO WAY	Dak Bunglow Hwy(NH-30)
1530300	1898368	ROAD	1000	2	0	0	0	ONE WAY	Dak Bunglow Hwy(NH-30)
1530199	1898273	ROAD	1000	0	0	0	0	TWO WAY	Dak Bunglow Hwy(NH-30)
1530181	1898255	ROAD	1000	0	0	0	0	TWO WAY	Dak Bunglow Hwy(NH-30)
1530089	1898167	ROAD	1000	0	0	0	0	TWO WAY	Dak Bunglow Hwy(NH-30)
1530283	1898352	ROAD	1000	2	0	0	0	ONE WAY	Dak Bunglow Hwy(NH-30)

Figure showing the list of roads got affected due to floods





**Attributes of Theme1.shp**

<i>Alias/Name</i>	<i>Name</i>	<i>State</i>
	Jagdar	Bihar
	Tola Dehurkhi	Bihar
	Tola Agahara	Bihar
	Tola Sarebad	Bihar
	Tola Sabaijor	Bihar
	Tola Bautha	Bihar
	Tola Ghutwe	Bihar
	Kanhaipharka	Bihar
	Keshopharka	Bihar
	Shaharpharka	Bihar
	Churhit	Bihar
	Dokli	Bihar
	Tola Jugri	Bihar
	Tola Debipahari	Bihar
	Tola Sono	Bihar
	Tola Mandhata Majra	Bihar
	Tola Sonradih	Bihar
	Tola Balthar	Bihar
	Tola Balkakna	Bihar
	Tola Khushaldih Majri	Bihar
	Tola Kewali	Bihar
	Tola Mangruadih	Bihar
	Tola Thakurkura	Bihar
	Tola Debidih	Bihar
	Tola Chendara	Bihar

Figure showing the villages falling with in flood boundary