GEOINFORMATICS IN DISASTER MANAGEMENT:

Scope, Examples & Advancements

Training Workshop on Use of Space Technology for Disaster Risk Reduction

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GEOINFORMATICS TECHNOLOGY

- Remote Sensing
- Geographic Information Systems (GIS)
- Global Positioning System (GPS)
- Information Technology
- Communication Technology

DISASTER MANAGEMENT

Disaster Management comprises all forms of activities including structural and non-structural measures to avoid (prevention) or to limit (mitigation and preparedness) adverse effects of disasters in the pre-disaster phase and post disaster stage (Response, Relief , Recovery, Reconstruction).

GEO-INFO APPLICATIONS IN DM

Pre disaster
Examples: hazard mapping, Vulnerability and Risk Assessment, Preparedness Plans; Early Warning and monitoring, Risk Modelling etc

During Disaster
Examples: public warning systems; emergency operations; search and rescue, evacuation planning, distribution of relief

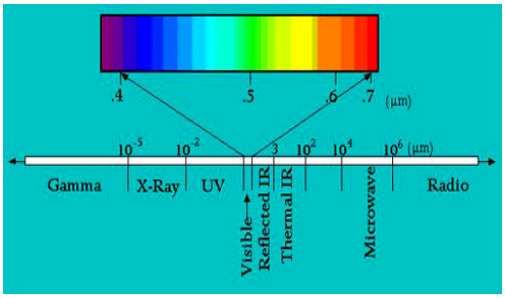
Post Disaster
Examples: damage assessment, temporary shelters; claims, processing and grants; reconstruction

REMOTE SENSING

Remote Sensing means deriving information about objects from measurements made from distance i.e. without actually coming into contact with them.

Such measurements require a medium of interaction. Medium of interaction is Electromagnetic radiation

Visible, infrared, and microwave portions of the spectrum are used for remote sensing

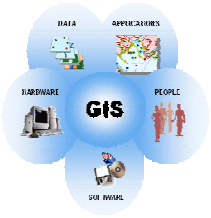


GEOGRAPHIC INFORMATION SYSTEM (GIS)

GIS is a system of hardware, software, data and personnel to efficiently capture, store, update, manipulate, analyze and display all forms of geographically referenced information.

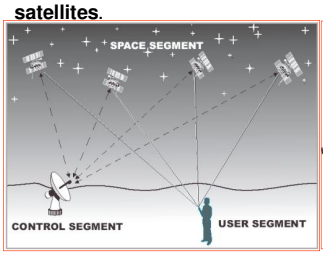
Hardware
Software
Data
People
Application/ procedures

COMPONENTS OF GIS



GLOBAL POSITIONING SYSTEM

A network of satellites that continuously transmit coded information, which makes it possible with help of an instrument (hand held or vehicles) to precisely identify locations on earth by measuring distance from the satellites.

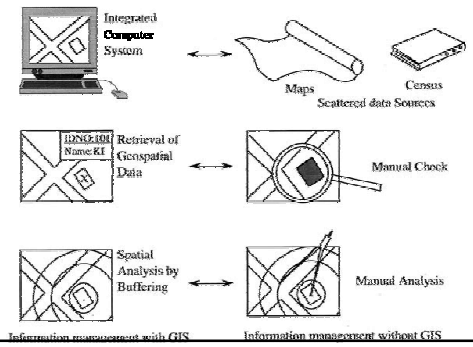


APPLICABLE FOR ALL DISASTERS

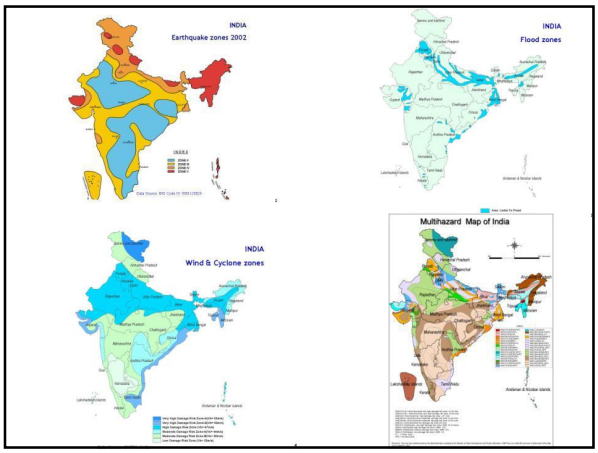
Conventional Tools in Disaster Management -Some Issues

- Conventional Maps- Outdated
- Scattered databases not easy to collate in short time
- Difficulty in assessing damage
- Difficulty in getting an overview of situation
- Difficulties in sharing data

Comparison between geospatial information management with and without GIS.



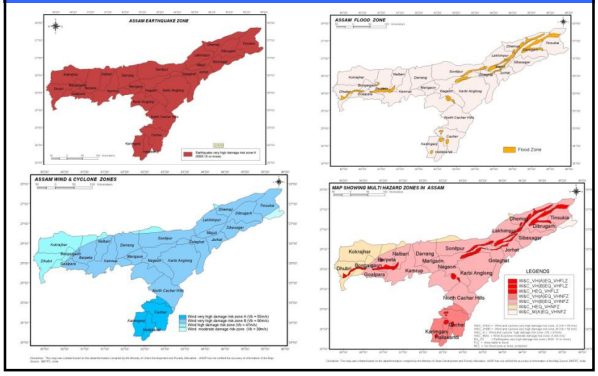
MULTIHAZARD VULNERABILITY MAPPING AND RISK ASSESSMENT



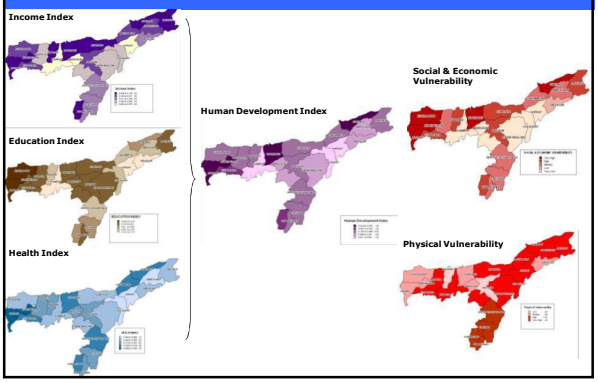
MULTI HAZARD VULNERABILITY MAPPING

- 169 districts were identified as multi hazard prone by overlaying individual hazard Maps and district boundary maps (Source of hazard maps is BMTPC atlas, 1997)
- 241 districts were classified as multi-hazard prone as per the revised Atlas (2006)

MULTI HAZARD MAP OF ASSAM



VULNERABILITY PROFILE OF ASSAM



VULNERABILTY ANALYSIS ORISSA CASE STUDY

STUDY AREA

- Having a long coast line
- Prone to all the hydro-meteorological disasters
- High Vulnerability
- Previous studies were having more of a hazard centric approach

APPROACH TO RISK ASSESSMENT

INDUCTIVE APPROACH

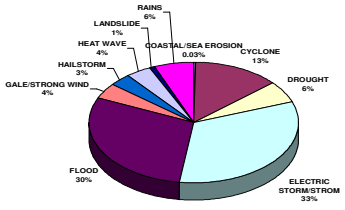
- Inductive approaches have been used to determine disaster risk using an overlay of detailed hazard maps, and the level of exposure (population density, infrastructure etc.) to vulnerable elements
- However, in most situations, this can be very expensive and time consuming.
- Models are based on assumptions..
- For validating models disaster inventory is required
- Multi hazard approach is not there in most of the existing models/ methodologies

DEDUCTIVE APPROACH OR DISASTER INVENTORY MAPPING

- Systematic tracking of occurrence of small medium and large disasters at the lowest possible administrative level
- Identifying the events and categorizing
- Preparation of Risk Matrix based on sectoral impacts and frequency
- Overlaying of different hazard maps and impact layers
- Map key socio economic and vulnerability indicators from Census, HDI and Economic Survey
- Identify the most vulnerable areas at the lowest possible spatial unit based on the weighted average method.
- Methodology was a combination of spatial and non spatial Analysis

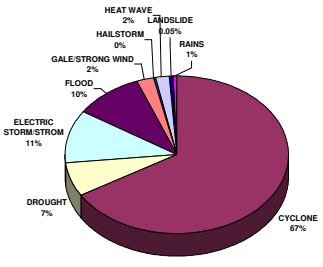
PRELIMINARY ANALYSIS

TYPOLOGICAL ANALYSIS: Objective is to identify the major hazard based on the number of recorded events

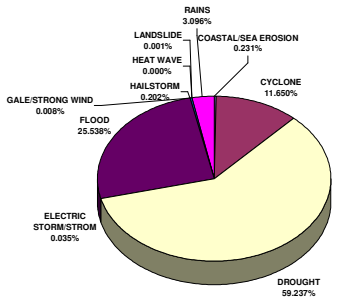


DISTRIBUTION OF VARIOUS DISASTROUS EVENTS

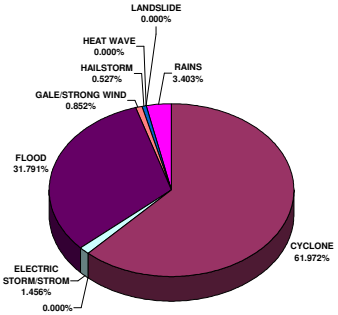
PRELIMINARY ANALYSIS



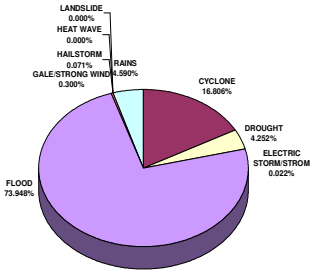
DISTIRBUTION OF DEATHS DUE TO VARIOUS DISASTERS



DAMAGE TO CROPS DUE TO DISASTERS(in Hect.)



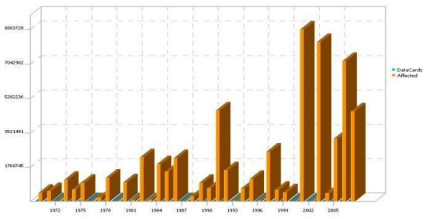
PROPERTY LOSSES DUE TO VARIOUS DISASTERS



PEOPLE AFFECTED DUE TO VARIOUS DISASTERS

PRELIMINARY ANALYSIS

TEMPORAL ANALYSIS: To identify the frequency and impact of various disasters over a period of 30 years

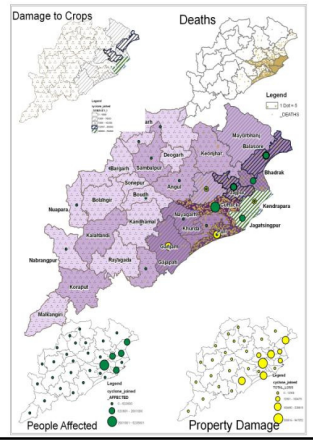


IDENTYING MAJOR HAZRADS

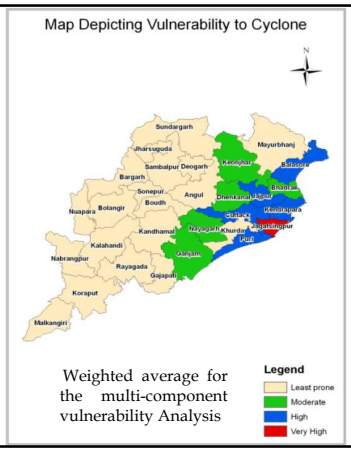
Based on the preliminary analysis the following hydro-meteorological hazards were taken for detailed analysis

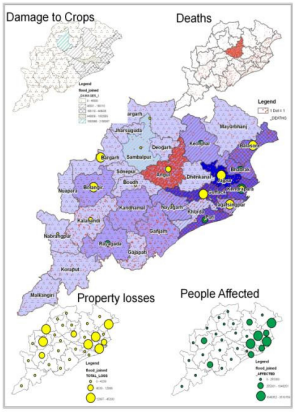
- Cyclone
- Floods and Heavy Rain
- Thunderstorms and Lightening
- Drought

SPATIAL ANALYSIS

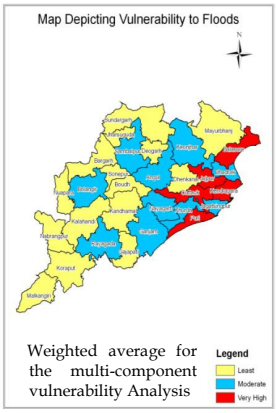


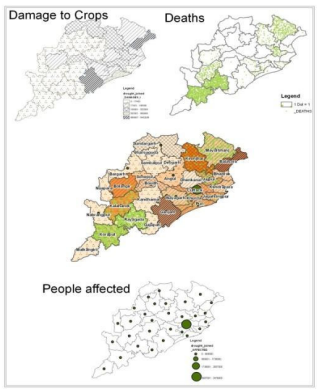
Spatial distribution of Sectoral Impacts of Cyclone



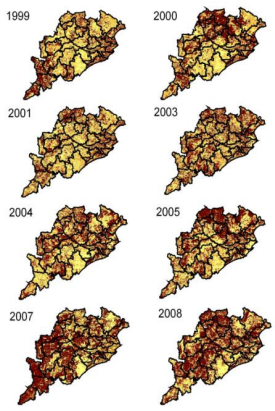


Spatial distribution of Sectoral Impacts of Floods

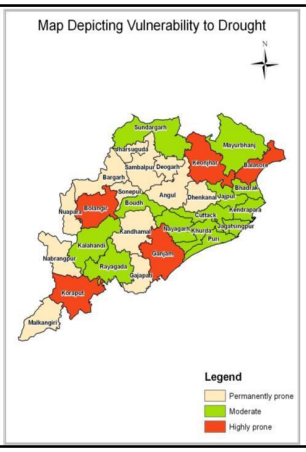


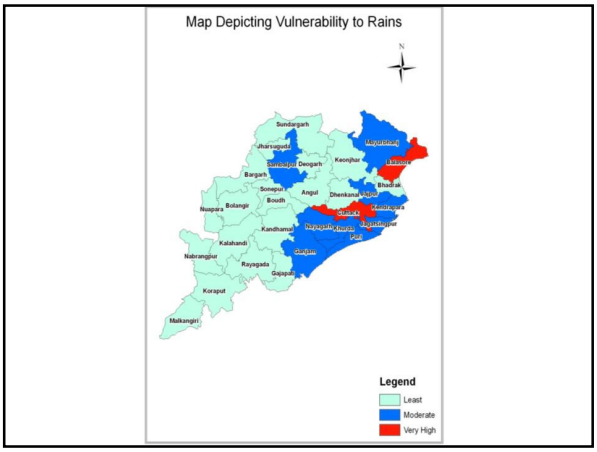


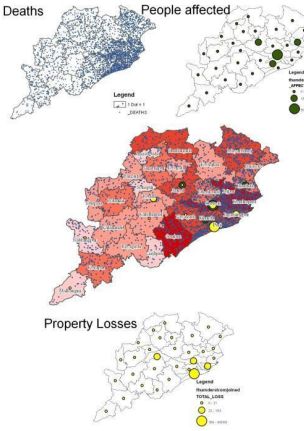
Spatial distribution of Sectoral Impacts of Drought



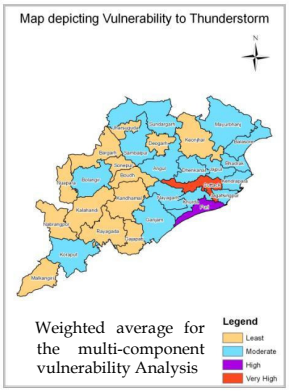
SPOT Vegetation Data
NDVI Difference Imageries
Based on 2001 data







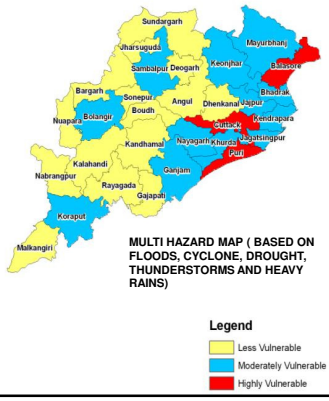
Spatial distribution of Sectoral Impacts of Thunderstorms



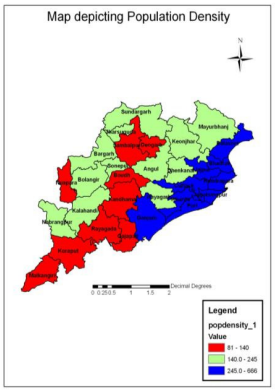
Weighted average for the multi-component vulnerability Analysis

MULTI HAZARD VULNERABILITY ANALYSIS

S.No	Hazard	Class	Weight
1.	Cyclone	Least prone	1
		Moderate	2
		high	3
		Very high	4
2.	Floods	Least	1
		Moderate	2
		High	3
		Very high	4
3.	Drought	Prone	1
		Moderate prone	2
		Permanently prone	3
4.	Rains	Least	1
		Moderate	2
		Very high	3
5.	Thunderstorm	Least	1
		moderate	2
		High	3
		Very high	4

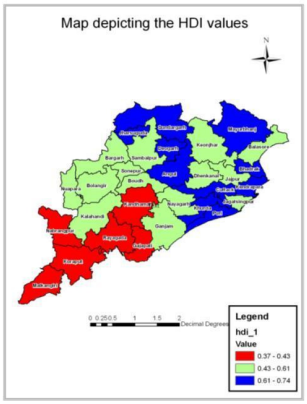


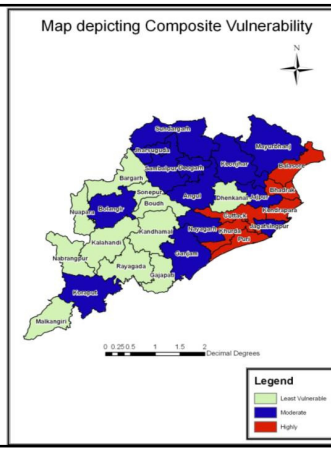
POPULATION VULNERABILITY ANALYSIS



Distribution of Districts by Range of HDI Values

HDI Value					
Orissa (0.579)					
District	≤0.5	District	>0.5 and <0. 6	District	≥0. 6
Malkangiri	0.37	Keonjhar	0.53	Kalahandi	0.606
Kandhamal	0.389	Boudh	0.536	Kendrapara	0.626
Gajapati	0.431	Jajpur	0.54	Mayurbhanj	0.639
Koraput	0.431	Balangir	0.546	Bhadrak	0.646
Nabarangpur	0.436	Ganjam	0.551	Puri	0.657
Rayagada	0.443	Jagatsinghpur	0.557	Angul	0.663
		Balasore	0.559	Deogarh	0.669
		Bargarh	0.565	Sundargarh	0.683
		Sonepur	0.566	Cuttack	0.695
		Nayagarh	0.571	Jharsuguda	0.722
		Nuapada	0.581	Khurda	0.736
		Sambalpur	0.589		
		Dhenkanal	0.591		

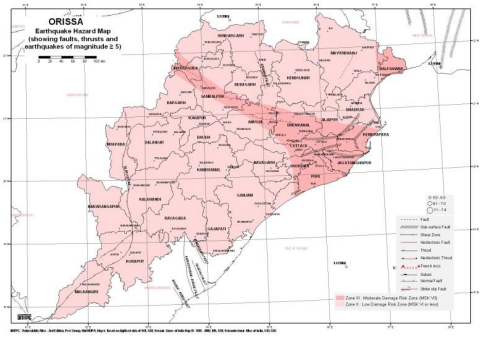


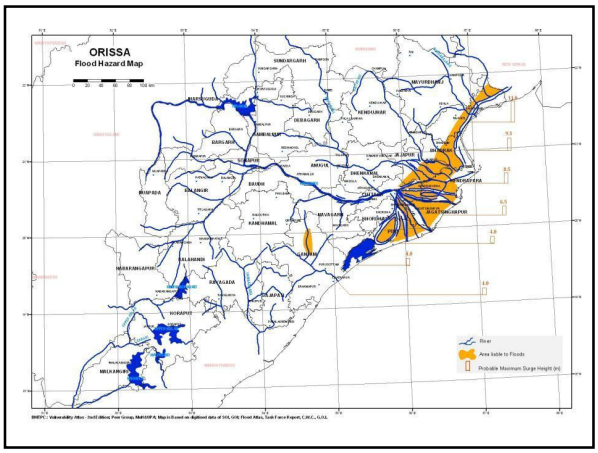


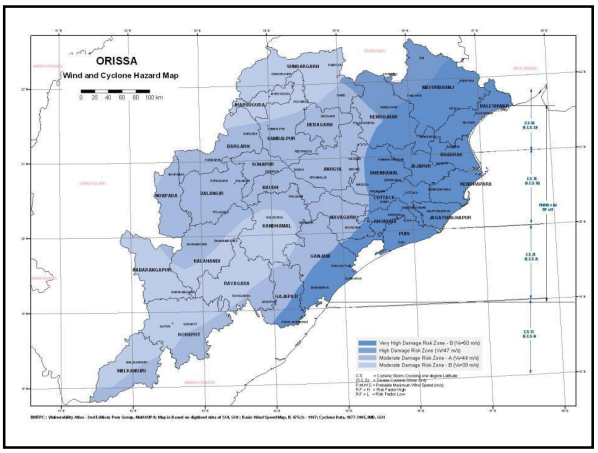
RESULTS OF ANALYSIS

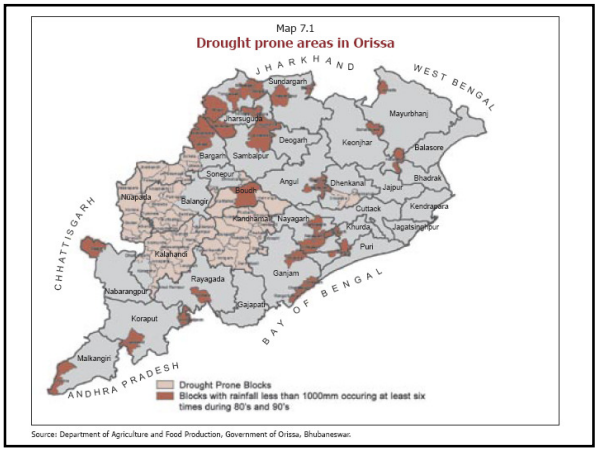
- Orissa is prone to all the hydro-meteorological disasters enlisted in HPC Report and IMD Report
- Major hazards are Cyclone, flood, drought, heavy rainfall and thunderstorms
- Direct relation between HDI indicators and impact particularly in the case of drought
- In the case of Hymet disasters phenomenal increase in impact although frequency not increased that much.
- Death due to disasters showing decreasing trend but impacts are increasing
- Helped in identifying spatial distribution of impacts of various disasters (individually and in combination)

EXISTING HAZARD MAPS

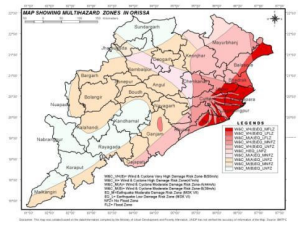


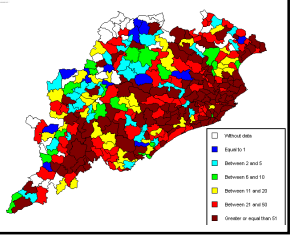






TOTAL NUMBER OF DEATHS REPORTED DUE TO DISASTERS AND ITS COMPARISON WITH VULNERABILITY ATLAS





Districts like Rayagada , Koraput, Kalahandi have low multi-hazard vulnerability (BMTPC ATLAS).

Most of the deaths are due to Famine, epidemics etc.

But the lose of life due to various disasters are high in these districts.

This real time data uncover the hidden vulnerabilities like lack of awareness, low economy level, poor health facilities , environmental degradation etc.

BENEFITS

- As a Policy Advocacy Tool – Evidence based
- HVR is key component of DMP
- Key inputs for EWS
- Identification and Prioritization of Mitigation Measures
- Helps in identifying the sectoral impacts
- Identifying the underlying causes of vulnerability
- Validating Models and methodology changes
- As a monitoring and Evaluation Tool : How the development/mitigation measured increased or reduced disaster Risk
- Reducing disparity in Relief distribution
- Key input for Insurance/ reinsurance sector

CHALLEGES

Strategic

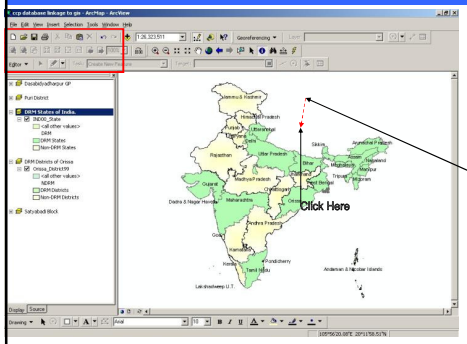
- Reliability and Credibility of data sets
- There is no well established system of collecting disaster databases similar to census .
- Reports of GSI, IMD, CWC etc are having hazard centric approach
- Political Issues

Methodological

- Segregation and aggregation of data.
- Series of associated events
- Potential in assessing futuristic risk scenarios

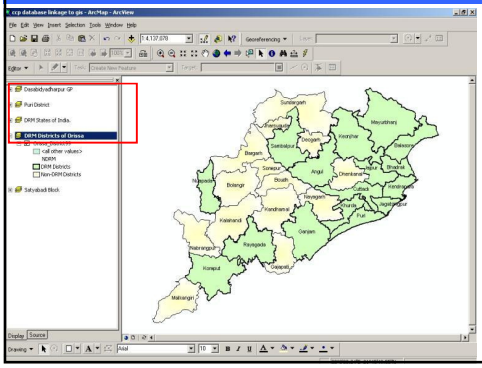
CONTINGENCY PLANS IN GIS

Community Contingency Plans in GIS

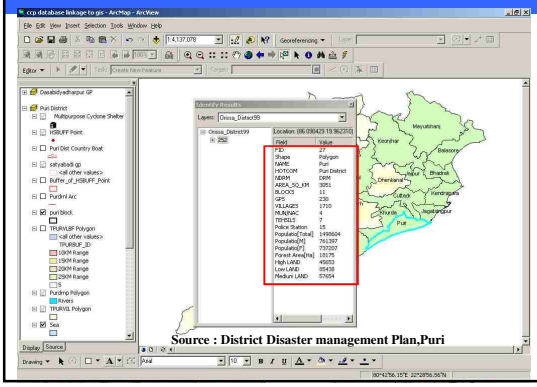


Clicking inside a state through Hyperlink tool will link to respective states details .

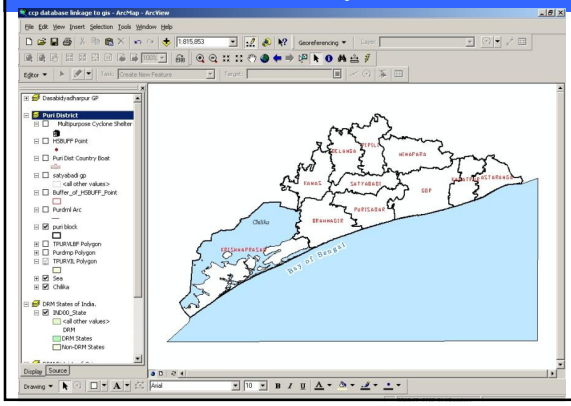
Map of Orissa showing the DRM Districts.



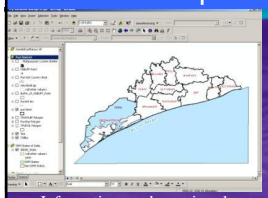
Statistical Information of Puri District



Administrative Boundary of Puri District



Description about the Analysis



- Information can be retrieved upto village level.
- Block to Village can be zoomed in to view the geographical location of resources.
- Details about item/resource can be seen and query based resources finding is possible
- Flexibility of moving macro to micro level in a same window.

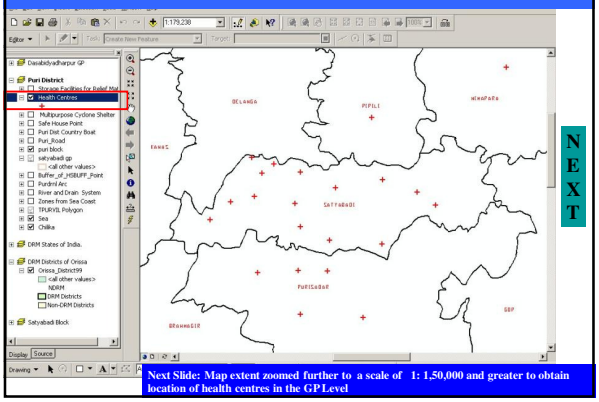
Layers Taken for analysis :

1. Health Centres
2. Multipurpose Cyclone shelters
3. Storage Facilities
4. Buffer zones
5. Location of Boats
6. River systems
7. Roads

LINKAGE HAS BEEN ESTABLISHED TO

1. District Disaster management Plan (DDMP)
2. Block Disaster Management Plan (BDMP)
3. Gram Panchayat Disaster Management Plan (GPDMP)
4. Village-CCP

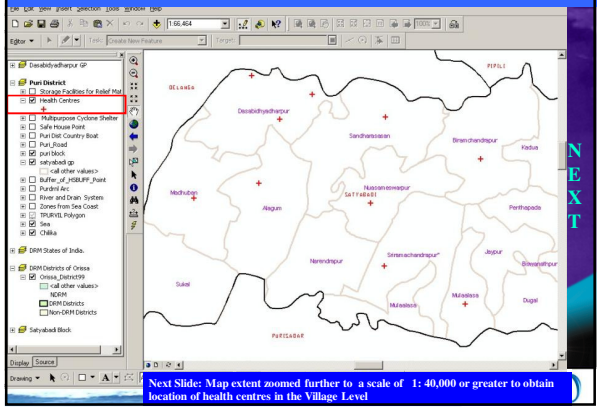
Location of Health Centres [Block Level]



NEXT

Next Slide: Map extent zoomed further to a scale of 1: 1,50,000 and greater to obtain location of health centres in the GP Level

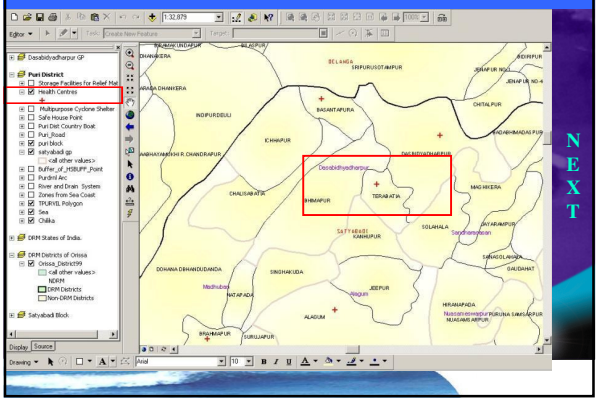
Location of Health Centres [GP Level]



NEXT

Next Slide: Map extent zoomed further to a scale of 1: 40,000 or greater to obtain location of health centres in the Village Level

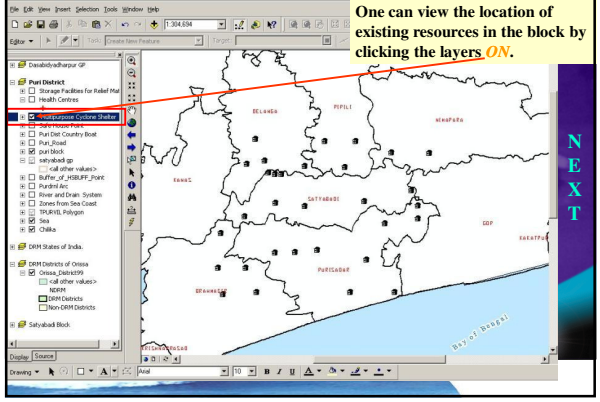
Location of Health Centres [Village Level]



NEXT

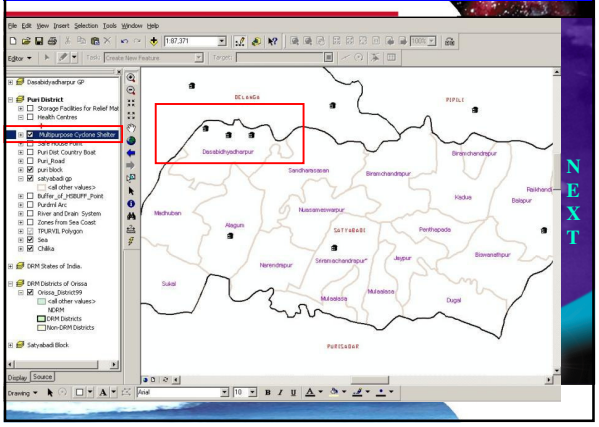
Location of Multipurpose Cyclone Shelters [Block Level]

One can view the location of existing resources in the block by clicking the layers *ON*.



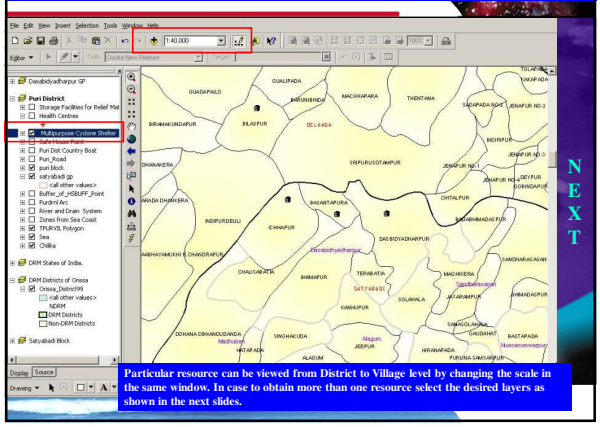
NEXT

Location of Multipurpose Cyclone Shelters [GP Level]



NEXT

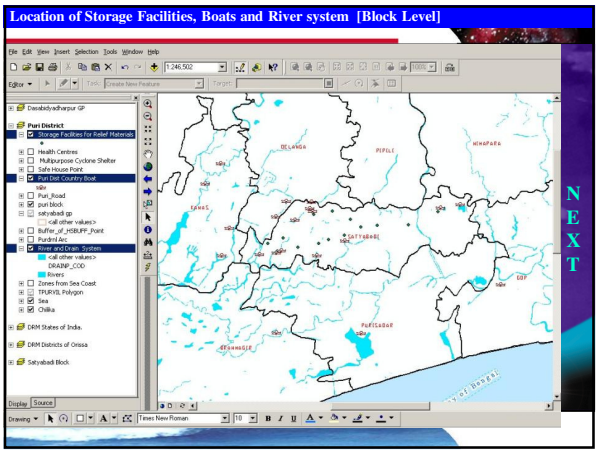
Location of Multipurpose Cyclone Shelters [Village Level]



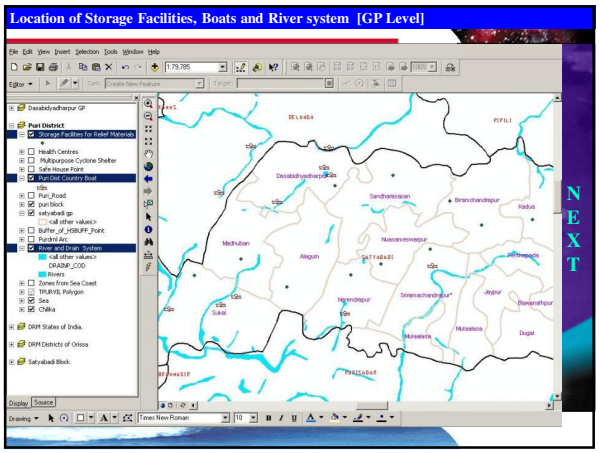
NEXT

Particular resource can be viewed from District to Village level by changing the scale in the same window. In case to obtain more than one resource select the desired layers as shown in the next slides.

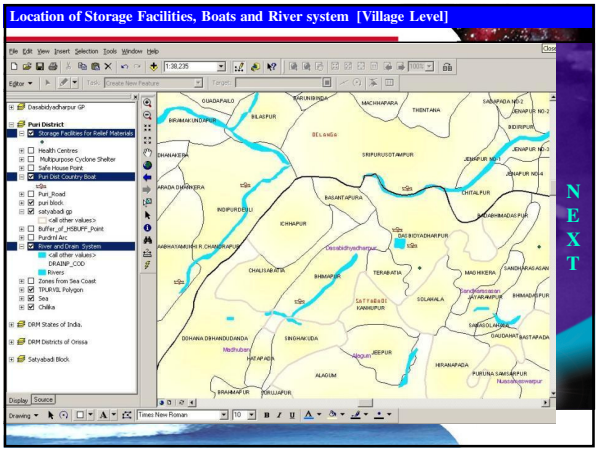
Location of Storage Facilities, Boats and River system [Block Level]



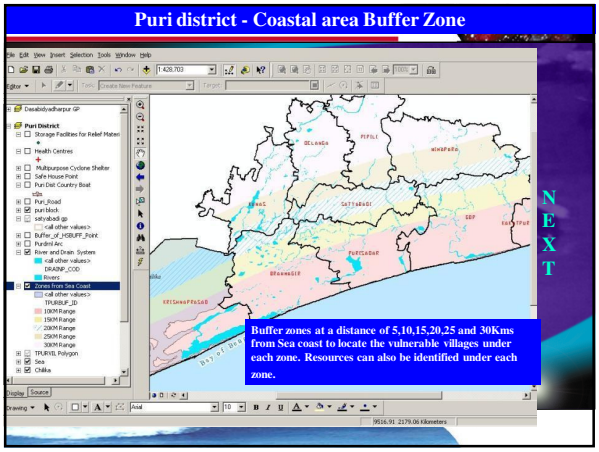
Location of Storage Facilities, Boats and River system [GP Level]



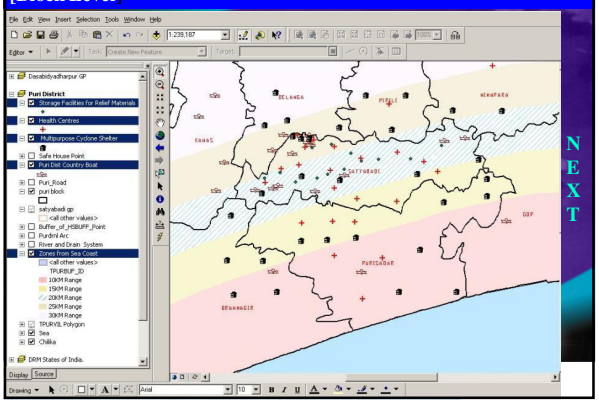
Location of Storage Facilities, Boats and River system [Village Level]



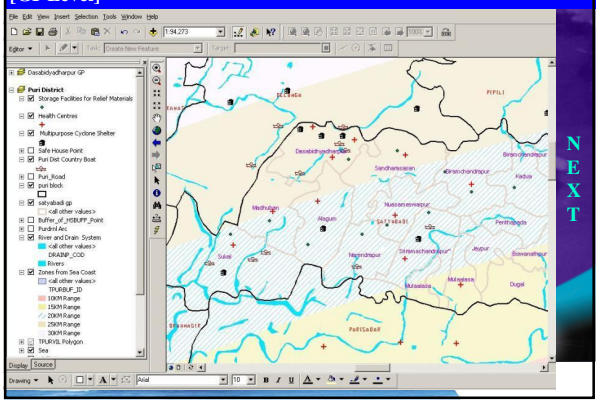
Puri district - Coastal area Buffer Zone



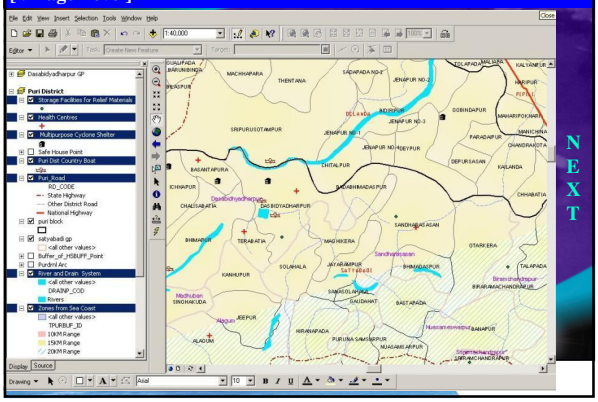
Location of resources in the respective Coastal area Buffer Zone [Block Level]



Location of resources in the respective Coastal area Buffer Zone [GP Level]

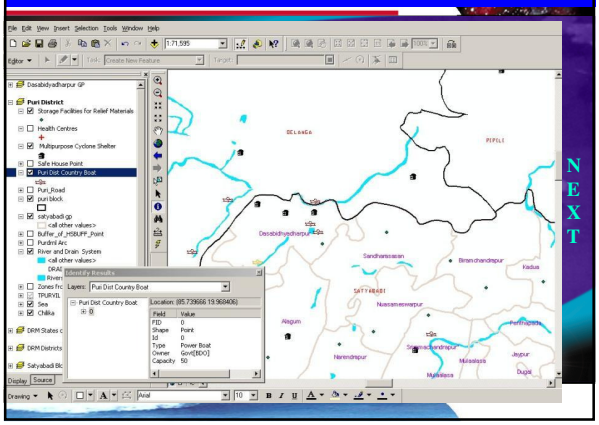


Location of resources in the respective Coastal area Buffer Zone [Village Level]



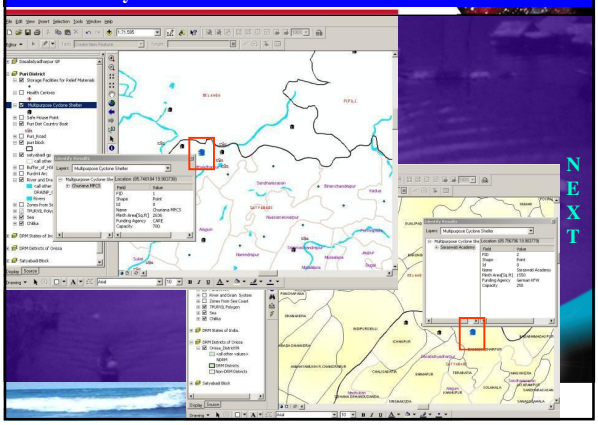
NEXT

Database of resources can be obtained at all levels



NEXT

Database of cyclone shelters at various levels

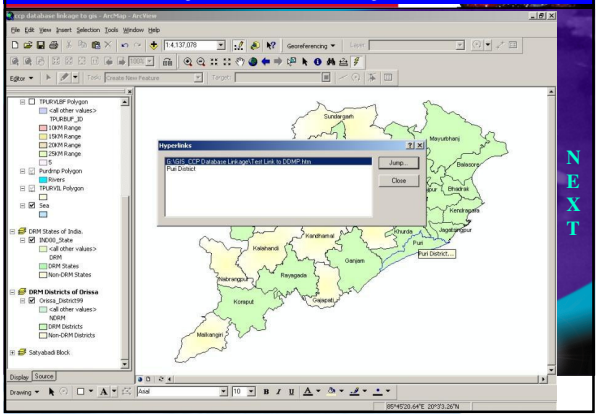


NEXT

Linkage of Disaster Management Plans

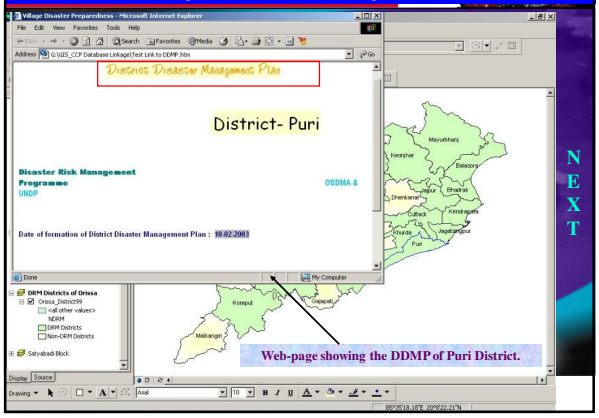
NEXT

Linkage of District Disaster Management Plan



NEXT

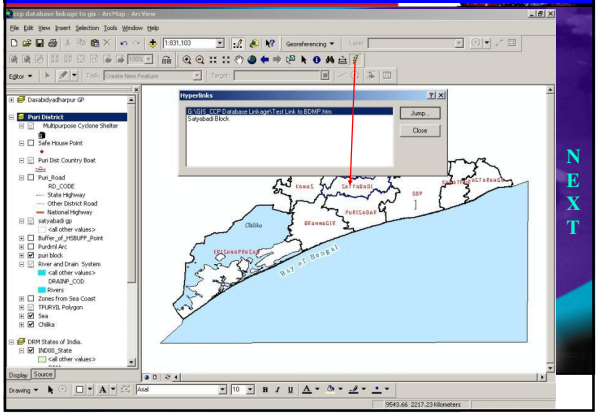
Linkage of District Disaster Management Plan



Web-page showing the DDMP of Puri District.

NEXT

Linkage of Block Disaster Management Plan



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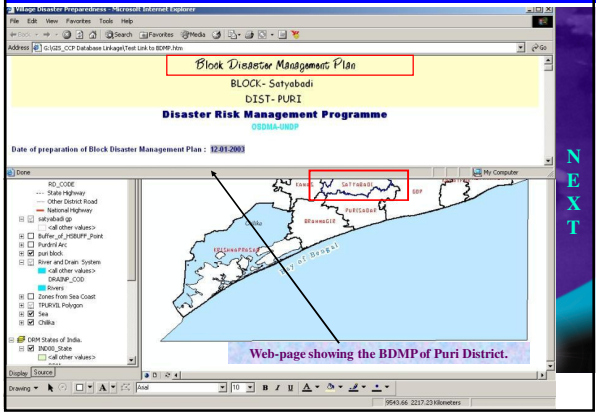
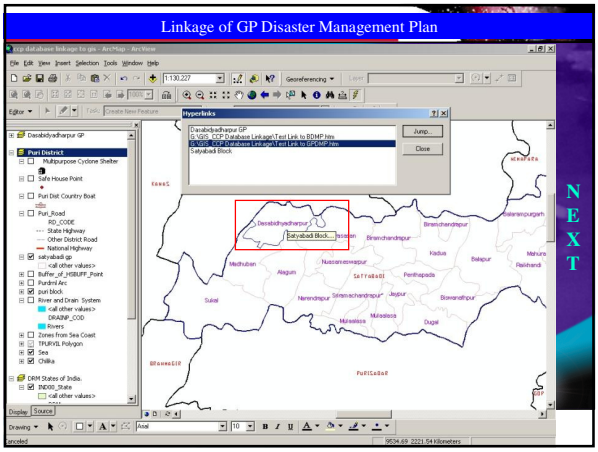
Linkage of Block Disaster Management Plan



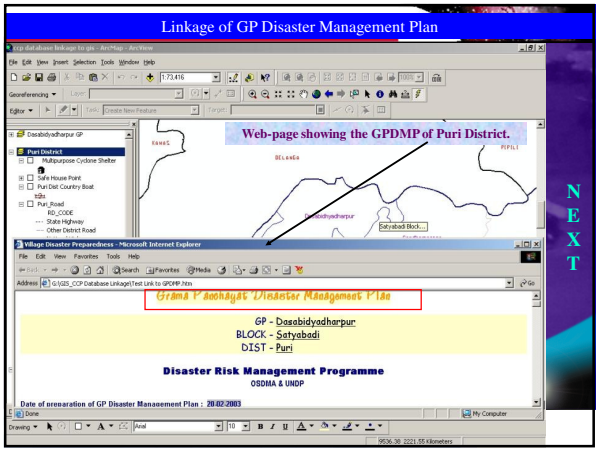
NEXT

Linkage of GP Disaster Management Plan



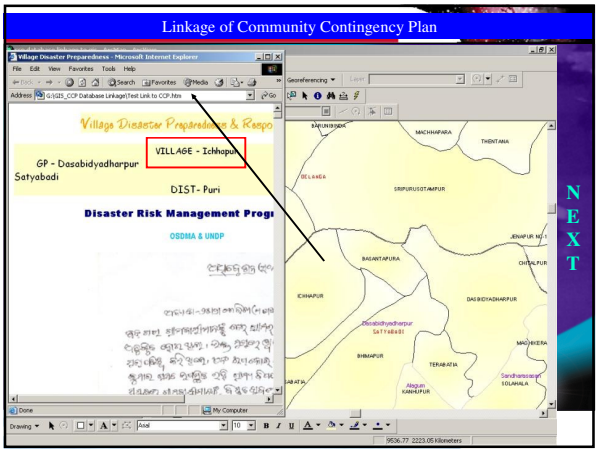
NEXT

Linkage of GP Disaster Management Plan



NEXT

Linkage of Community Contingency Plan



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