Sri Lanka

Session 4: Mitigation and Preparation

4.2.4 Sentinel Asia Success Story

S.K. Wijayasinghe

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(Mapping)

Survey Department, Sri Lanka

Sri Lanka

Positioned in the Indian Ocean, to the southwest of the Bay of Bengal, between latitudes 5° and 10°N, and longitudes 79° and 82°E.

Sri Lanka

Land area over 65,000 sq km

Population over 20m

Common Natural Disasters in Sri Lanka

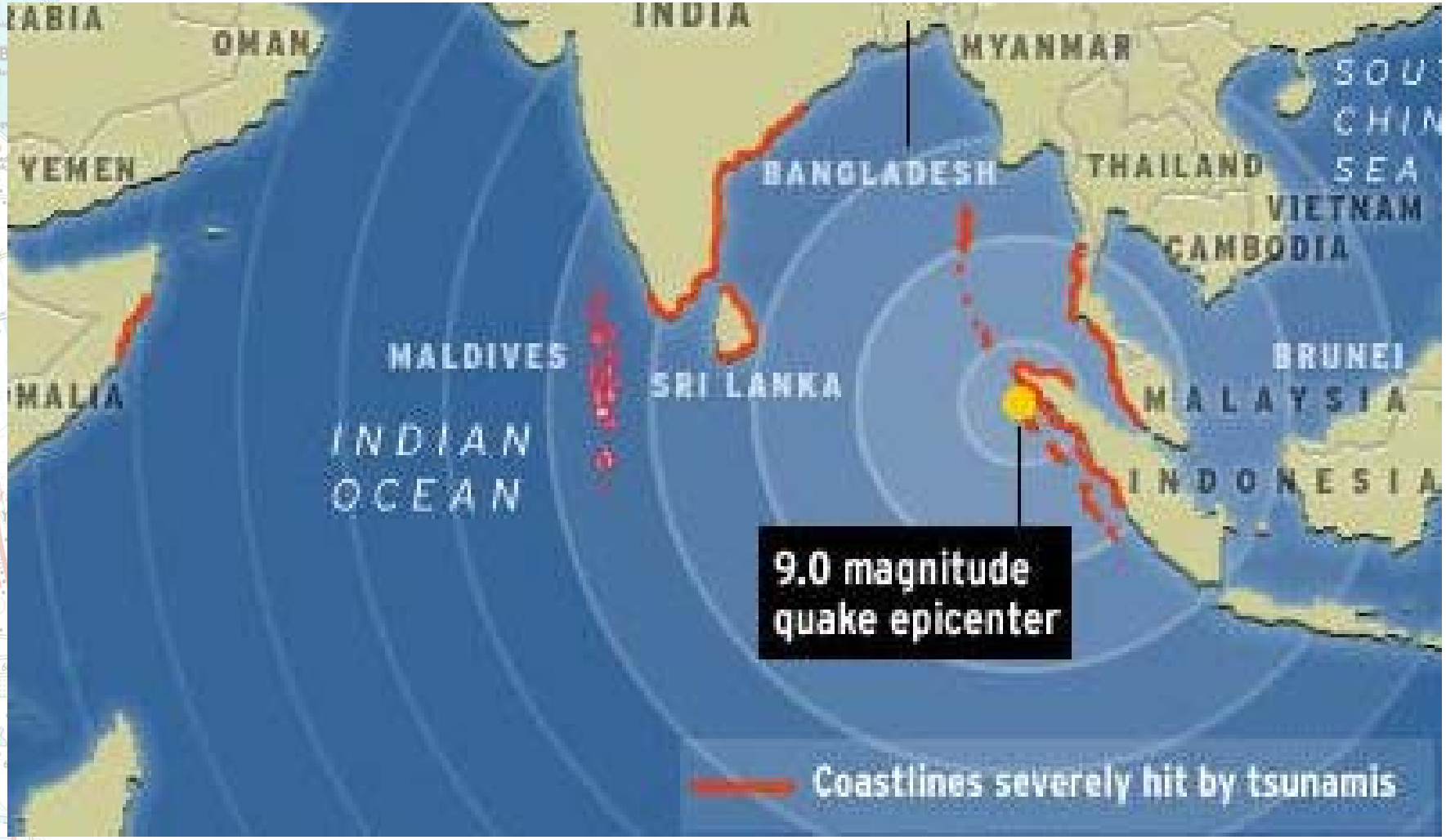
- Flood
- Landslides
- Wind Storm
- Cyclones
- Epidemic
- Drought
- Combinations of above

Natural Disasters in Sri Lanka

Natural Disasters in Sri Lanka(Period, Type) (1901-2000)

		Data						
Period	**DisTypes**	**Count of DisNo**	**Sum of Killed**	**Sum of Injured**	**Sum of Homeless**	**Sum of Affected**	**Sum of TotAff**	**Sum of DamageUS$ ('000s)**
1951-1960	Wind storm	1	200			250,000	250,000	
1961-1970	Epidemic	1	2			200,000	200,000	
	Flood	3	109		100,000	1,722,347	1,822,347	16,500
	Wind storm	1	206		100,000	280,000	380,000	37,300
1971-1980	Drought	3	0			250,000	250,000	
	Epidemic	1				728	728	
	Flood	2	10			2,000	2,000	
	Slide	2	54					
	Wind storm	1	740	5,000		1,000,000	1,005,000	100,000
1981-1990	Drought	5	0			6,806,000	6,806,000	
	Epidemic	1	53					
	Flood	11	638	1,000	1,220,000	2,629,000	3,850,000	38,000
	Wind storm	2	37			394,400	394,400	
1991-2000	Epidemic	3	4	0	0	11,985	11,985	
	Flood	13	64	0	1,557,441	1,538,295	3,095,736	283,010
	Slide	1	65			130	130	
	Wind storm	1	5	0	0	375,000	375,000	
Grand Total		52	2,187	6,000	2,977,441	15,459,885	18,443,326	474,810

2004 Tsunami



Damage due to Tsunami Disaster

Damage due to Tsunami Disaster

Damage due to Tsunami Disaster

Displaced 548, 931

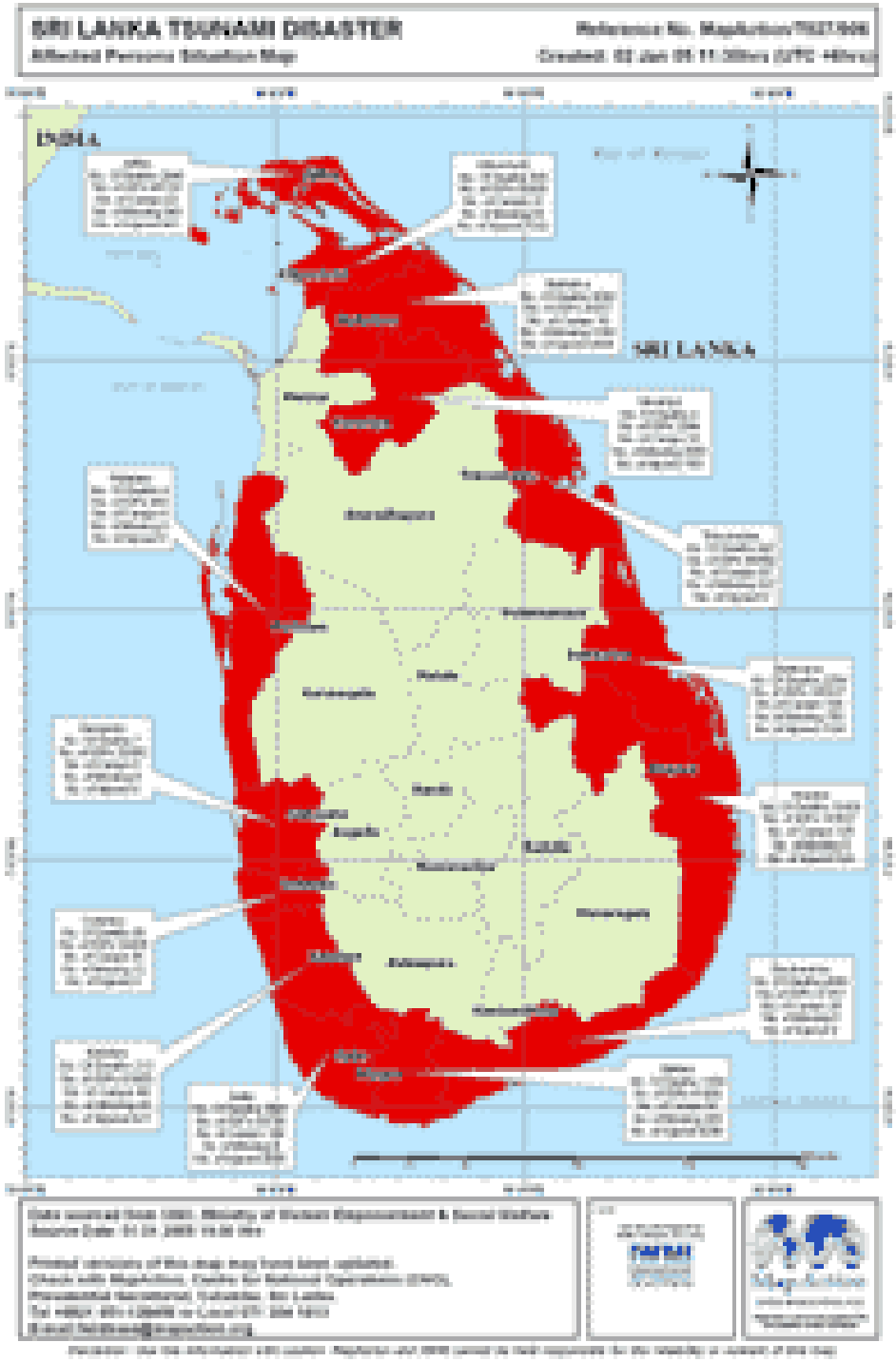
Damage due to Tsunami Disaster

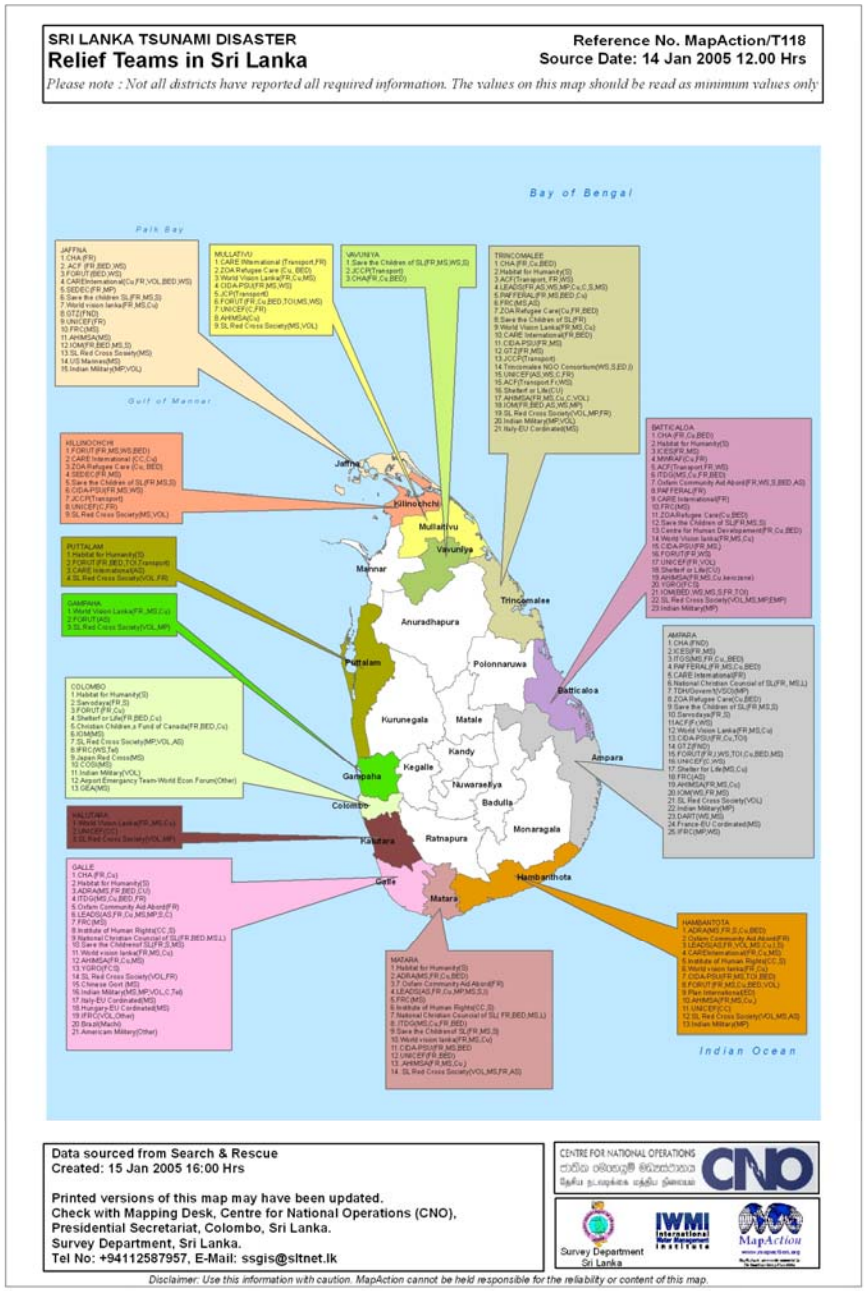
Tsunami - Rail Disaster in Sri Lanka

Tsunami - Rail Disaster

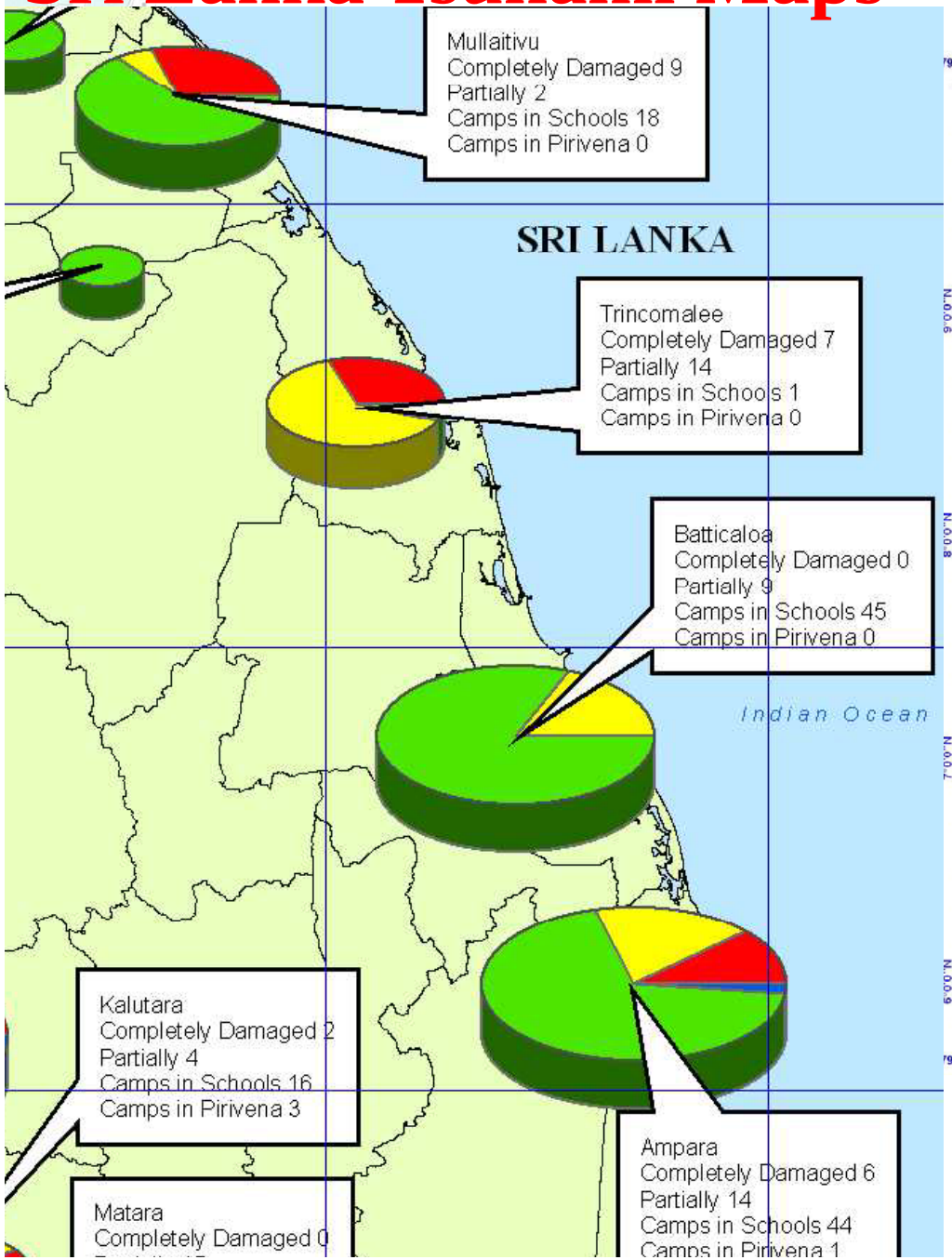
- **Tsunami - Rail Disaster** was a rail disaster with the highest count of deaths in history. It occurred when a crowded passenger train was destroyed on a coastal railway in Sri Lanka by the Tsunami resulted in the greatest loss of life in railroad history. More than 1,700 people died.

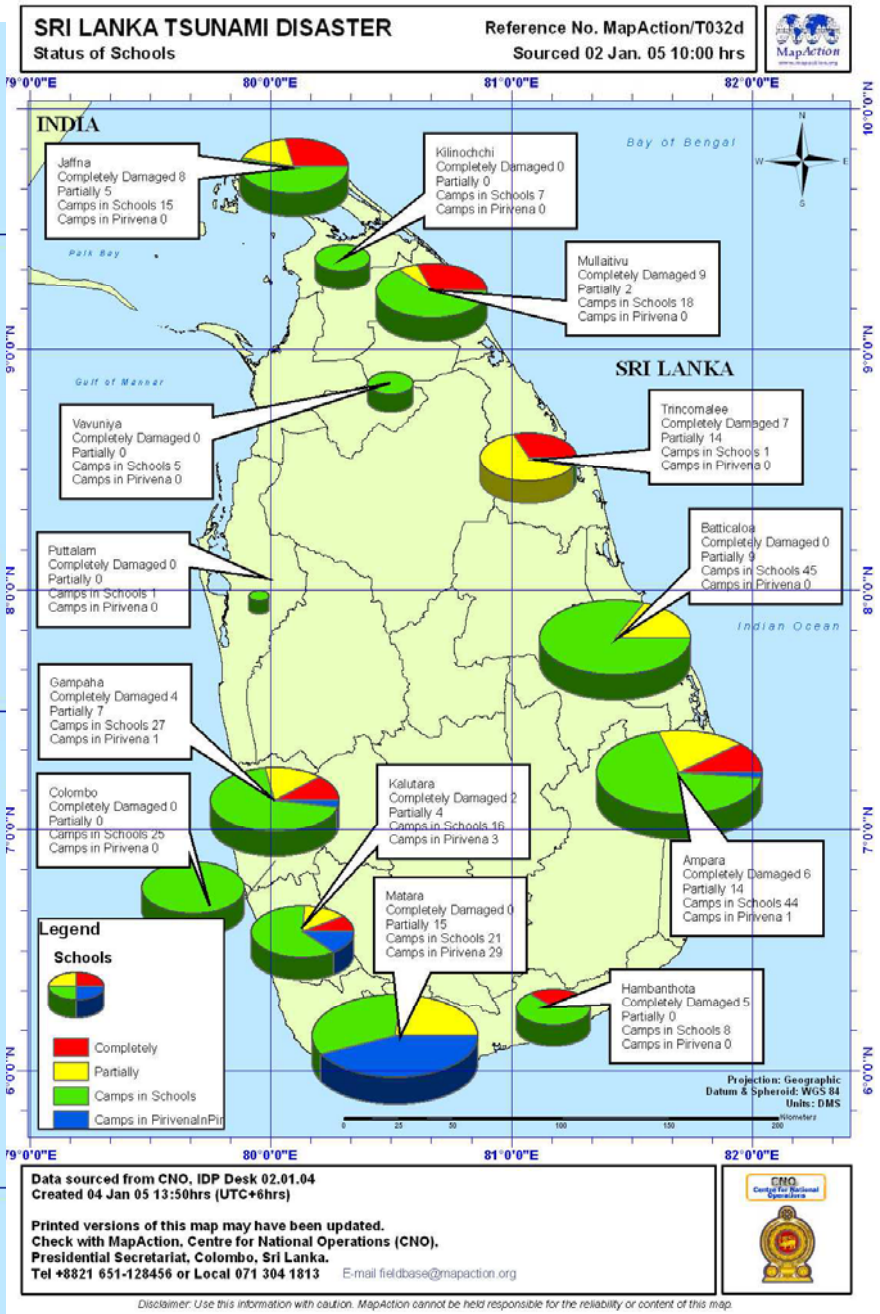
Effect of Tsunami in Maps





Sri Lanka Tsunami Maps





DISASTER MANAGEMENT ACT, No. 13 OF 2005

- In May 2005, the Disaster Management Act No.13 of 2005 was enacted. This provides the legal basis for a DRM system in the country. The Act establishes the National Council for Disaster Management (NCDM), chaired by the President, vice-chaired by the Prime Minister with participation from Opposition, minority communities and Chief Ministers of the Provinces. This high-level oversight body, provides direction to DRM work in the country.

Disaster Management Centre

- The Disaster Management Centre (DMC) was established to implement the functions indicated in the Act namely, for the purpose of planning, co-coordinating and implementing of certain natural and other forms of disasters

Sentinel Asia

- Aiming to mitigate disaster damage in the Asia – Pacific region from space
- aims to promote international cooperation to monitor natural disasters in the Asia-Pacific region. It uses earth observation satellites and other space technologies to collect disaster-related information, and shares it over the internet.

Sentinel Asia

- The aim is to mitigate and prevent damage caused by natural disasters such as typhoons, floods, earthquakes, tsunamis, volcano eruptions and wildfires. Sentinel Asia, first advocated in 2005, now counts 8 international organizations and 51 participating organizations from 20 countries as members, and utilization of its systems is steadily expanding.

Sentinel Asia

- Sentinel Asia receives images from JAXA's Land Observing Satellite Daichi, and helps assess damages caused by natural disasters.

Sentinel Asia

History

APRSAF -12 held in Kitakyushu, Japan in Oct. 2005, approved the plan to initiate the pilot project to contribute to disaster management support in the Asia-Pacific region.

Joint Project Team (JPT) was organized and Sentinel Asia was initiated in the meeting in Feb 2006, Hanoi

Sentinel Asia

Approach

Step1: Utilization of earth observation satellite data for disaster management, which is called "Sentinel-Asia Project" (2006-2007)

Step2: Utilization of satellite communication system besides earth observation satellites (2008-2009)

Step3: Establishment of comprehensive disaster management support system (2010 onwards)

MINI PROJECTS 2005 - 2012

GeoInformatics Center
Asian Institute of Technology

JAXA Japan Aerospace Exploration Agency

Mini project 2005-2006

- Application of Remote Sensing & GIS Technology for Landslide Susceptibility Assessment
- Phase I (Aug –Sep 2005)
  - Viraj Dias CECB - Engineer
  - D.T.N.Jayasumana Survey Department of Sri Lanka
- Phase II (Jan –Feb 2006)
  - Viraj Dias CECB - Engineer
  - H.J.S.Fonseka Survey Department of Sri Lanka

Mini project 2006-2007

- USE OF DETERMINISTIC SLOPE STABILITY PREDICTING TOOLS FOR LANDSLIDE VULNERABILITY ASSESSMENT IN RATNAPURA AREA, SRI LANKA
  - Kumari M. Weerasinghe
    - National Building Research Organization (NBRO)
  - Manori Abewickrama
    - Survey Department of Sri Lanka

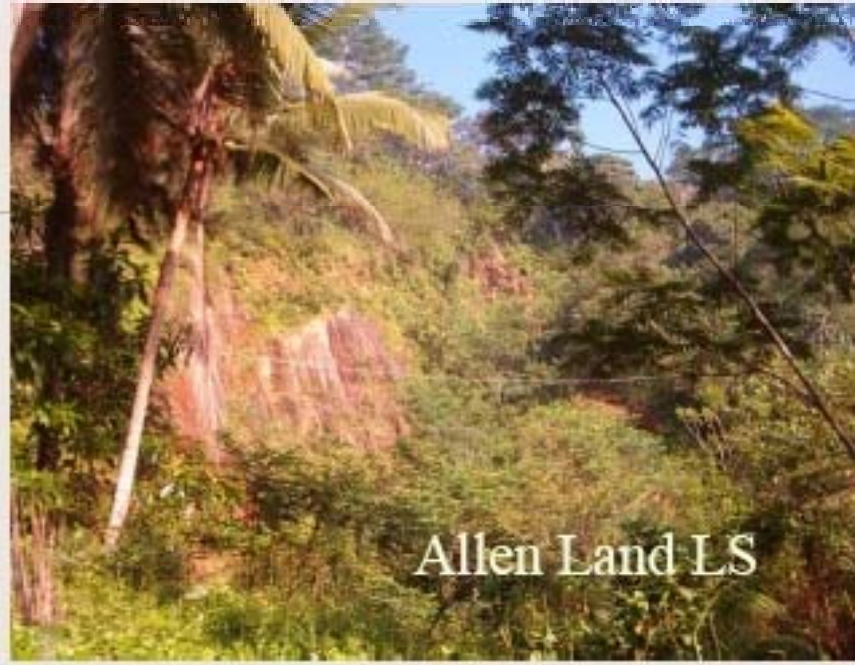
The objectives

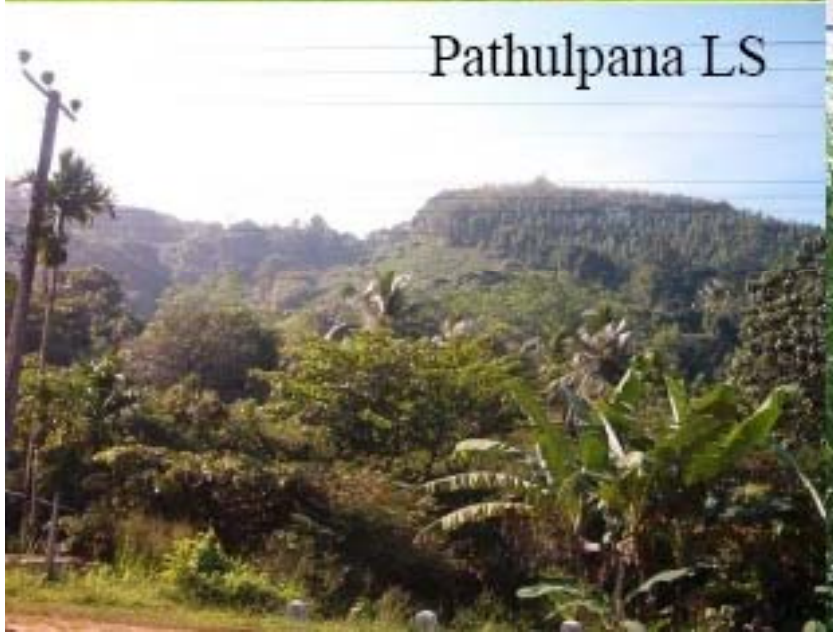
- Study landslide hazard map produced above with the landslide hazard zonation map prepared by the National Building Research Organisation (NBRO) of Sri Lanka.
- Generate a landslide hazard zonation map of the selected study area utilizing a deterministic slope stability model.
- Propose modifications and suggestions, if necessary, to make the product more meaningful to the end user.

Field Visit

- Field Visit 21st & 22nd December 2006

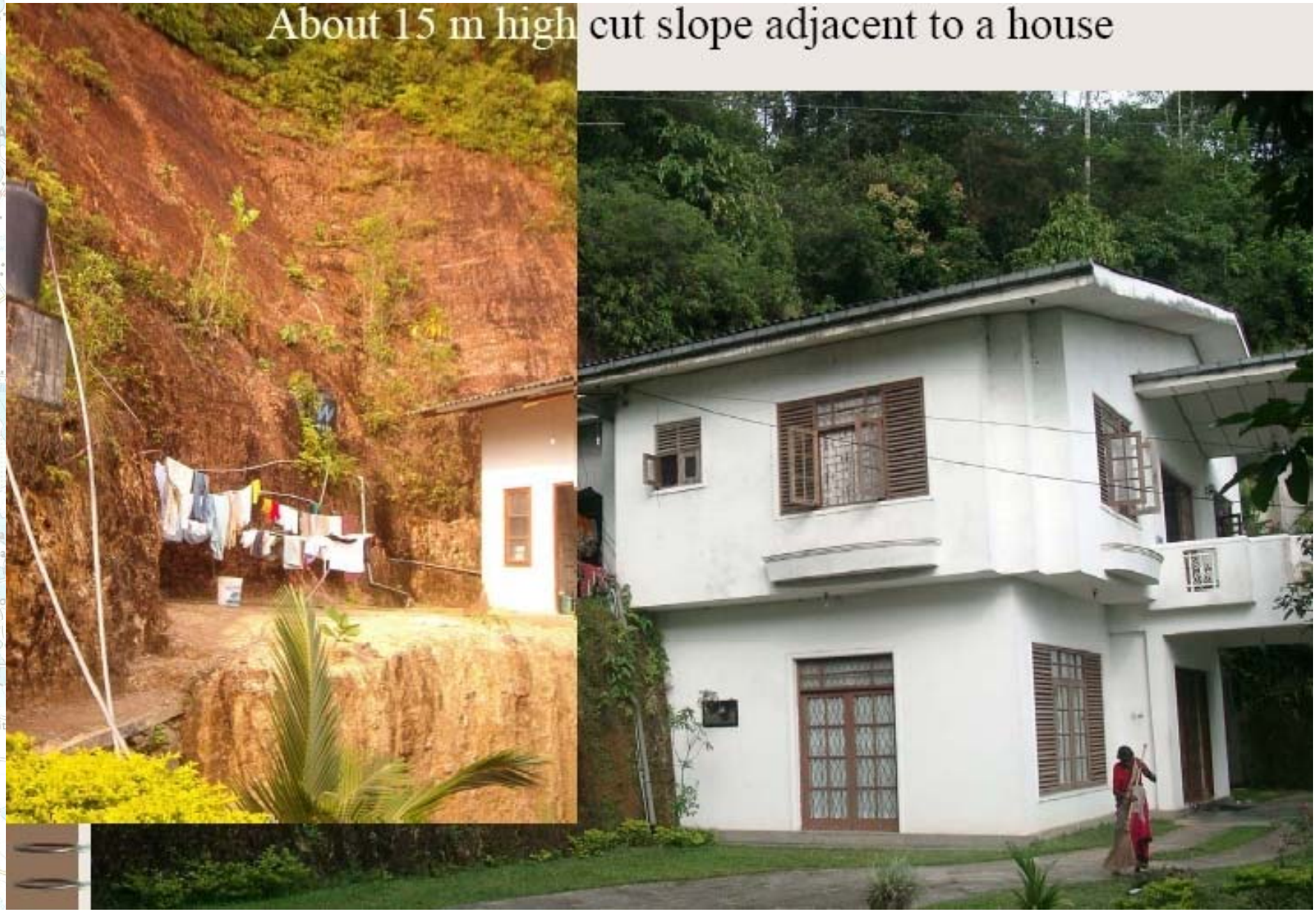
Some Land slides



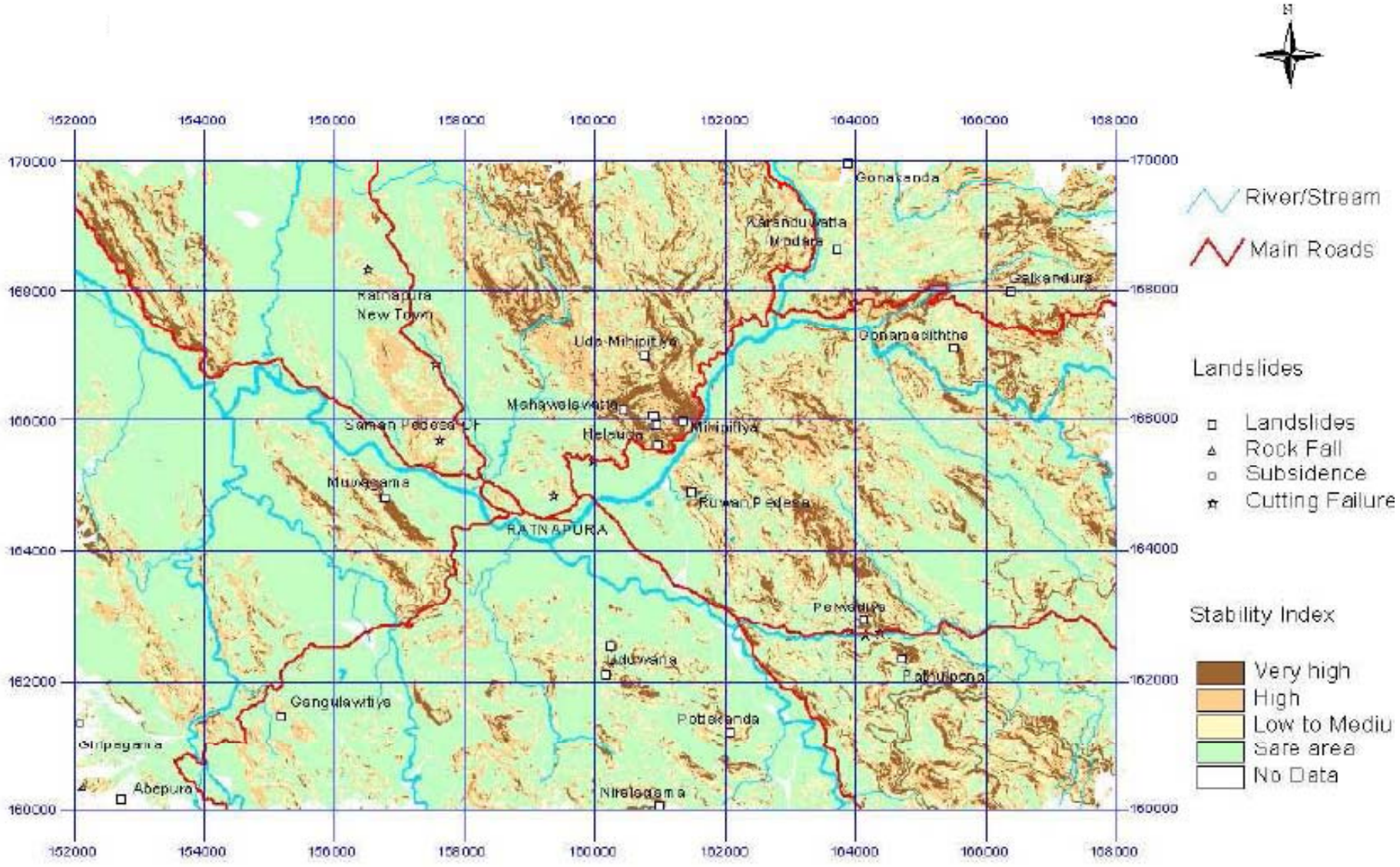


Cut slope adjacent to a house

About 15 m high cut slope adjacent to a house



- Four stability Themes



Conclusions

- SINMAP would be a practical tool for identification of landslide hazard zones.
- It is interesting to note that the areas identified as hazard zones due to natural causative factors by NBRO have been predicted very well by SINMAP model.

Mini Project 2007-2008

- Flood Hazard Mapping in the Lower Reach of Kelani River Basin
  - **Ms.P. P. Liyanage**
    - Survey Department, Sri Lanka
  - **Mr. I.P.A. Gunasekara**
    - Irrigation Department, Sri Lanka

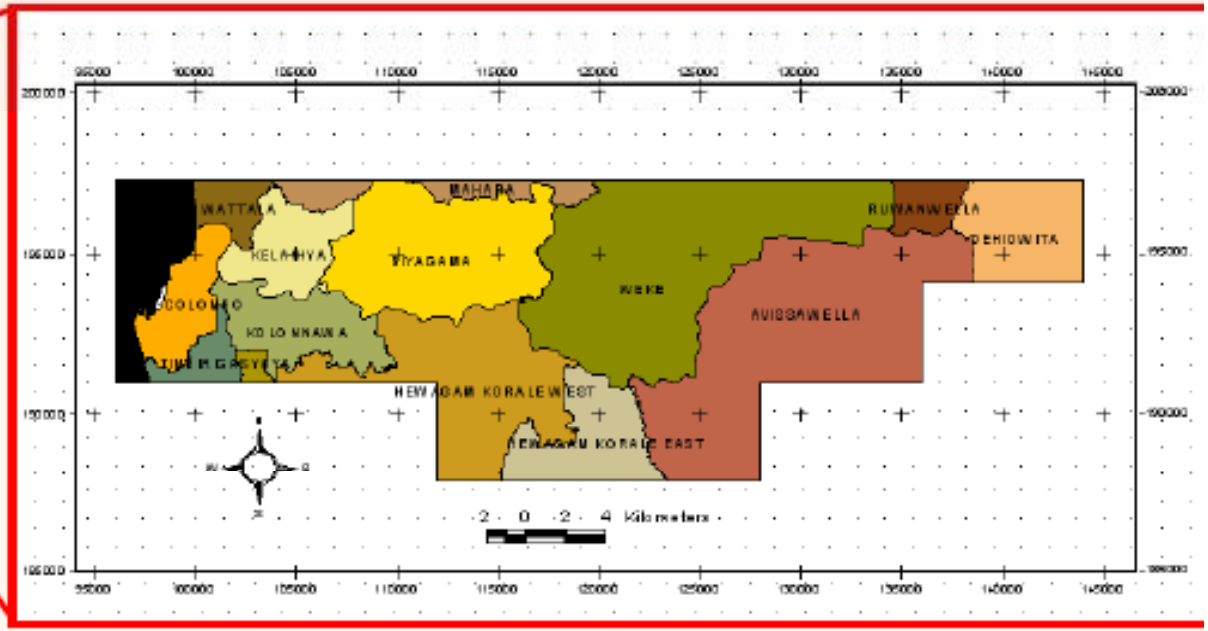
Objectives

- Preparation of flood hazard maps for 10yr, 20yr and 50yr return periods.
- Identification of flood encroachments on different land use types.

Study Area

79° 52" 08' - 80° 13 " 49' E Lon

06° 47" 16' - 07° 00 " 19' N Lat

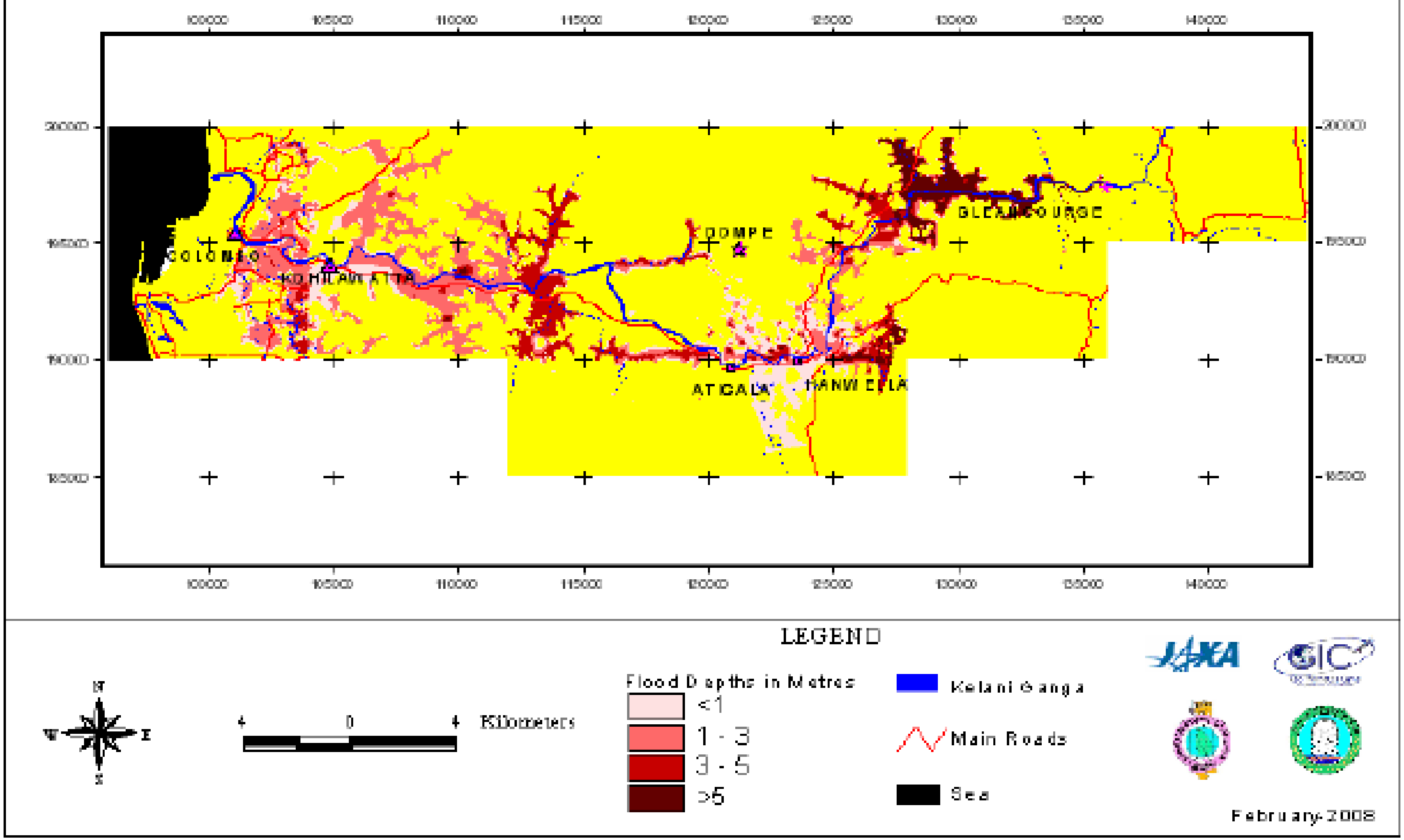


Data Used

- Hydrological data(Source: Irrigation Department)
  - Rating curve Discharge data, since 1972
- Topographic Data (Source: Survey Department)
  - Contour data (1: 10,000) as of Year 2000
  - Spot Heights as of Year 2000
  - River X-Sections at 10 locations as of Year 2007
- Vector Layers -1: 10,000(Source : Survey Department, 1987-2000)
  - River network /Road network / Land Use
  - Administrative Boundaries
  - Building Foot-prints
- Satellite data(Source: JAXA)ALOS/AVNIR-2

50 YEAR FLOOD HAZARD MAP

LOWEI LANKA



Conclusions

- HEC-RAS Software together with HEC-GeoRASwas successfully utilized to prepare flood hazard maps.
- Statistics show that the study area would be subjected to flood encroachments of 60, 77, and 94 square kilometers for events with return periods of 10 years, 20 years, and 50 years respectively .

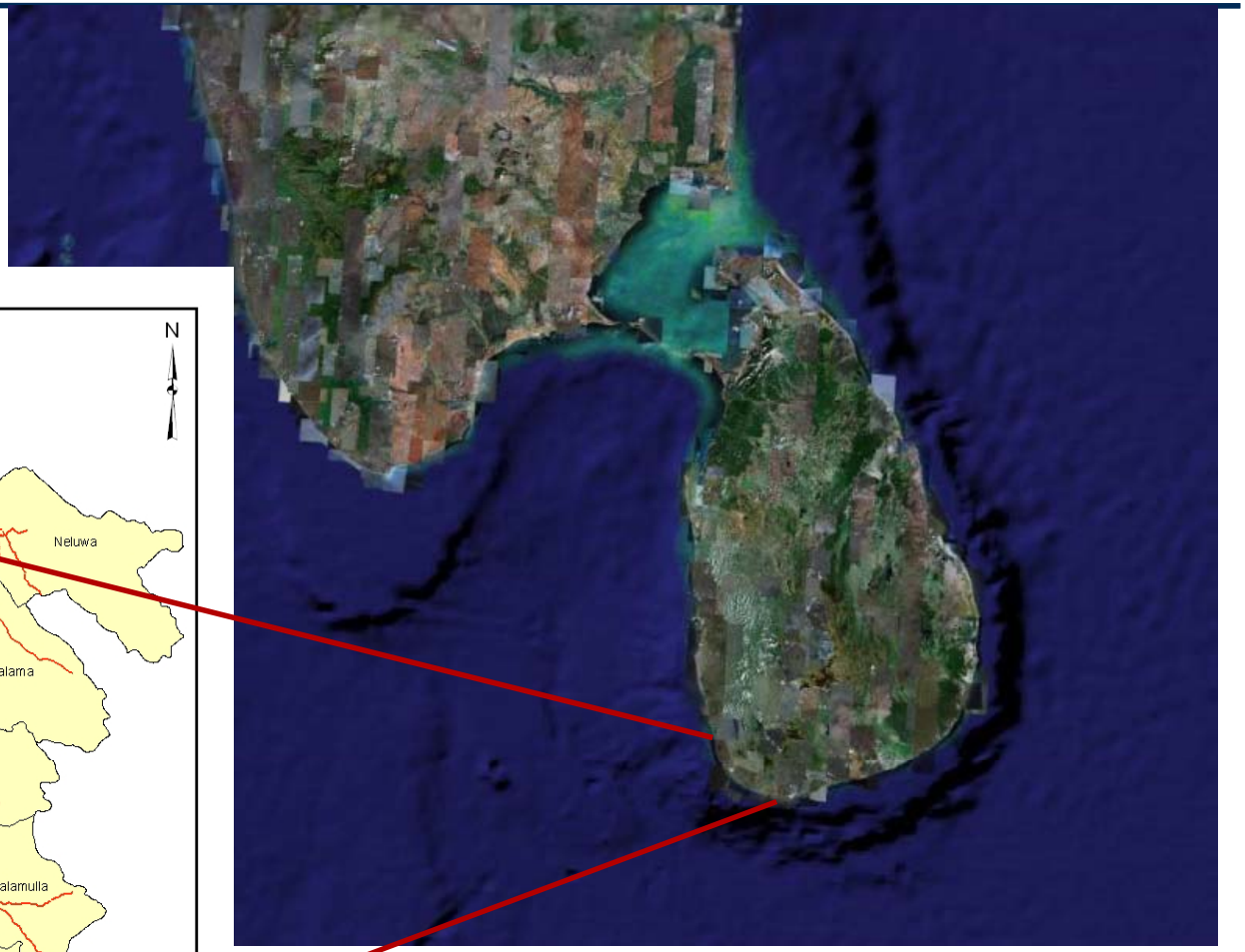
Mini Project 2008-2009

Risk Profile on Sea Level Rise
for
Coastal Zone Management
Galle District, Sri Lanka

» S.Sivanantharajah
» Senior Supdt. Of Surveys

» Bandula Wickramarachchi
» Chief Enginner

Project Area

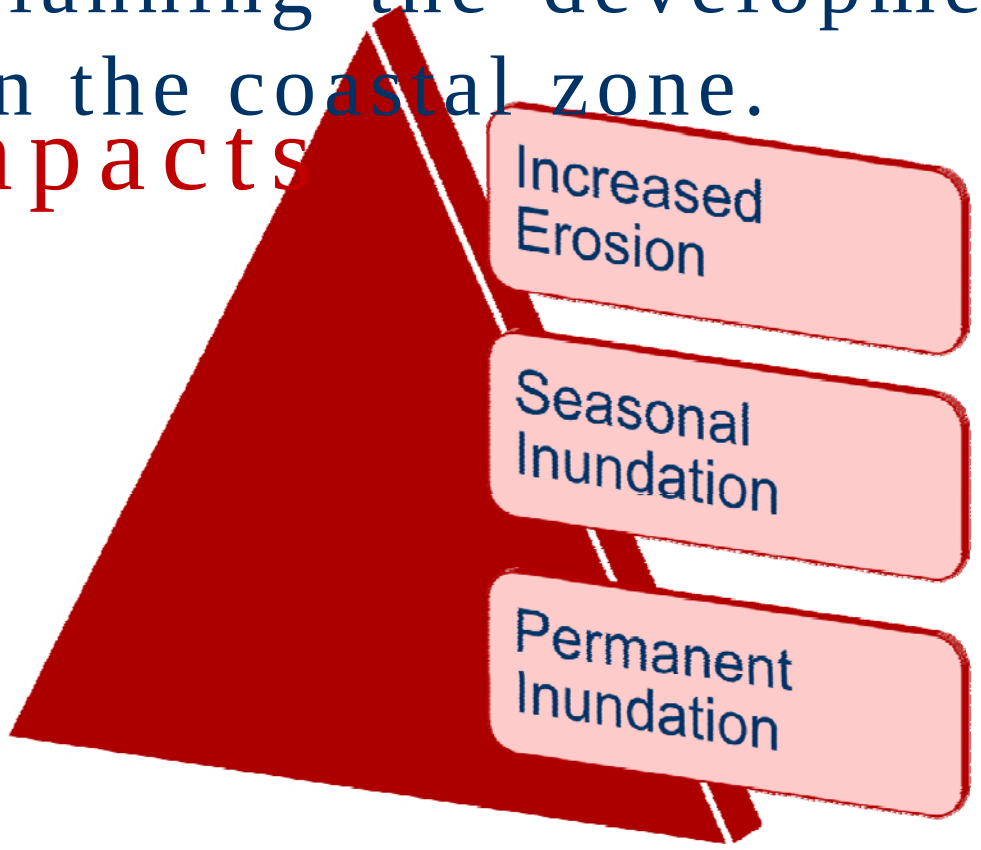


Coastal length	95 km
Population	2.3 million
Max pop density	8500 per sq km

Objective

Providing an overview of the vulnerabilities of the coastlines to the sea level rise is highly important in planning the development in the coastal zone.

Impacts



Data

- Topo Sheets 10k/(5k City Limits)
  - Building Foot Prints
  - Rivers/Streams
  - Roads
  - Admin Boundaries
  - Land Use
  - Land Cover
- LiDAR
- Ikonons 2002
- ALOS
  - AVNIR2 10% coverage
  - PRISM 50% coverage
  - PULSAR 50% coverage
- Shoreline
  - Major/Micro Coastal Cells
  - Shore Characteristics
  - Shore Profiles

Senses 2001

Demographic

Coastal Economic Study 2004

Tidal Forecast

Wave Climate 5 years off Galle

Sea Level Measurements

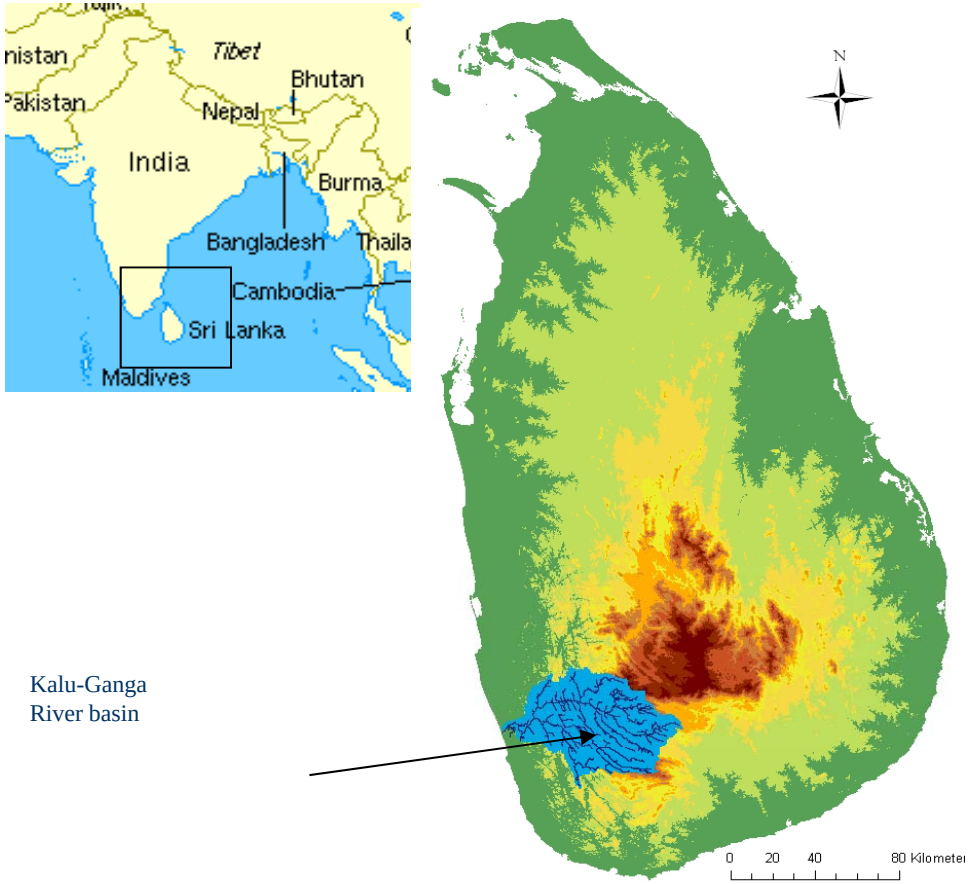
Commercial Habour

NARA

Mini Project 2009-2010

- **APPLICATION OF REMOTE SENSING AND GIS FOR FLOOD RISK ANALYSIS: A CASE STUDY AT KALU- GANGA RIVER, SRI LANKA.**
- S.M.J.S.Samarasinghe
  - Survey Department, Sri Lanka
- H.K.Nandalal
  - Department of Civil Engineering, University of Peradeniya,

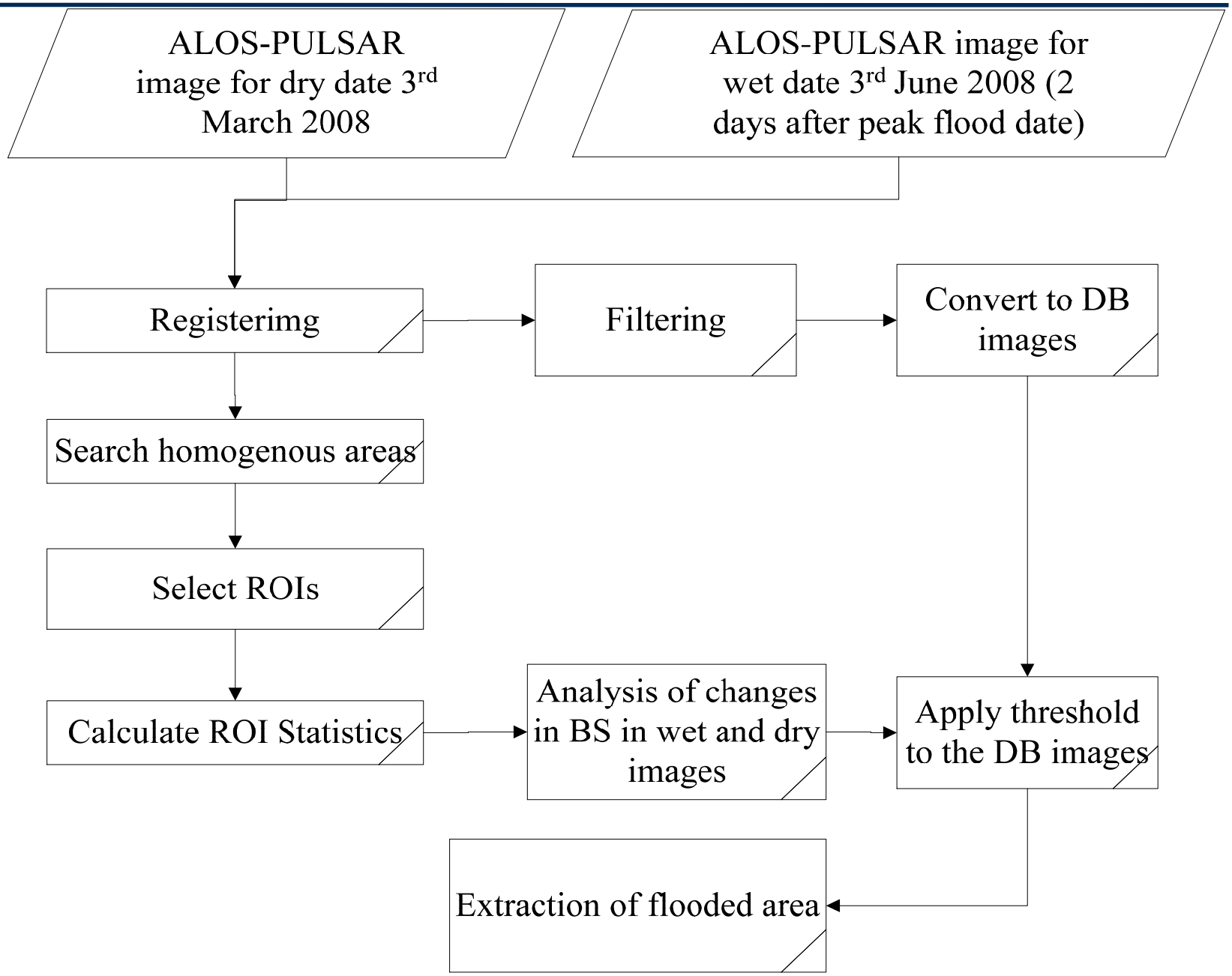
- Area



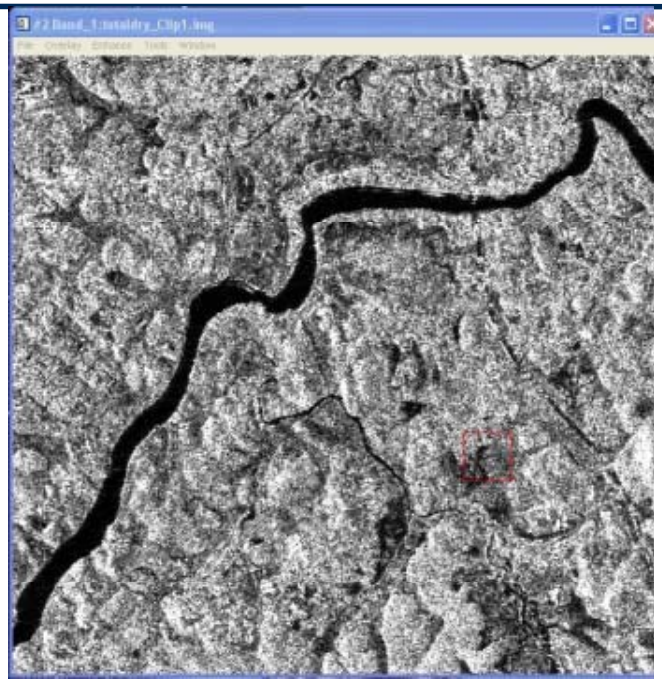
Kalu-Ganga
River basin

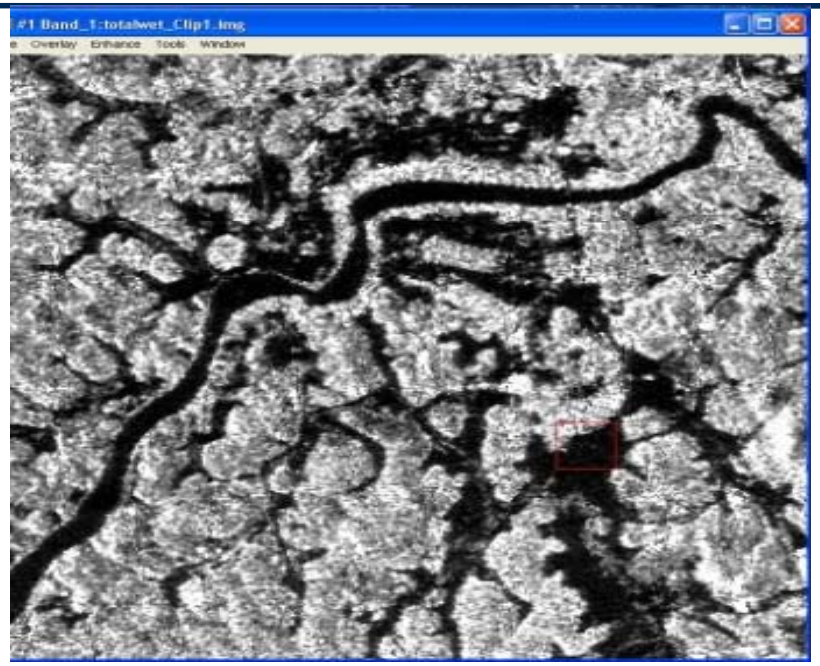
Figure 1: Kalu-Ganga River basin

Methodology for flood extent delineation



Data Analysis





ALOS PALSAR Images in
Dry date and Wet Date

Data Analysis

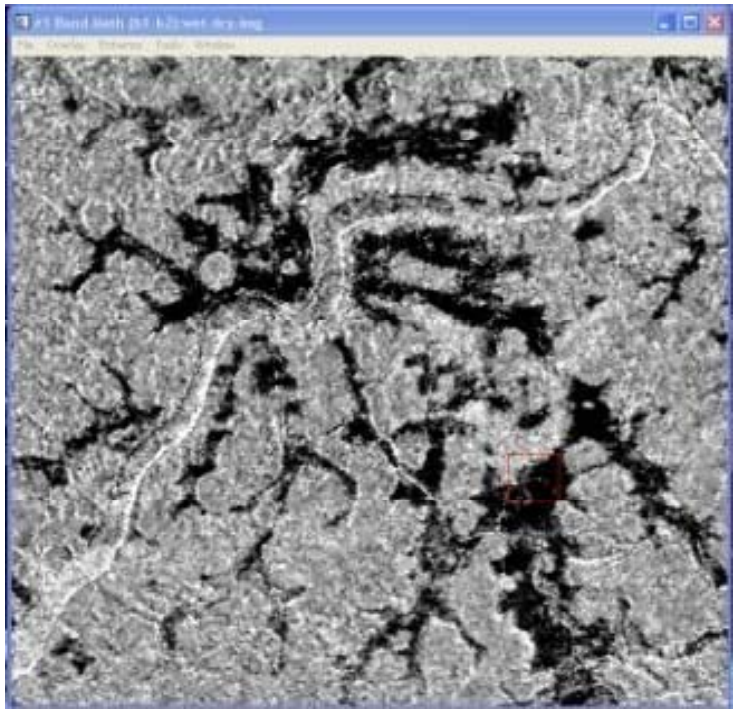


Image after performing the band math.

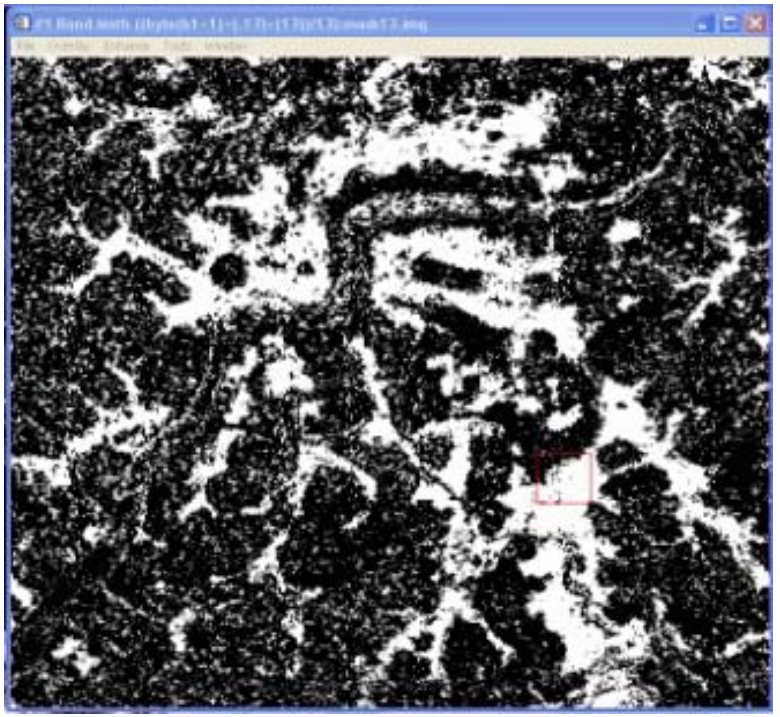
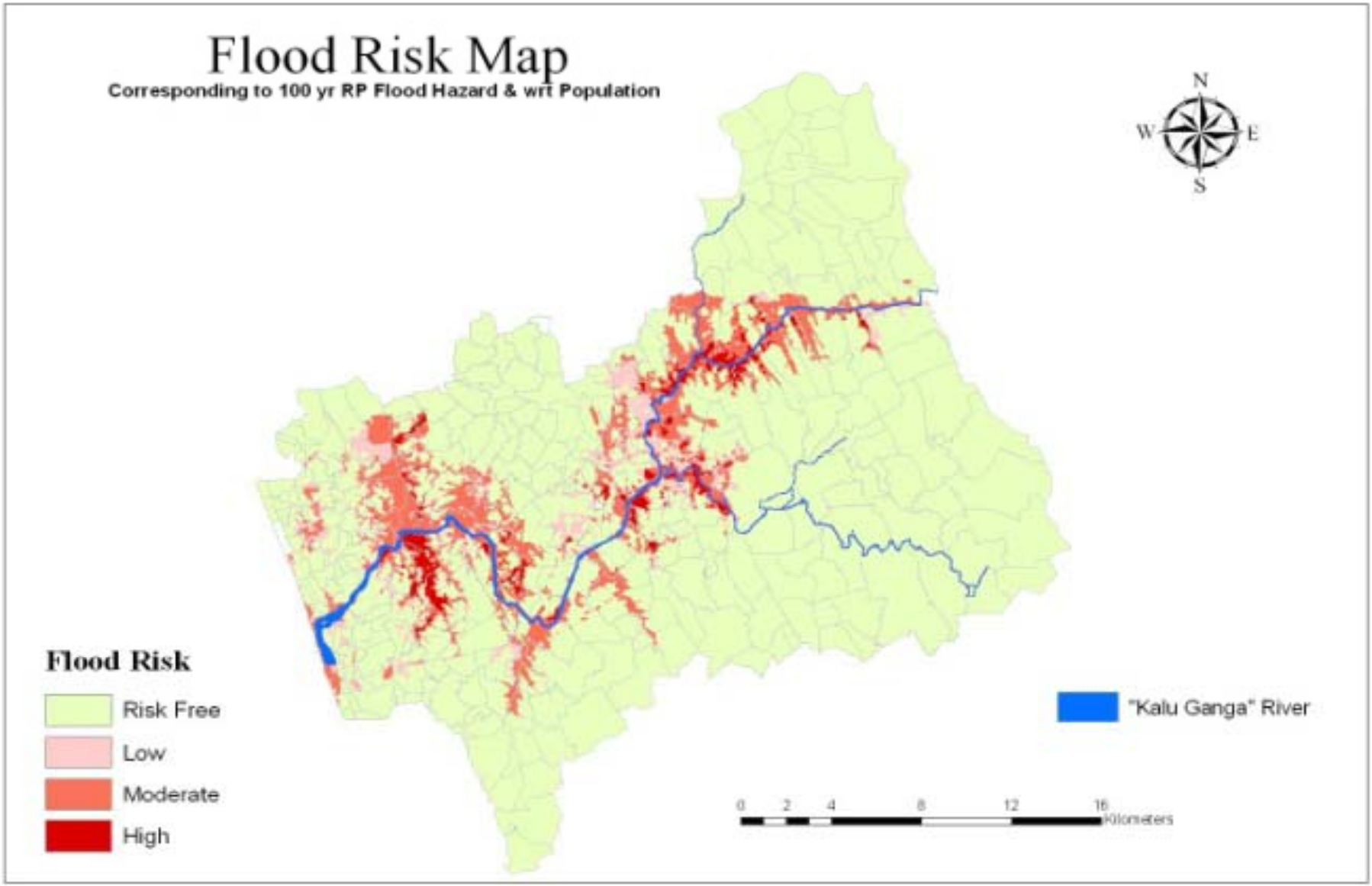


Image after masking for flood areas.

Flood Risk Map



Conclusions

- For the first time in Sri Lanka ALOS/PALSAR derived remote sensing data was utilized successfully for extracting flood extent and thereby to calibrate/validate HEC-RAS model output.
- The study had produced a series of (10, 20, 50, 100 yr return period) Hazard maps followed by Vulnerability and Risk Maps corresponding to the above return period events and considering the vulnerability of population and buildings.

Mini Project 2010-2011

Application of Remote Sensing and GIS for Flood Inundation Modeling, Mapping and Regulation in Gin Ganga Basin, Sri Lanka

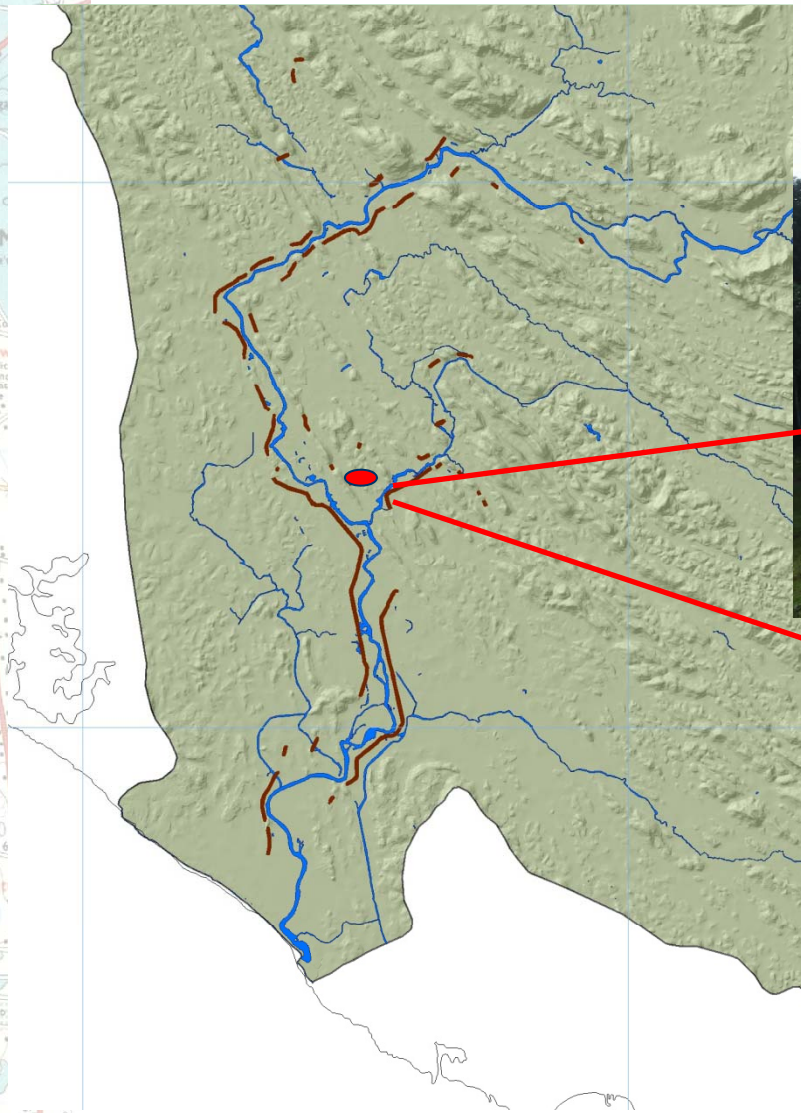
Irrigation Department

S.M Premasiri

Survey Department

B.C.P. Bogahawathta

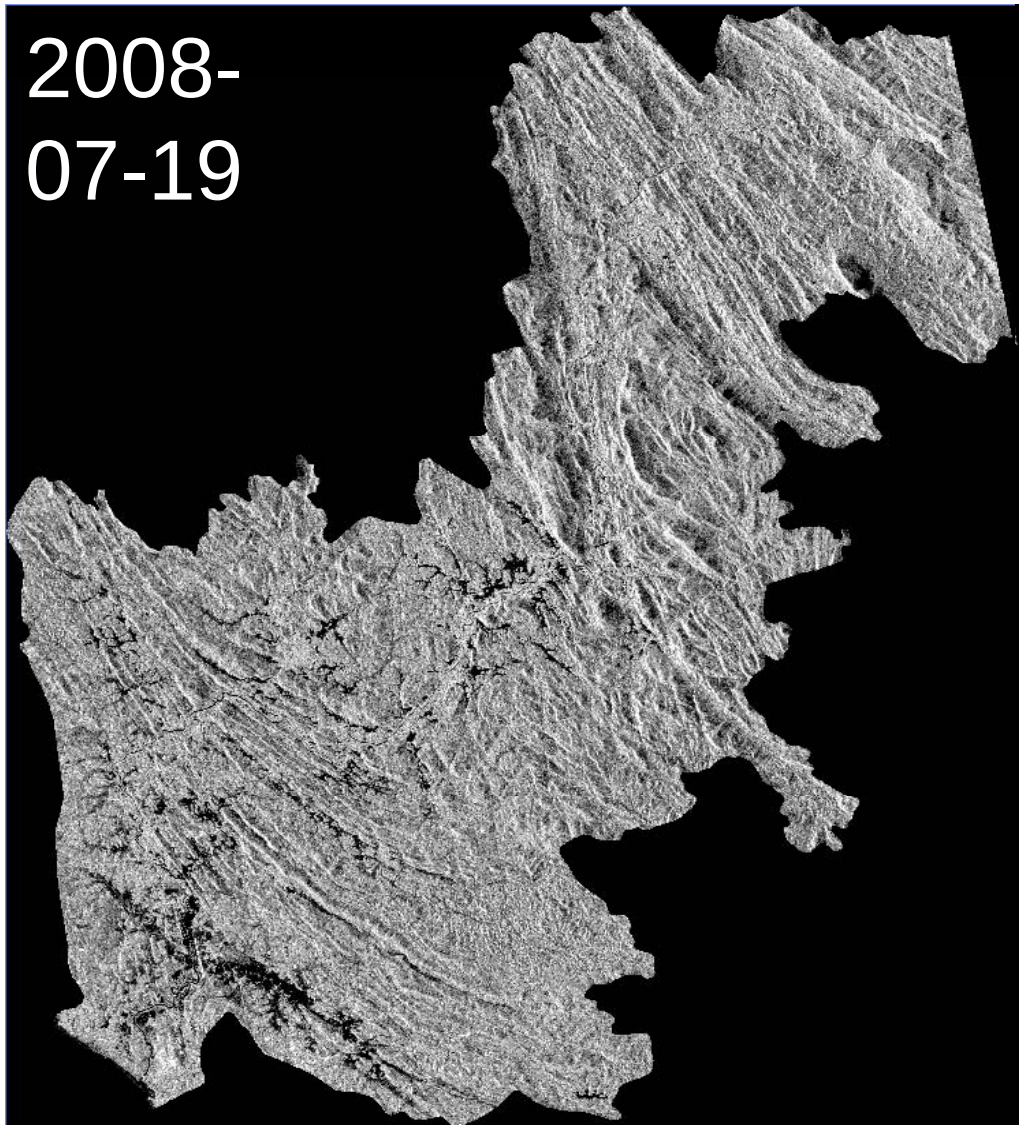
Study Area…



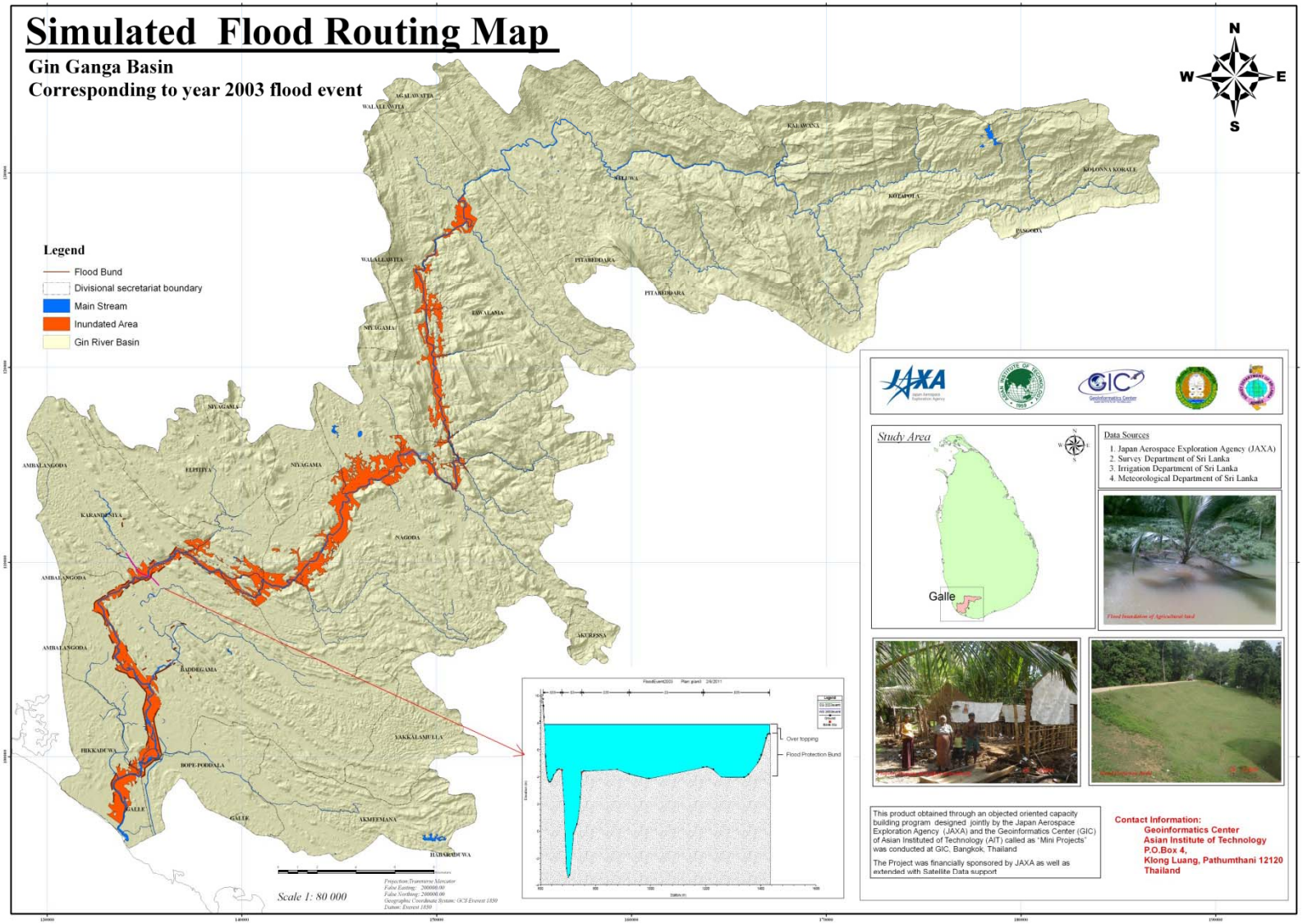
Flood regulation Bunds – 74 Total Length - 24184 m

Methodology…

Situation Analysis using ALOS/PALSAR



Results


Simulated Flood Routing Map
Gin Ganga Basin
Corresponding to year 2003 flood event
N
W
E
S
Legend
Flood Bund
Divisional secretariat boundary
Main Stream
Inundated Area
Gin River Basin
Scale 1: 80 000
Study Area
Galle
Data Sources
1. Japan Aerospace Exploration Agency (JAXA)
2. Survey Department of Sri Lanka
3. Irrigation Department of Sri Lanka
4. Meteorological Department of Sri Lanka
Over topping
Flood Protection Bund
This product obtained through an objected oriented capacity building program designed jointly by the Japan Aerospace Exploration Agency (JAXA) and the Geoinformatics Center (GIC) of Asian Instituted of Technology (AIT) called as "Mini Projects" was conducted at GIC, Bangkok, Thailand
The Project was financially sponsored by JAXA as well as extended with Satellite Data support
Contact Information:
Geoinformatics Center
Asian Institute of Technology
P.O.Box 4,
Klong Luang, Pathumthani 12120
Thailand

Conclusions

Remote sensing, GIS, and GPS together with flood modeling technique have successfully been applied to model existing flood routing system at the lower Gin basin in support of disaster preparedness and mitigation activities.

- Modeling reveals that in order to protect the inundation areas due to extreme events such as those of year 2003 which was of about 125 year return period event a raising of about 1m would be necessary
- Produced flood routing maps corresponding to 10yr, 20 yr, and 50 yr return period flood events are in good agreement with historical records pertaining to events of similar magnitude
- ALOS/PALSAR derived remote sensing data was also utilized to make a situation analysis of the flooding event of yr 2008.
- Outcomes of this study would be very much useful in devising an effective and efficient flood mitigation and management strategy in the lower Gin basin.

Mini Project 2011-2012

Mapping & Change detection in Mangrove areas in North & North Western Provinces in Sri Lanka

» M/S. Chamari Nanayakkara

» Survey Department of Sri Lanka

» M/S. Fernando

» Central Environment Authority

Study Area

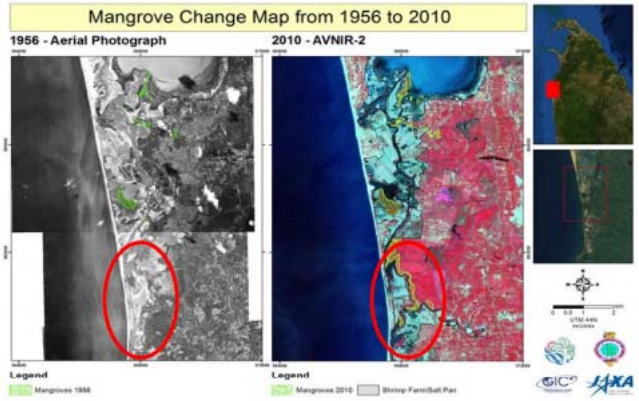


Figure 4.9.2: Mangrove changes in Puttlam Area 2

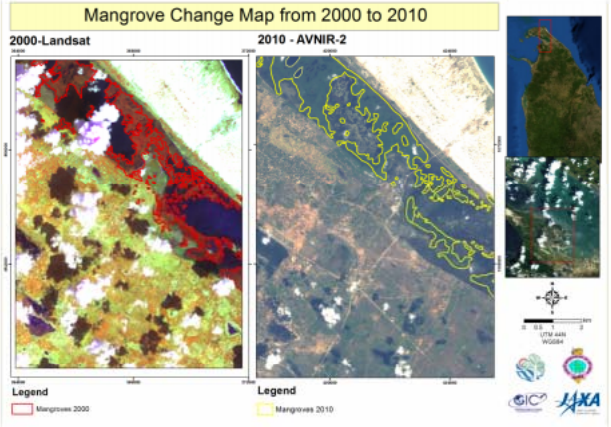
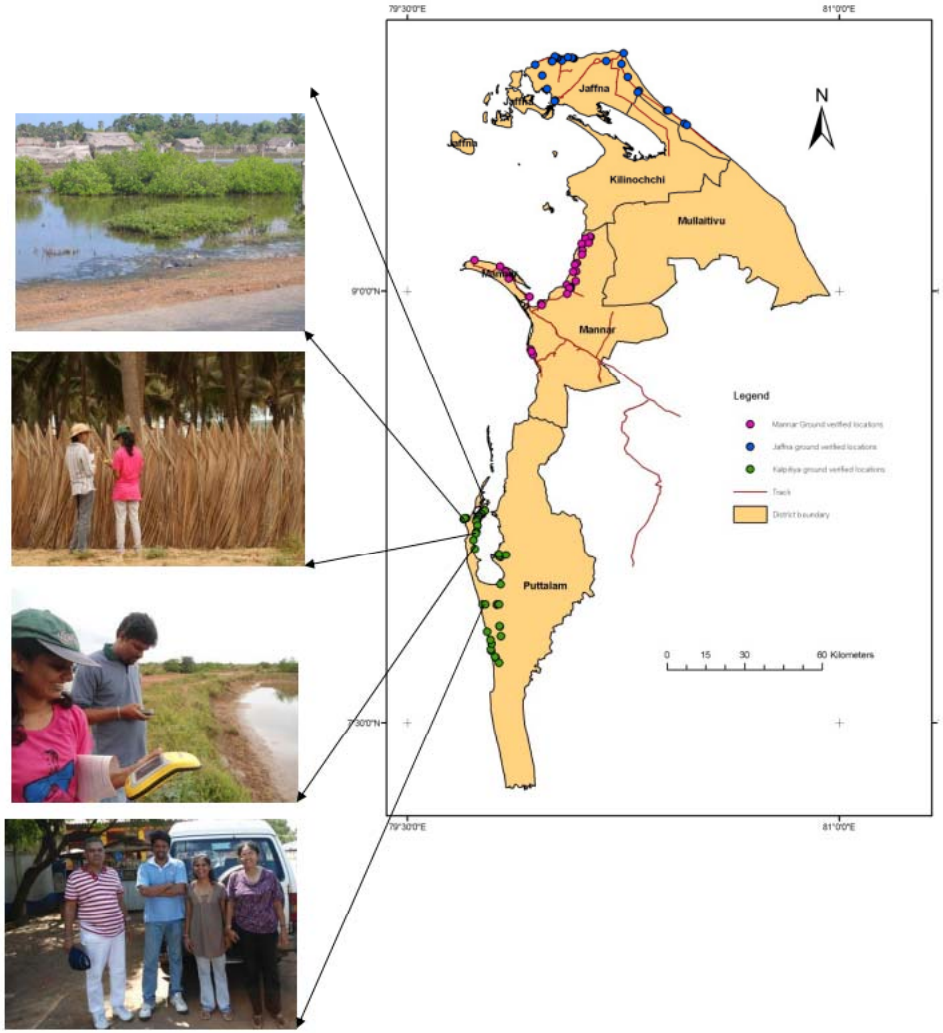
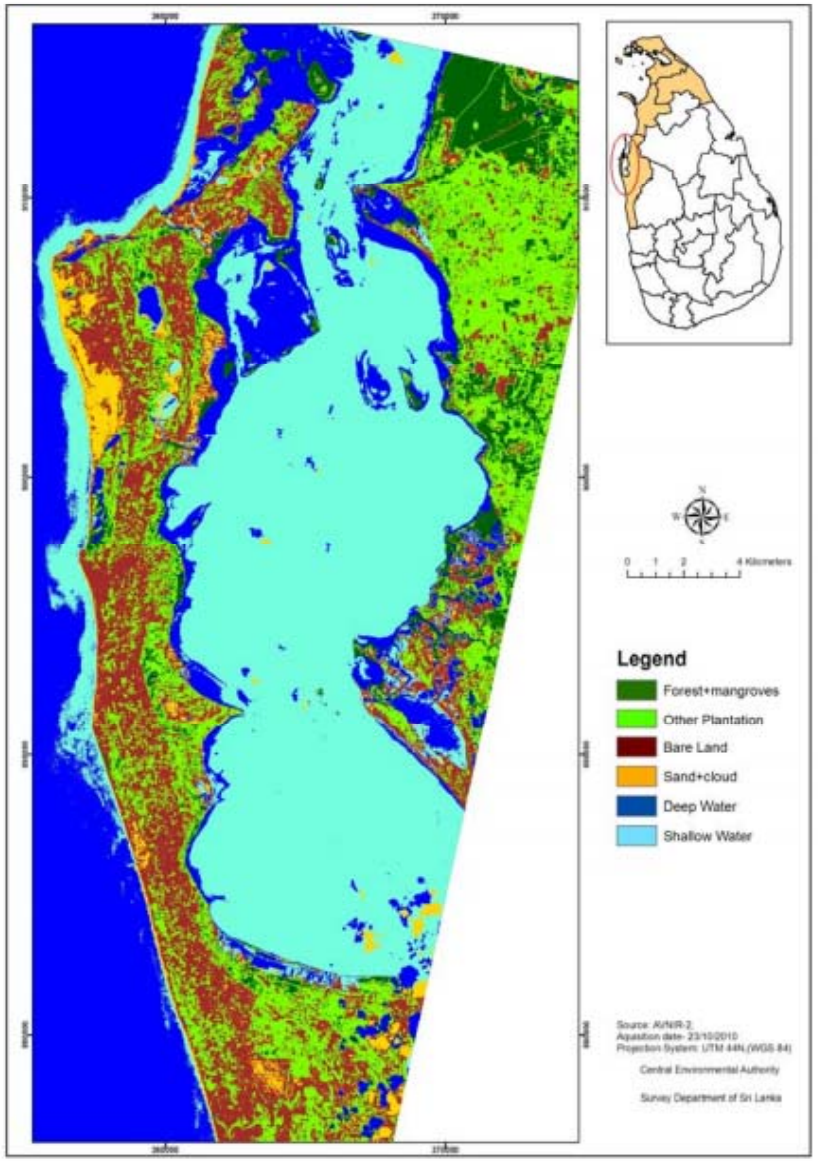


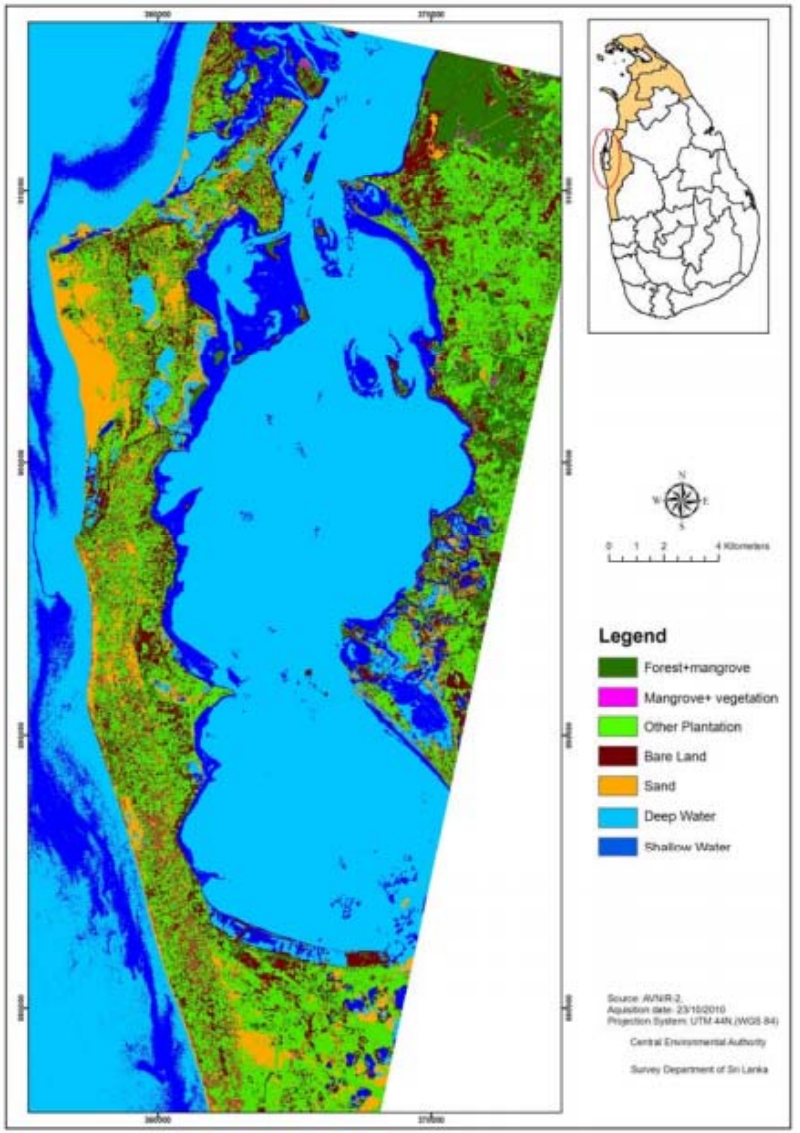
Figure 4.9.3: Mangrove changes in Jaffna Lagoon



Results

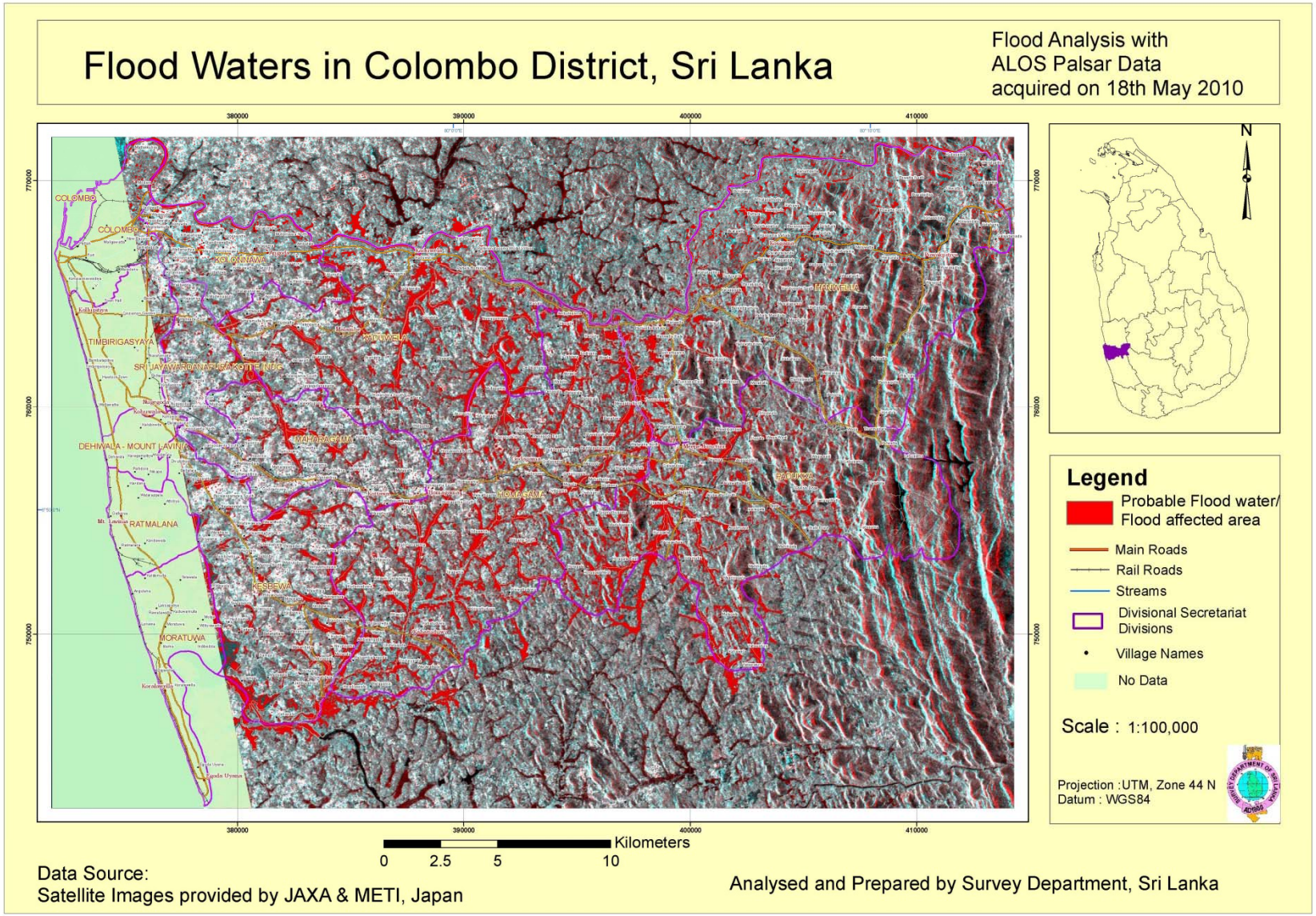


4.2.1: Classified images AVNIR-2 – Unsupervised classification

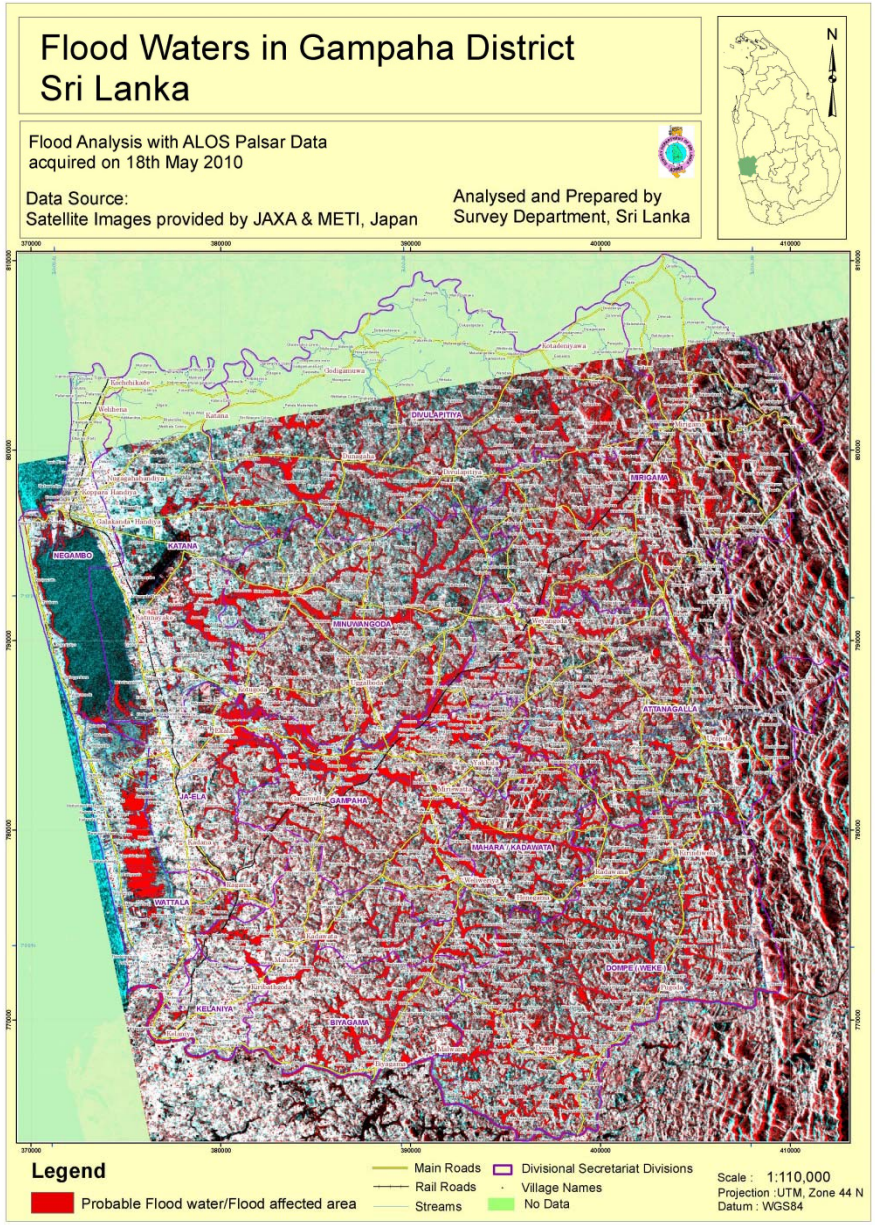


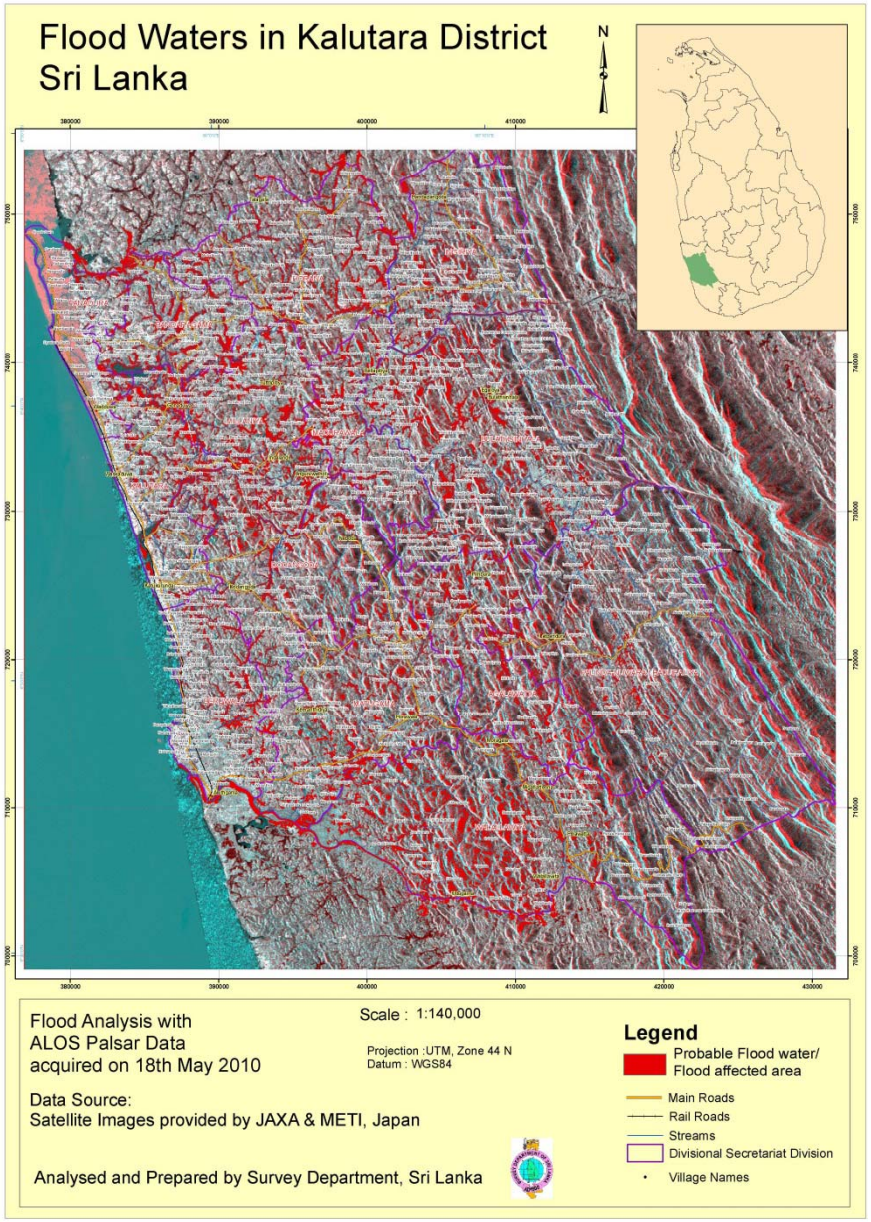
4.3.1: Classified images AVNIR-2 – Supervised classification

Flood waters in Colombo



Flood waters in Gampaha & Kalutara





Awareness Workshop on the On-going Mini Project

At Irrigation Department of Sri Lanka

Next Mini Project will start in Dec 2013

Thank You