GIS AND REMOTE SENSING IN VIETNAM:

SOME PROBLEMS AND PERSPECTIVES

Mai Trong Nhuan[1], Tran Nghi [2], Pham Van Cu[3], Nguyen Dinh Duong [4], Nghiem Vu Khai[5], Nguyen Ngoc Thach [2]

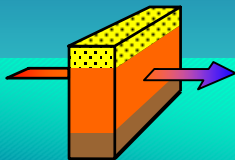*1 Vietnam National University (VNU), Hanoi*
2 University of Science, VNU
3 Centre for Remote Sensing and Geomatics VTGEO
  Institute of Geological Sciences, Vietnamese Academy of Science and Technology (VAST)
4 Institute of Geography, VAST
5 National Assembly of Vietnam

Main contents

- Introduction

- RS and GIS research and application in Vietnam in recent years

- RS and GIS training in Vietnam in recent years

- Future for RS and GIS research and training

- Conclusion

INTRODUCTION

- Remote sensing (RS) & GIS become popular in the world in various applications since at least more than 30 years.

- GIS has a longer development starting from 60's in Canada and rapidly extended its applications scope in the others.

- Especially from the first Earth observation of satellite (Landsat 1972)

- Measuring the spectral behavior of its component: Soil, Water and Vegetation

- Main goal: exploring the Earth resources, monitoring the changes in natural resources and environment, disasters …

INTRODUCTION
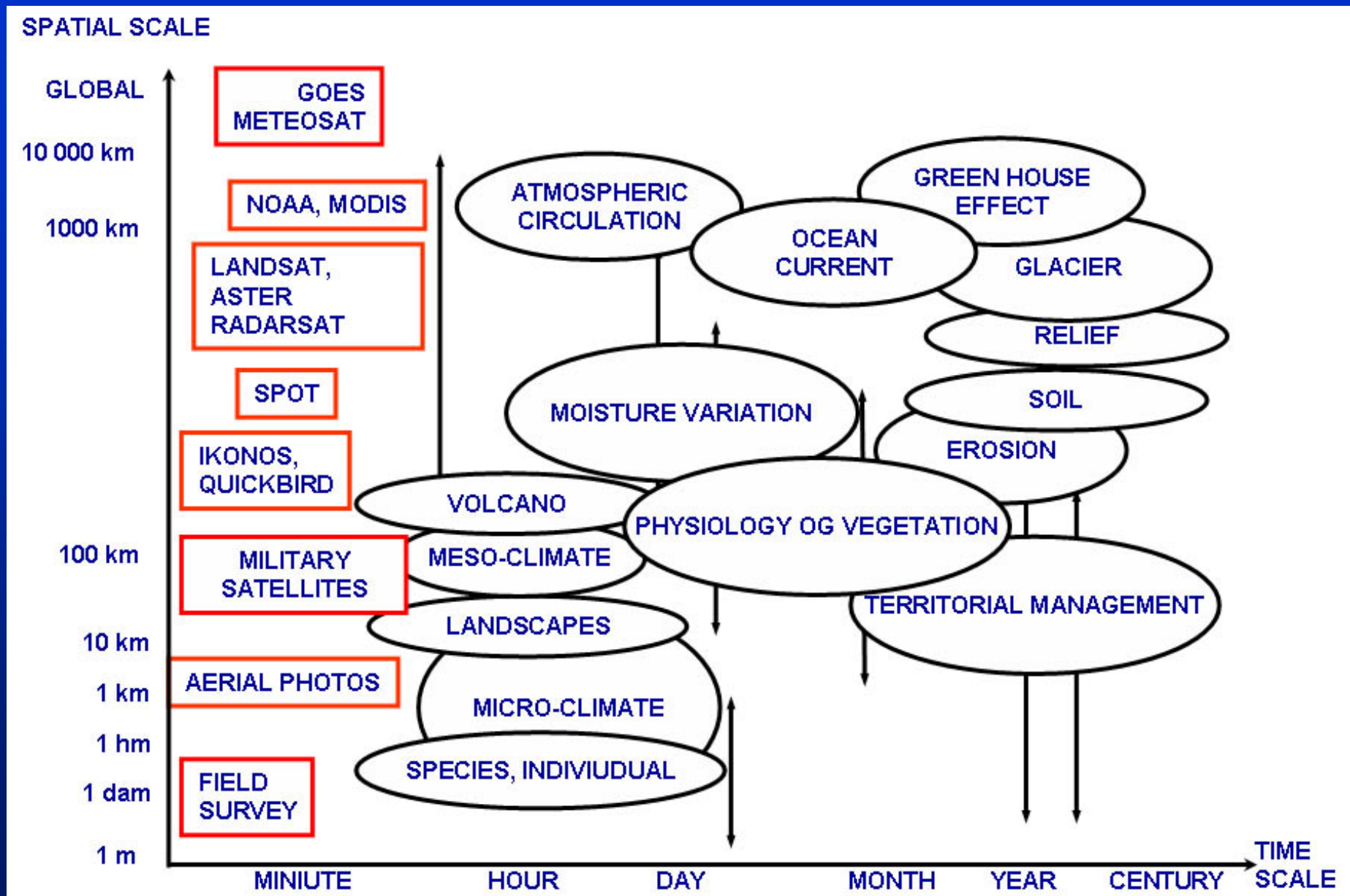
Spatio-temporal Multi-scaling Applications of Different Satellites (Bonn, 1998)

II. RS AND GIS CAPACITY BUILDING
2.1 Training

Remote Sensing Curriculums in use

■ Most of universities of sciences in Vietnam have training program on RS only for Earth science departments: geography, geology, cartography, geodesy, environment, hydrometeorology, oceanography land administration etc. and in agriculture and forestry universities in Hanoi, Ho Chi Minh City, Can Tho, Hue, Thai Nguyen since 1990.

■ The curriculums used is built for and especially on the lecturers often coming from research institutions → not a common standard in the universities

■ Physics of imageries, image processing and data modeling → frequently given in a single course

■ The courses are commonly oriented directly towards application in Earth sciences and natural resources and environment management

II. RS AND GIS CAPACITY BUILDING
2.1 Training

GIS Curriculums in use

■ The most adopted manuals for curriculum actually used in our universities are those of Aronnof (1991, 1993) and Bourrough (1986, 1998).

■ The User Guides of commercialized software such as Arcinfo, ILWIS etc. are sometimes cited and adopted for theoretic part of GIS courses

■ The manuals published by the lecturers of Hanoi University of Sciences, High School of Geology and Mining, High School of Civil Engineering of Hanoi are often a mixture of GIS data model .

■ The volume of GIS courses given for Batchelor level is of 45 to 60 hours for students of 3rd years with about 30% of overall time reserved for practical exercises.

The efforts done for applied courses in GIS training are still inadequate and supplementary training is frequently requested by our students who are strongly interested only in software manipulation rather than to improve their theoretic background.

II. RS AND GIS CAPACITY BUILDING
2.1 Training

Software and Satellite Images used in Vietnamese universities and research institutions

- Almost all the most popular software are now used for training and research activities in our universities: PCI, ERDAS, IDRISI, ENVI,ILWIS, Arcinfo, Arcview, Mapinfo,MIKE, WINCHIP....

- Landsat data are the most common in training exercise and demonstration for its great accessibility and reasonable price.

- Recently, ASTER data are introduced into the universities via several research projects with Japanese Universities and research institutions.

- SPOT data are less used due to its extremely expensive price.

- SAR data (ex. Radarsat, ENVISAT, high resolution data of IKONOS and Quickbird) are not yet used for training and research in universities;

- Hyperspectal data are quite unknown yet.

- NOAA data have recently been introduced into two Batchelor memories of 2003 and 2004 at the department of Geography of Hanoi University of Sciences.

II. RS AND GIS CAPACITY BUILDING

2.1. Training

University Human Resources for Remote Sensing and GIS Training

Most of permanent of university lecturer staff specialized in Remote Sensing have been graduated from AIT, Bangkok and from ITC (Netherlands) or Iidian,Belgium.

The rest of staff received their background in different universities of Australia, Japan and Sweden.

It must be remarked that the participation of the scientists coming from research institutions of Vietnam in remote sensing and GIS training is considerable.

These scientists are graduated mostly in abroad as : France,Jerman,Russia, Canada , Japan... with their research and application experiences and evidently bring a diversity of approached into their courses.

II. RS AND GIS CAPACITY BUILDING

2.1. Training

Link of GIS, Remote sensing education and research

Aim of the link : Improving quality of GIS, RS education and Research; Enhancing GIS, RS education and research capacity building; increasing effectiveness of GIS, RS education and research.

- *What to do*: Creating mechanism for effective link of GIS, Remote sensing education and research:
- Connect to the international RS and GIS network with the AIT, GISDA (Thai land) and the Japan networks for renewing and increasing effectiveness of GIS, RS education and research.
- -Exchanging of RS-GIS experts between universities and research facilities from national and oversea such as from Japan, Thailand, India, Canada, China, France, EU, US... .

II. RS AND GIS CAPACITY BUILDING
Research institutions growth but collaboration to be ameliorated

- Environment Information Processing Division, Ins. Geography, VAST
- Spatial technology Application Centre (STAC), Ins. of Physics, VAST
- Centre for RS and Geomatics VTGEO, Ins of Geology, VAST
- Remote Sensing and Data Base Division, Ins. of Oceanography, VAST
- RS and GIS Centres, MONRE
- RS Centres, Ministry of Agriculture and rural Development
- Centre of RS and Centre of GIS, Army cadastral Department
- RS and GIS Department, Institute of Metrology and Hydrology
- College of Science, VNU Hanoi, Centre for Research and application of RS and GIS (ARGIS)
- Others

II. RS AND GIS CAPACITY BUILDING

Training institutions

- HUGM
- HUS, VNU HN, VNU HCM
- HUA
- UF
- UAF, HCM city
- UA (Nha Trang)
- College of Science, Hue University
- …..

II. RS AND GIS CAPACITY BUILDING
2.2.RS and GIS Infrastructures development

RS and GIS hardware and software development\

Hardware

- Receiving stations: mainly for weathering
- Telecommunication transmissions lines: rather good
- Internet system: good
- Intranet depending on capacity of each institution: bad $\rightarrow$ good

Software:

- PCI, ERDAS, IDRISI, ENVI,ILWIS, Arcinfo, Arcview, Mapinfo,MIKE, WINCHIP....

III. International cooperation

3.1 RS and GIS capacity building

* UNDP's project of RS in Vietnam (1980)
  - Forestry inventory at FIFI
  - Vietnam academy of science and technology
* Other international projects at:
  - MARD, MOFI, MONRE, …
  - Universities: projects funded by ESA, CIDA, IDRC, SIDA, AUF, JICA.

3.2 RS and GIS workshops, conferences funded by foreign institutions and organizations: Kyoto University, Osaka City University, UNU, Japan Embassy in Vietnam, AIT,…

III. International cooperation

3.3 RS and GIS infrastructure development

3.4 RS and GIS application

- Flood prediction and mapping
- Soil erosion modeling
- Spatial analysis of deforestation risks
- Urban extension mapping and health problems related to environment quality
- Geological structure study and others

3.5 Lessons learn from the international cooperation

- The international projects with the best results should be:
^ Well and long-term planned
^ Supported on a long-term basic
^ Based on combination of governmental, industrial and university interventions

IV. APPLICATION OF REMOTE SENSING AND GEOGRAPHICAL INFORMATION IN VIET NAM

Remotely sensed Data used in Vietnam

* For resource studies:
 - Landsat
 - Spot
 - Radarsat
 - Aster
  - IKONOS, Quickbird

* For environment studies:
-NOAA, NOAA-AVHHR
-Modis (USA)
-Moss, Jers (Japan)
-GMS,

-FY (Fung -Yun, China)

IV. RS and GIS application
4.1 Disaster mitigation
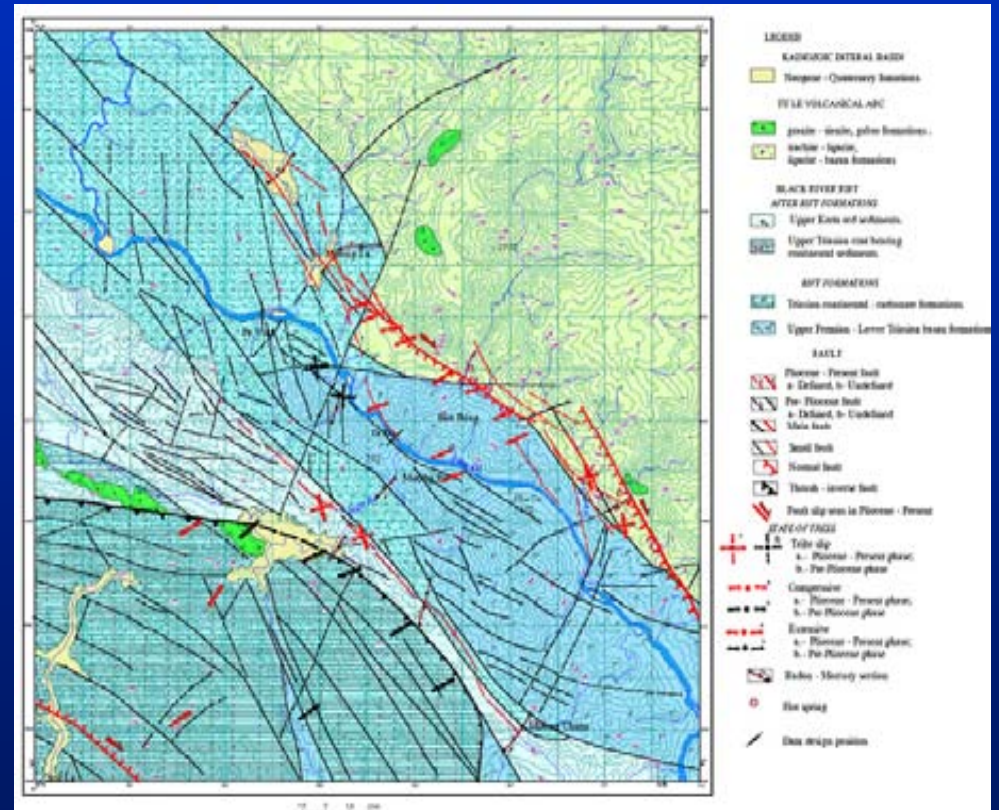
Flooding

Landslide

Active fault ▪

Forest fire

Desertification

Vulnerability assessment

IV. RS and GIS Application
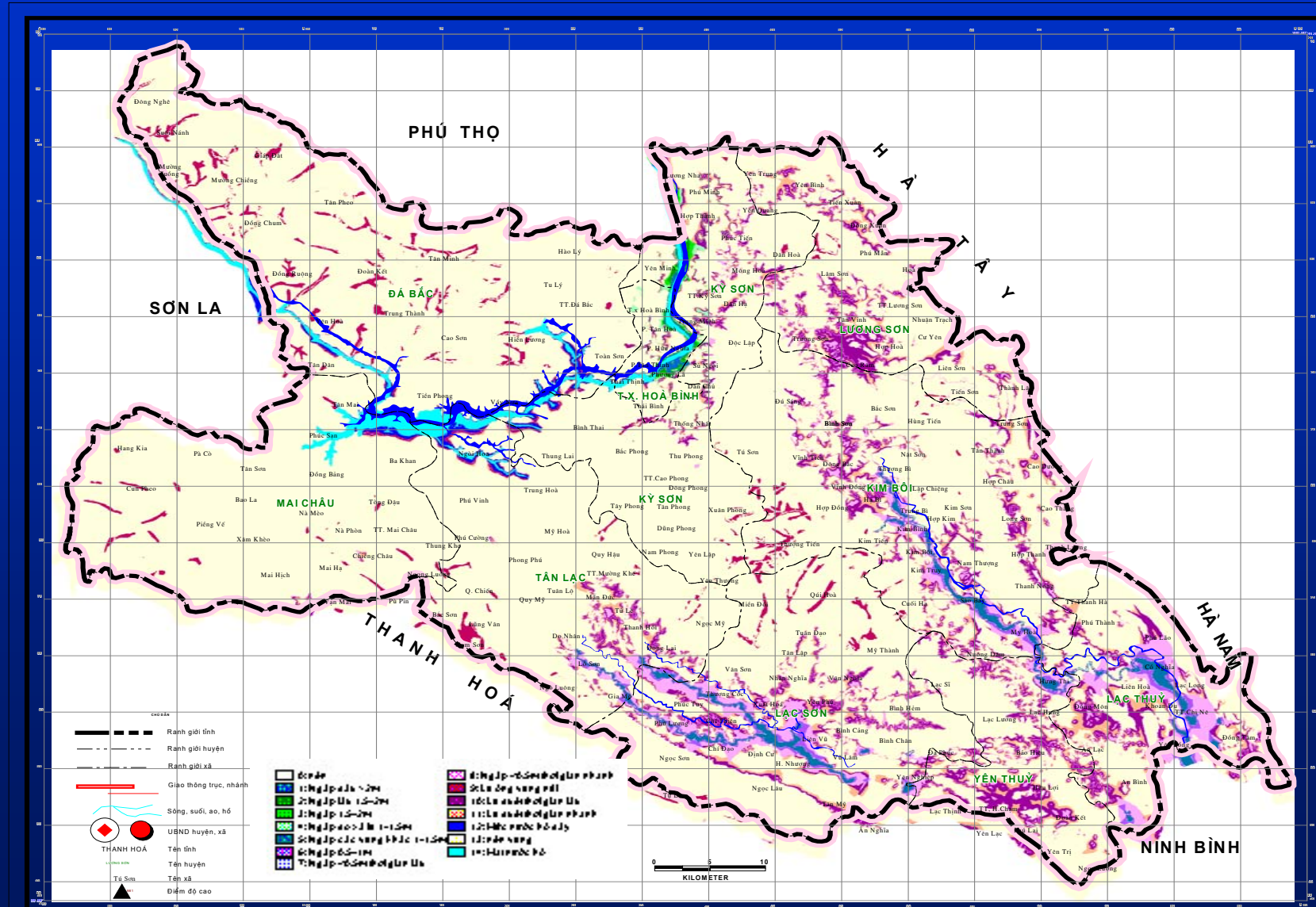## 4.1 Disaster mitigation

SPOT image and seismotectonic map in Son La hydropower dam area
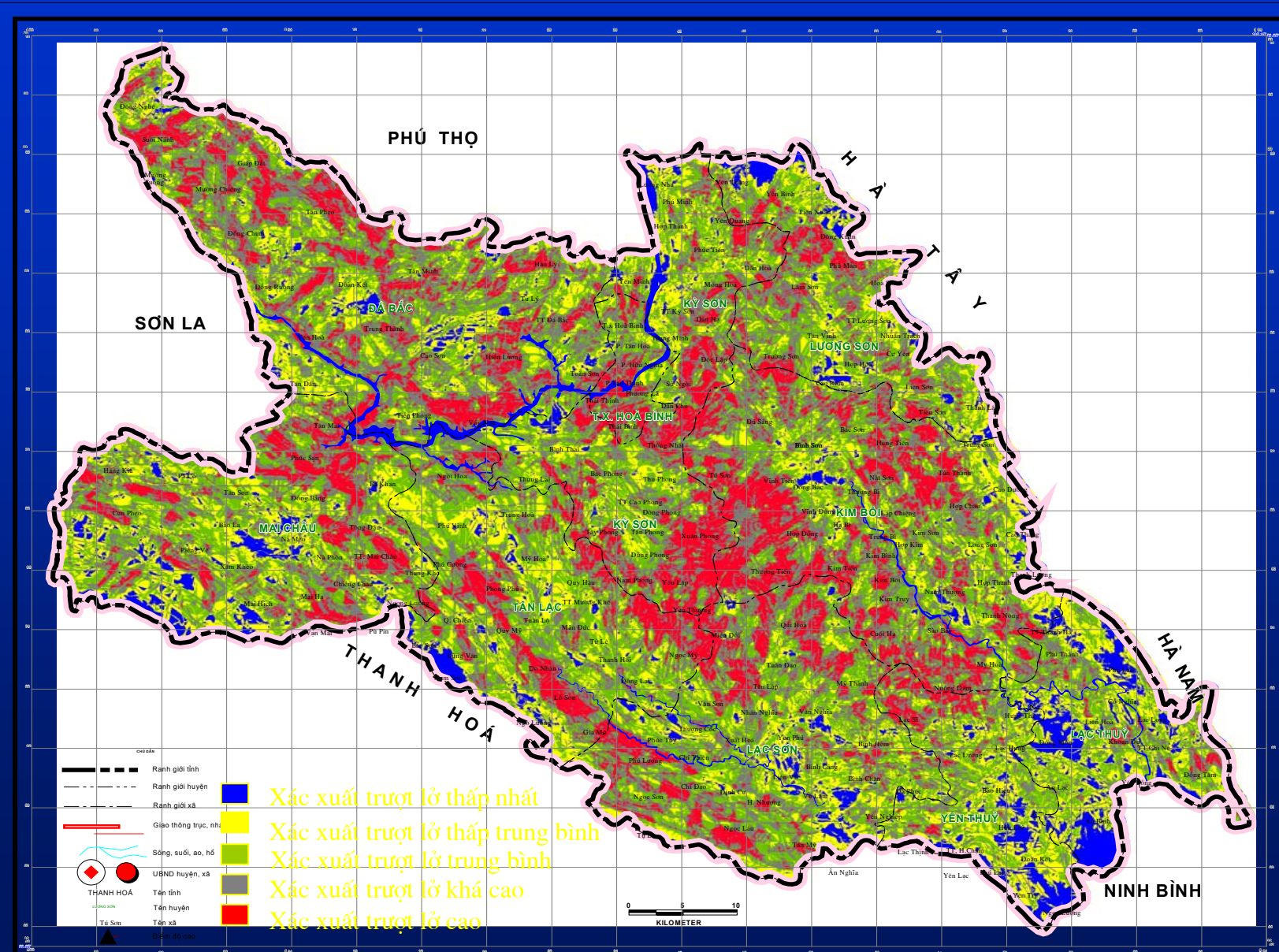
IV. RS and GIS Application
4.1 Disaster mitigation

Perdition of flood and landslide in Hoa binh province by using RS and GIS

IV. RS and GIS Application

4.1 Disaster mitigation

Flooding prediction by using RS and GIS

IV. RS and GIS Application
4.1 Disaster mitigation

Landslide prediction map by integration of RS and GIS
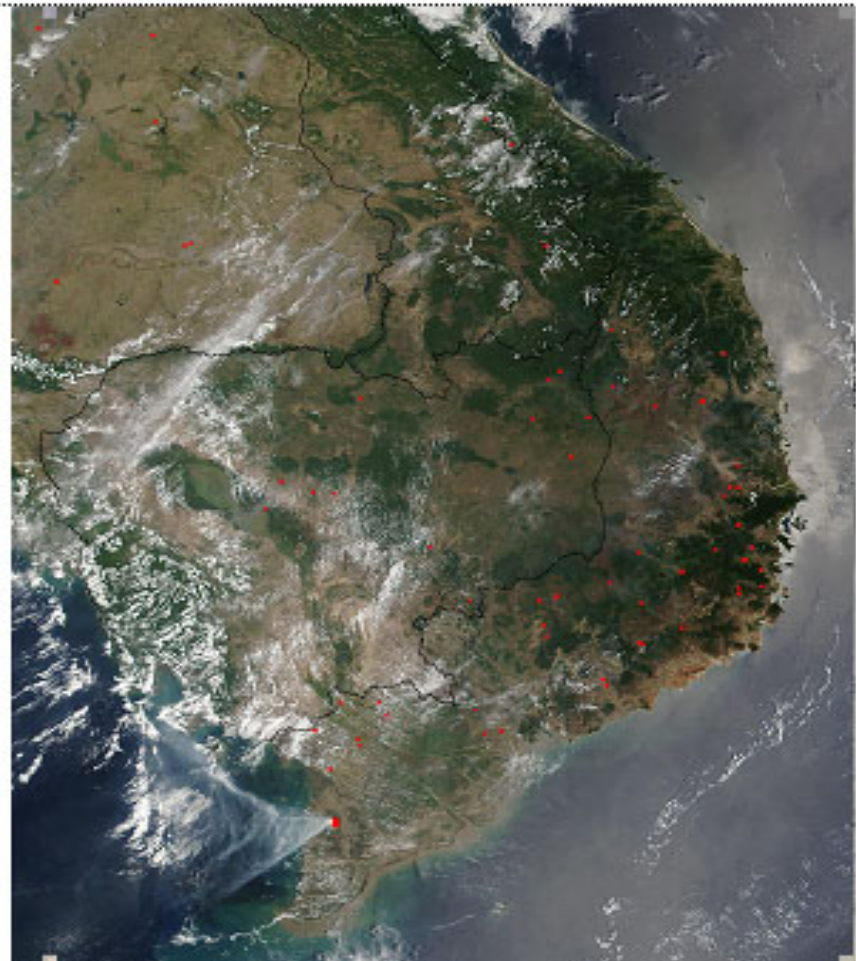
IV. RS and GIS Application
4.1 Disaster mitigation

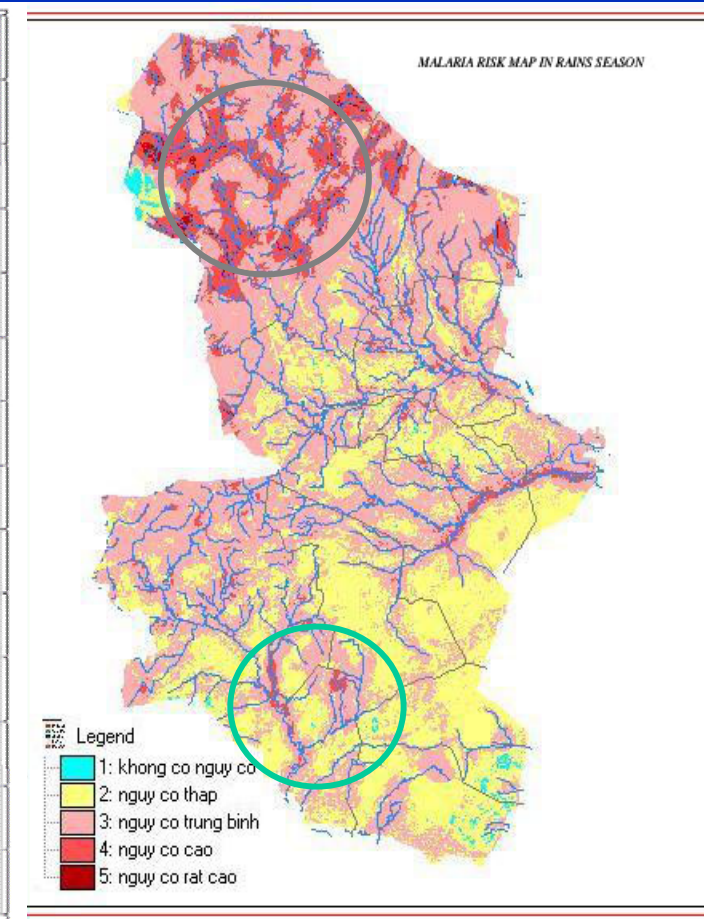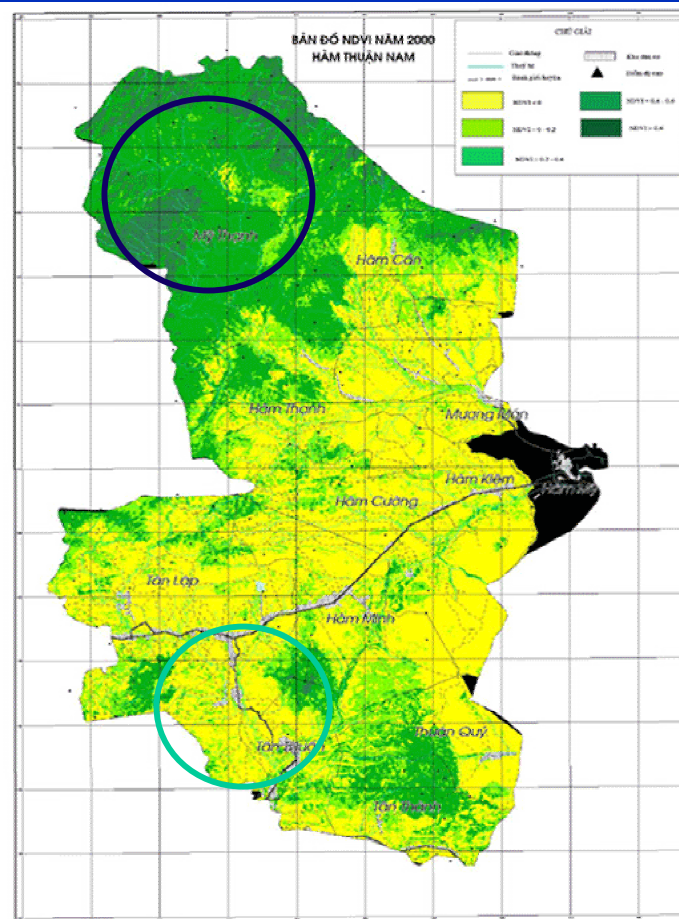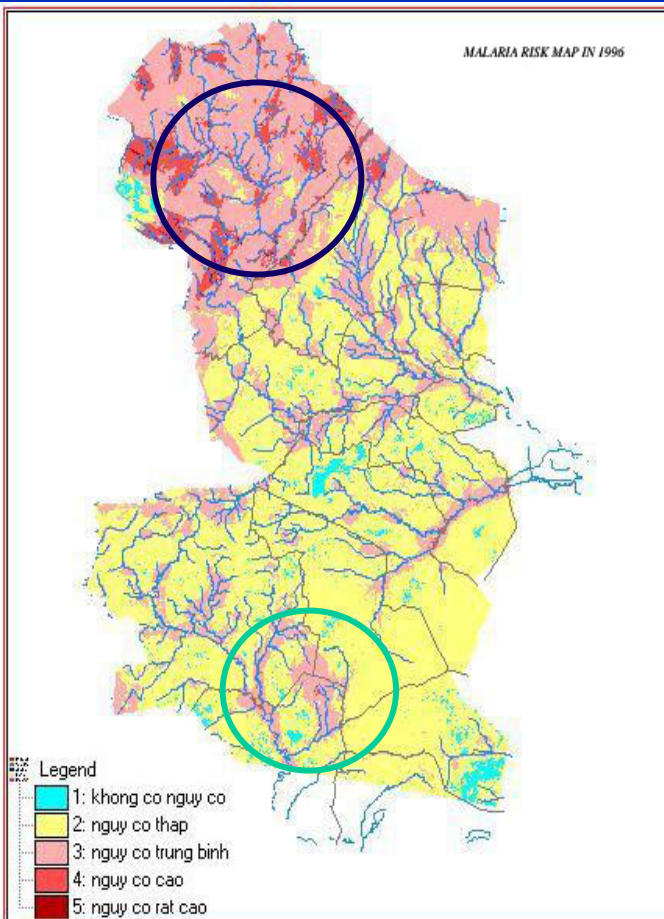Application of modis data for forest fire monitoring in viet nam

FOREST FIRE AT KIEN GIANG PROVINCE 11- 2002 FROM MODIS DATA

IV. RS and GIS Application
4.1 Disaster mitigation

Change of malaria rick compare with NDVI changed during seasons
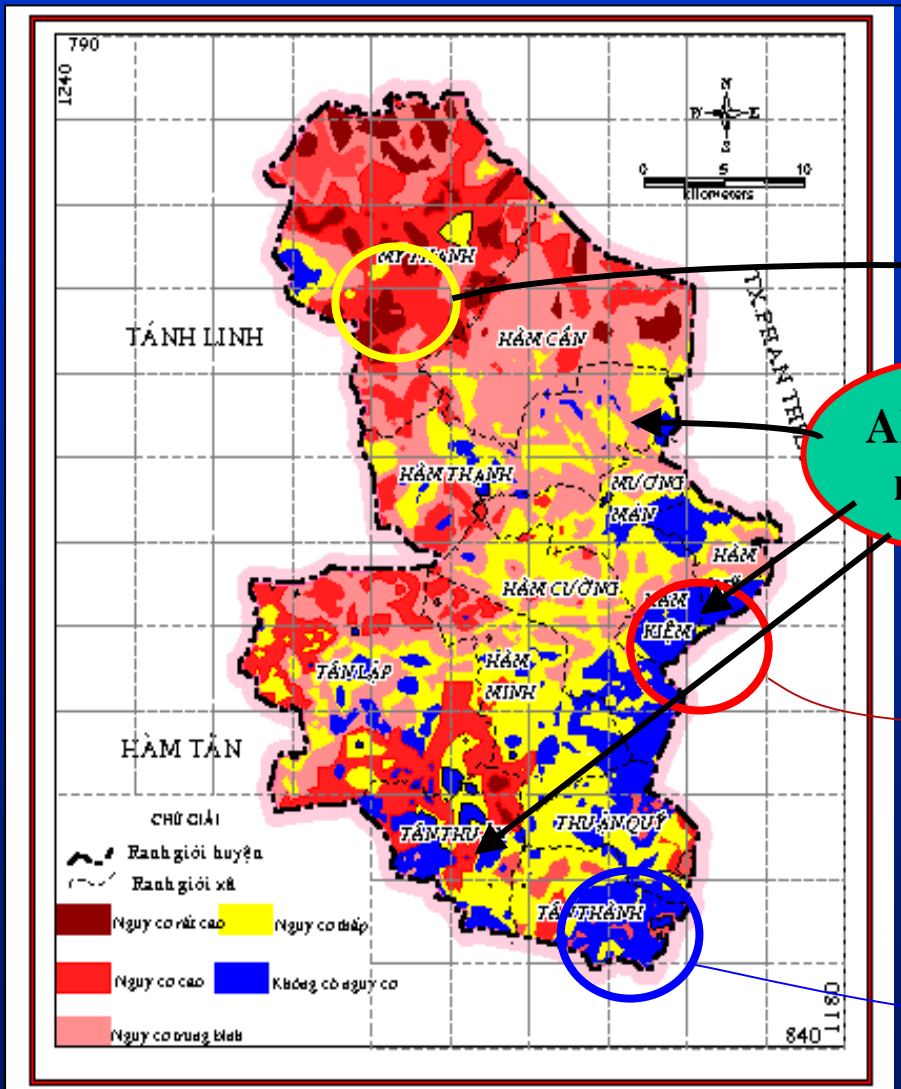

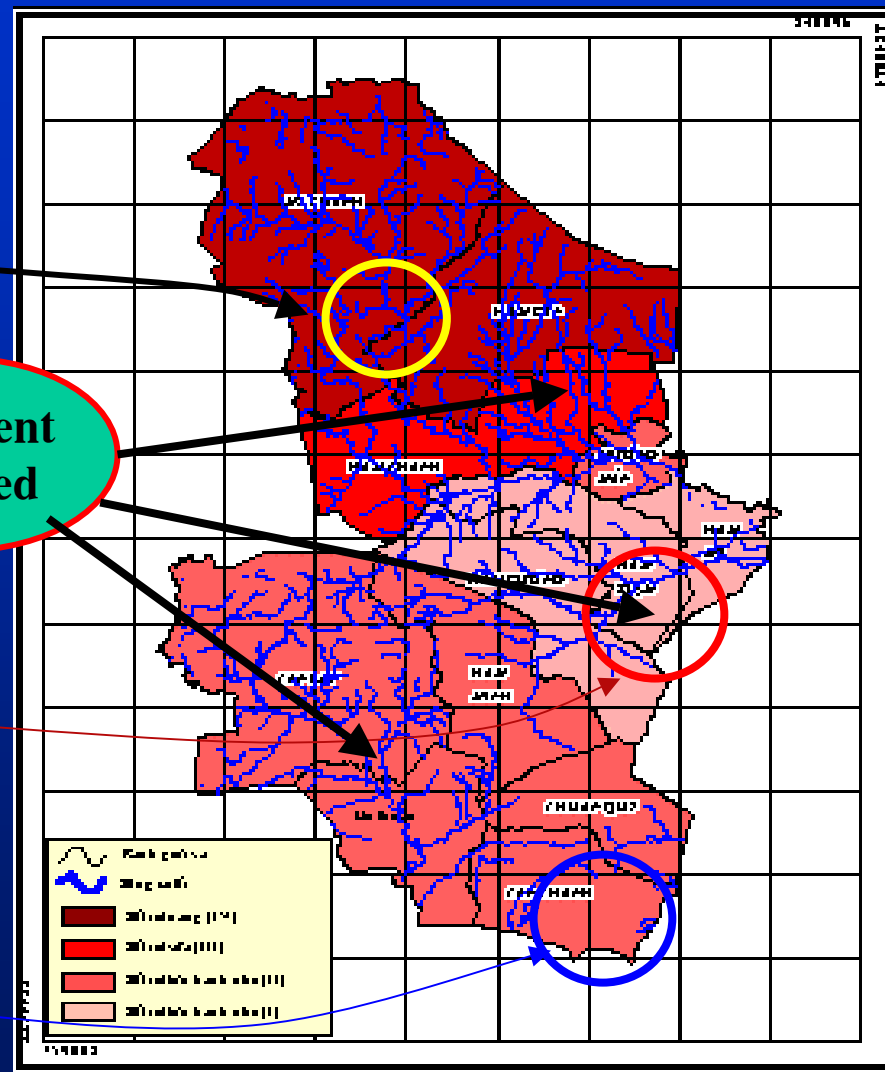**Malaria risk in dry season** **NDVI change** **Malaria risk in rainy season**

IV. RS and GIS Application
4.1 Disaster mitigation

Result verifying

Aligment needed

Malaria risk map

Statistic map of the malaria risk

IV. RS and GIS Application
4.1 Disaster mitigation

Using of the Aster data for malaria risk mapping at
Ham thuan nam Diatrict , Binh Thuan Province

Densiduas forest

Fruit plantatuon

Rice field

Cash cro
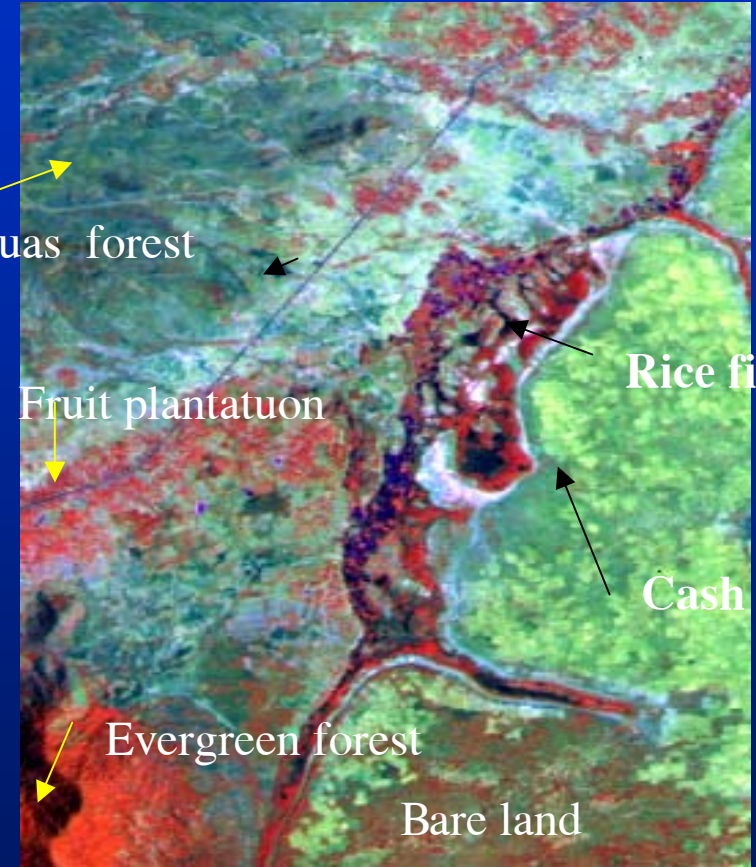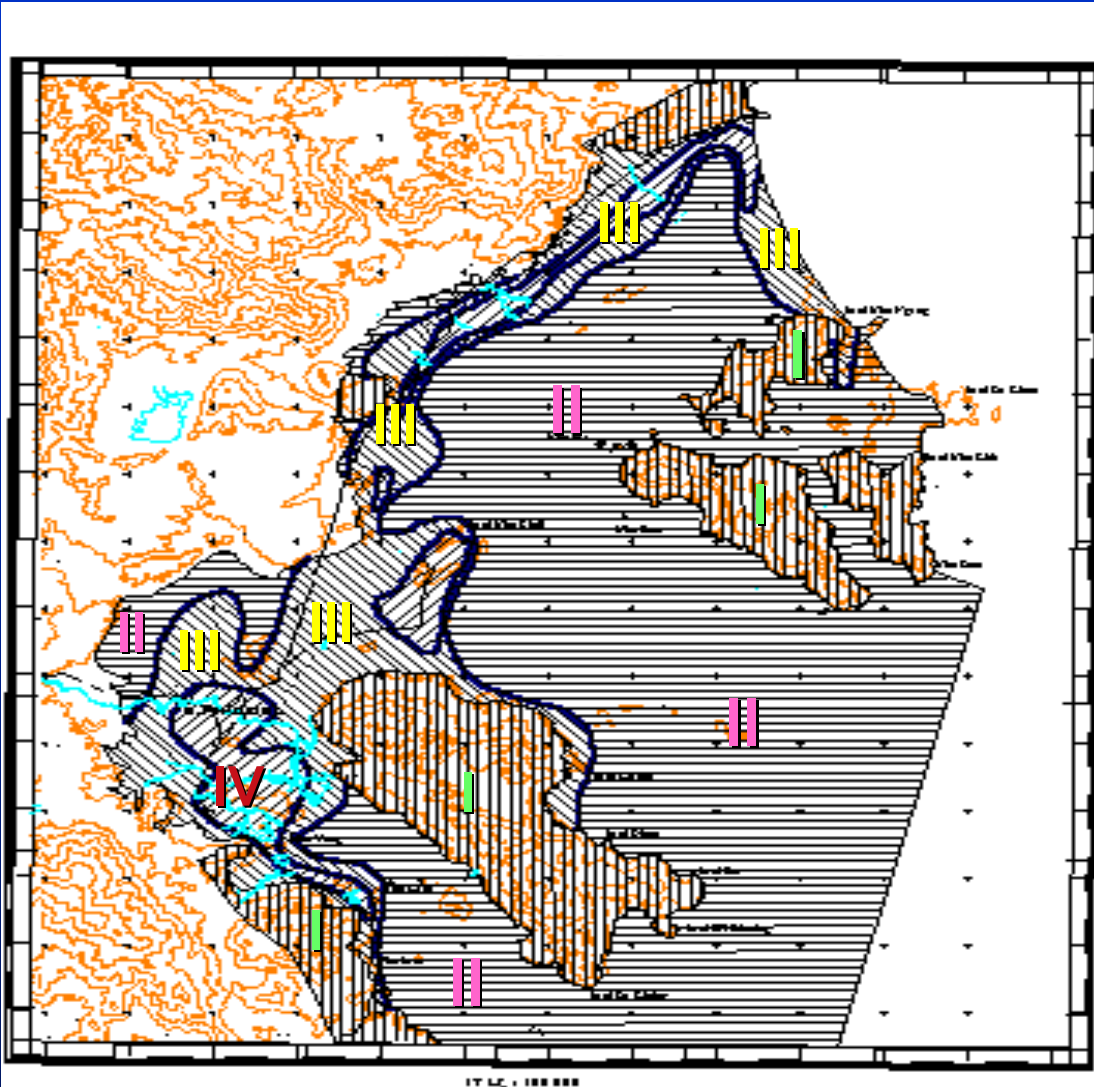
Evergreen forest

Bare land

IV. RS and GIS Application

4.1 Disaster mitigation- vulnerability assessment

I. Low vulnerability area

II. Medium vulnerability area

III. Fairly high vulnerability area

IV. High vulnerability area

Schematic vulnerability zoning map of Khanh Hoa coastal zone

Radar data for structural geological research
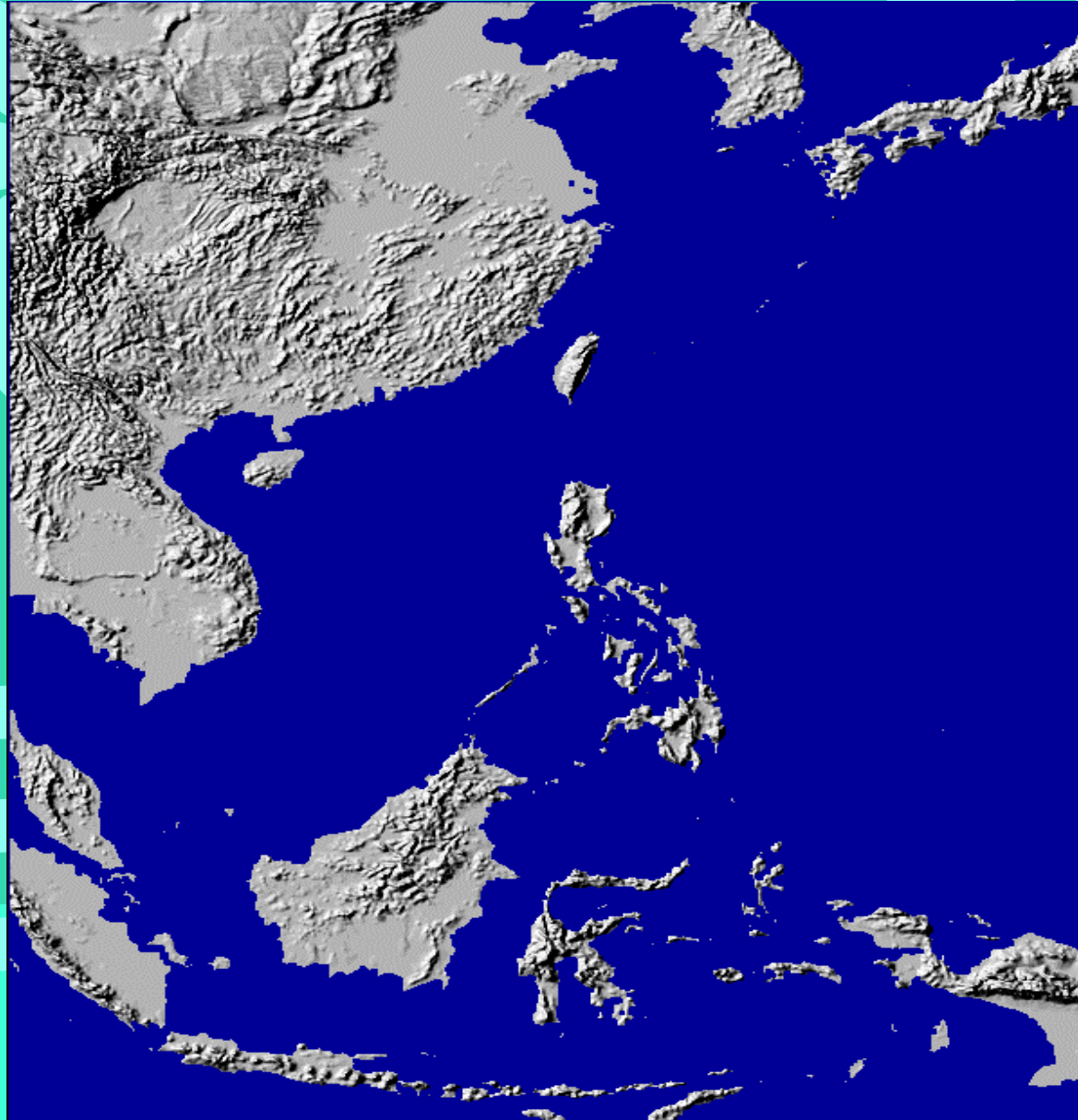
IV. RS and GIS application

4.2 Natural management

Forest monitoring

Land use and change monitoring

Agriculture development

Mineral resources monitoring

Marine and coastal area monitoring

IV. RS and GIS Application
4.2. Natural Resource management

Landsat- ETM of Ninh Binh area
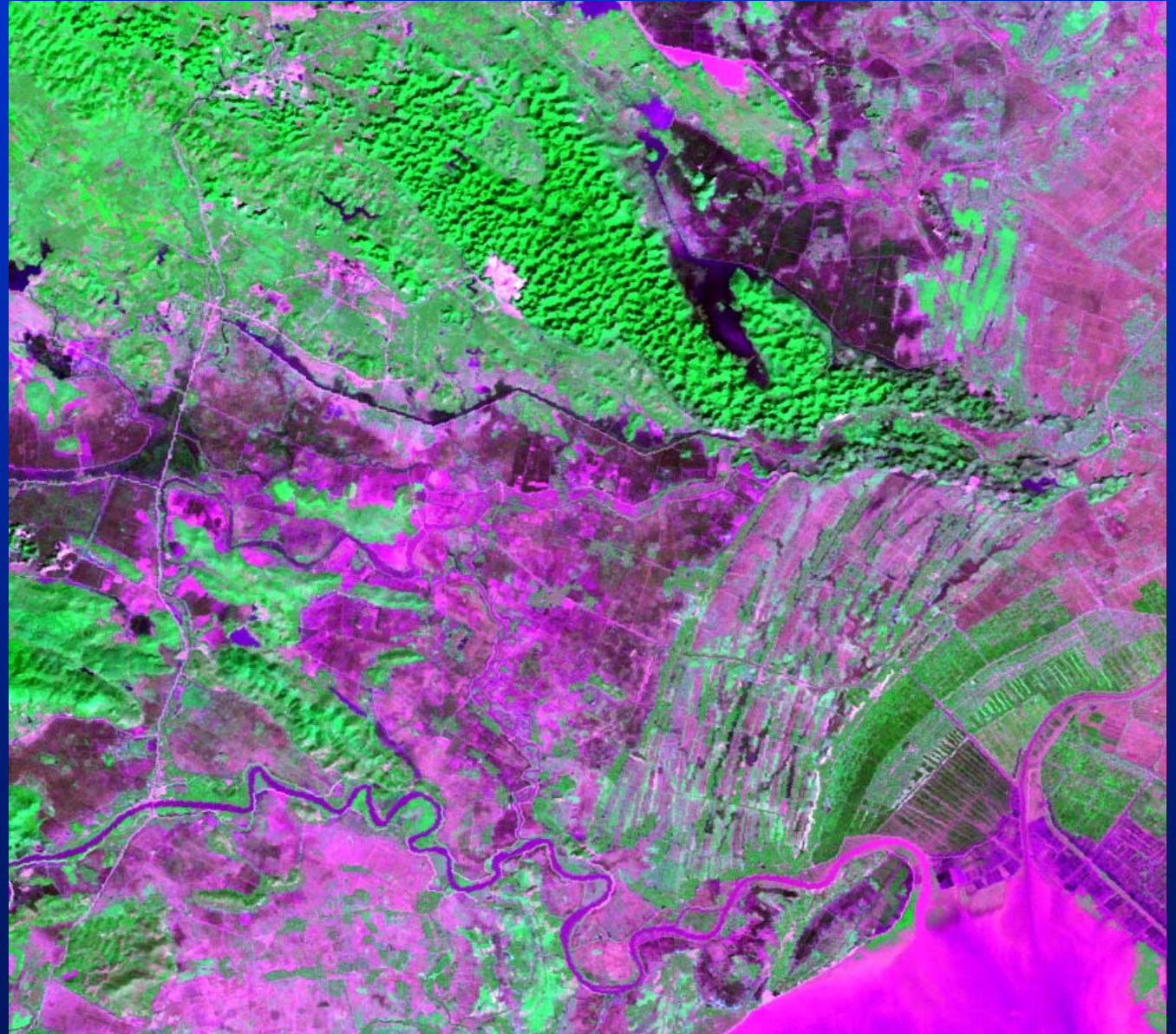
HA LONG BAY WITH 3D VIEW
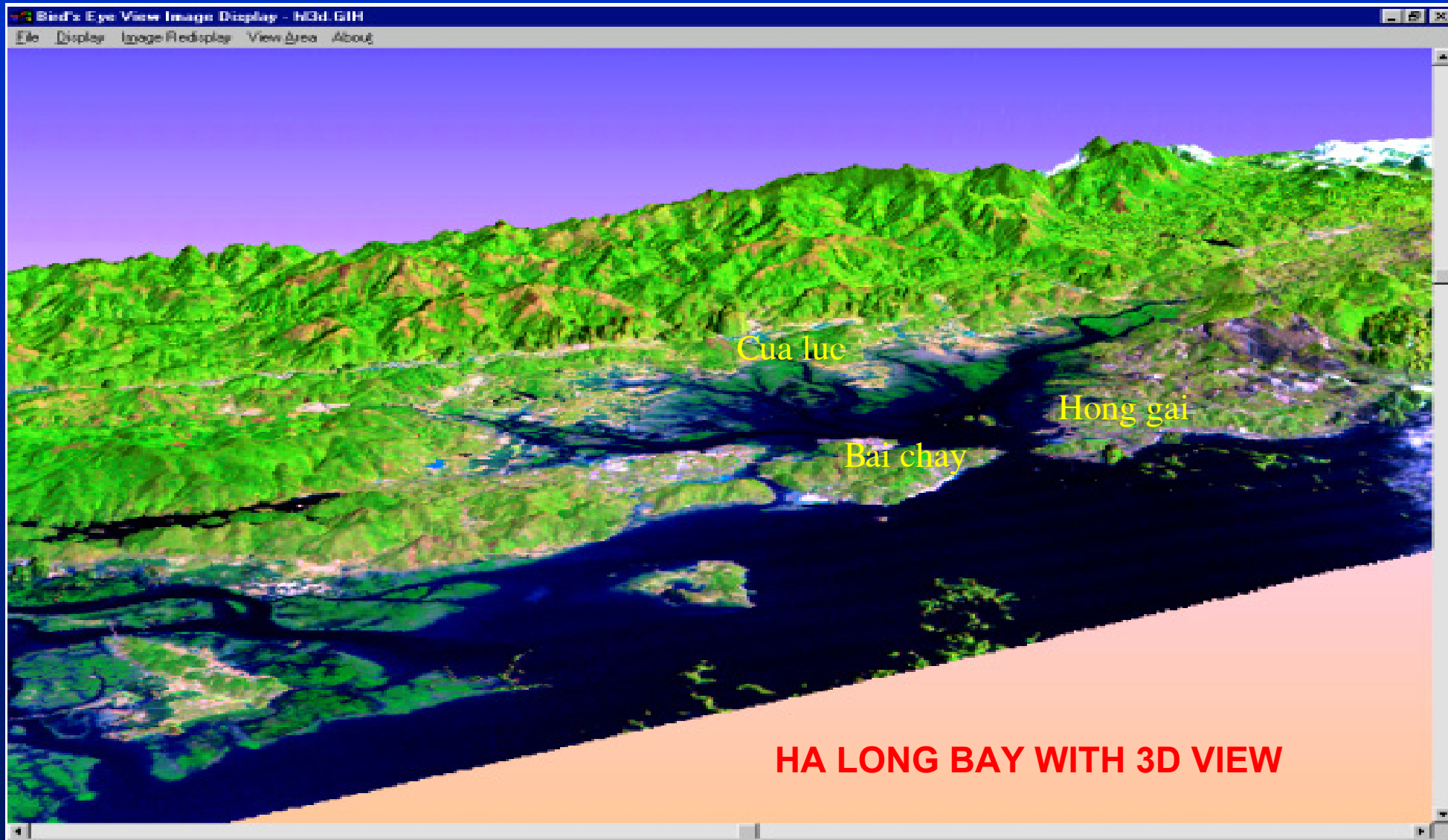
IV. RS and GIS Application
4.2. Natural Resource management

LANDSAT IMAGES OF HÀM THUẬN NAM DISTRICT
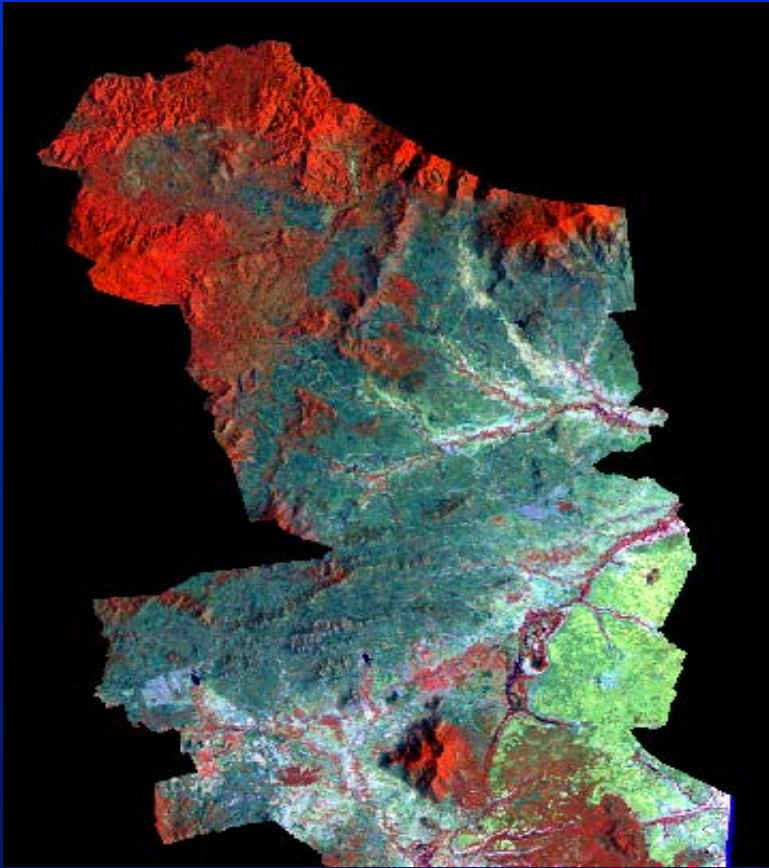
Dry season (1 /2000)

Raining season(9 /2000)

IV. RS and GIS Application
4.2. Natural Resource management

Application SPOT for land use and ecolgy at Mekong River Delta
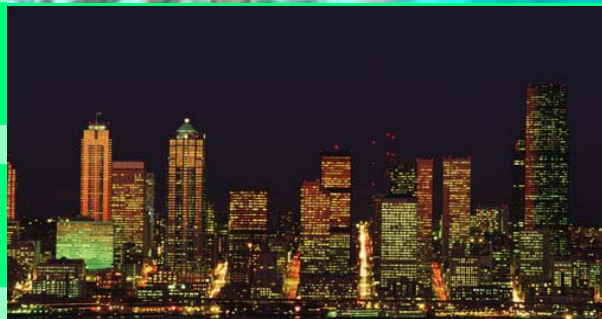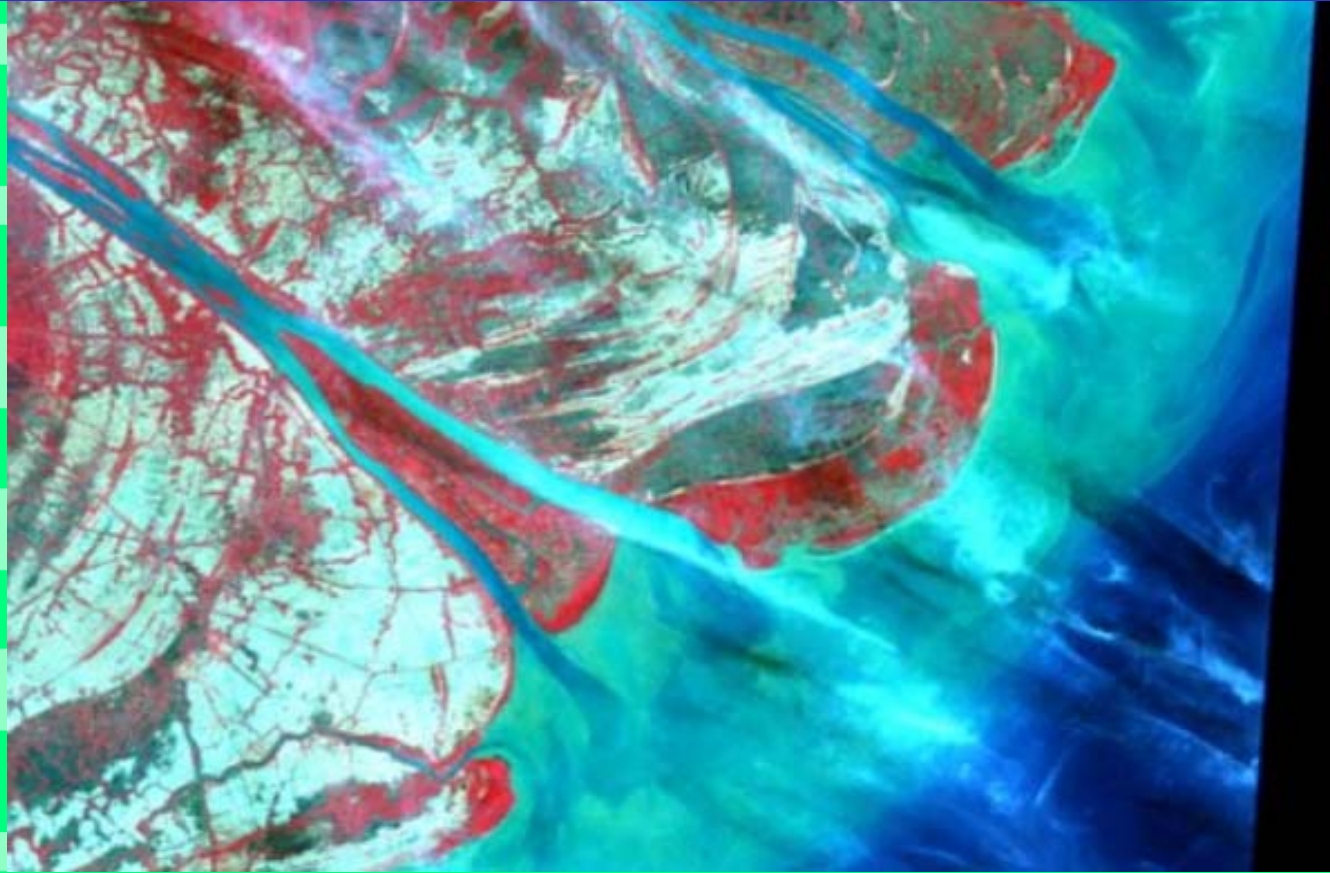
IV. RS and GIS Application
4.2. Natural Resource management
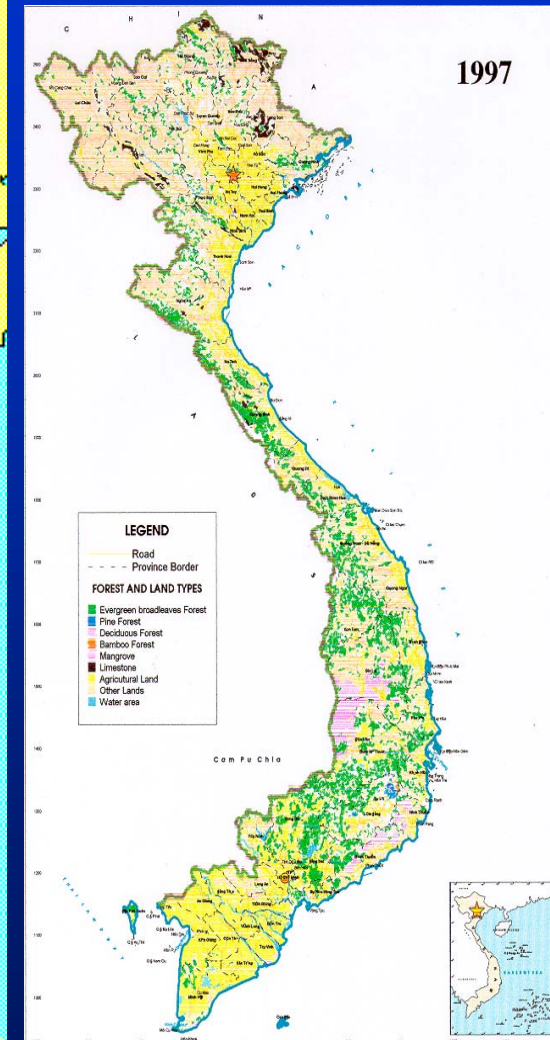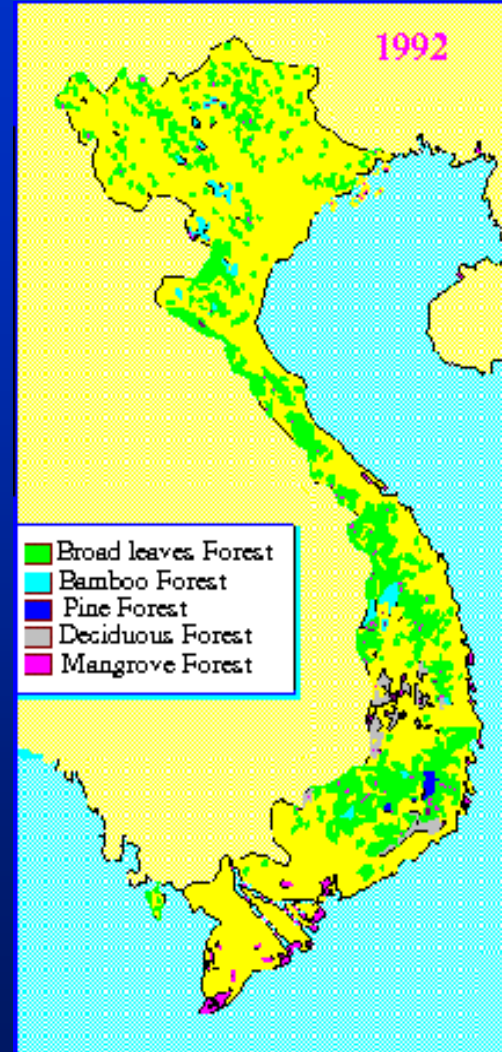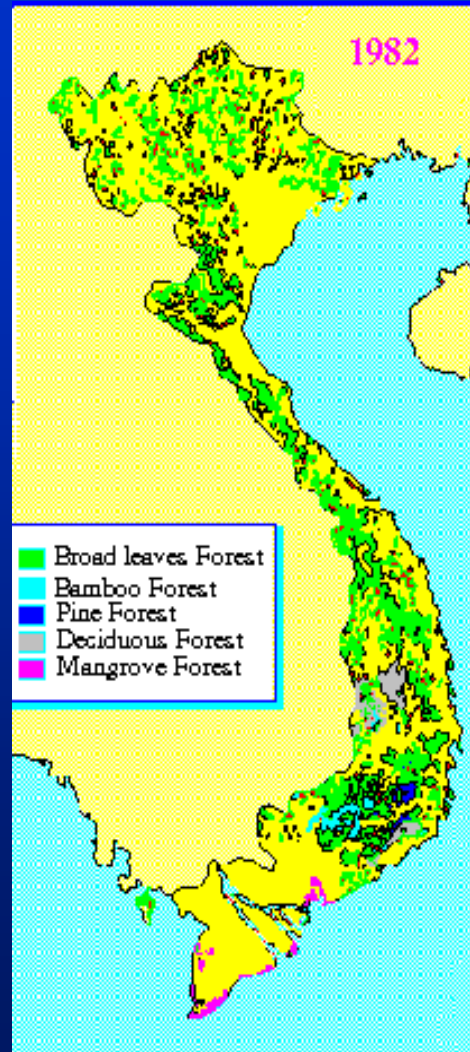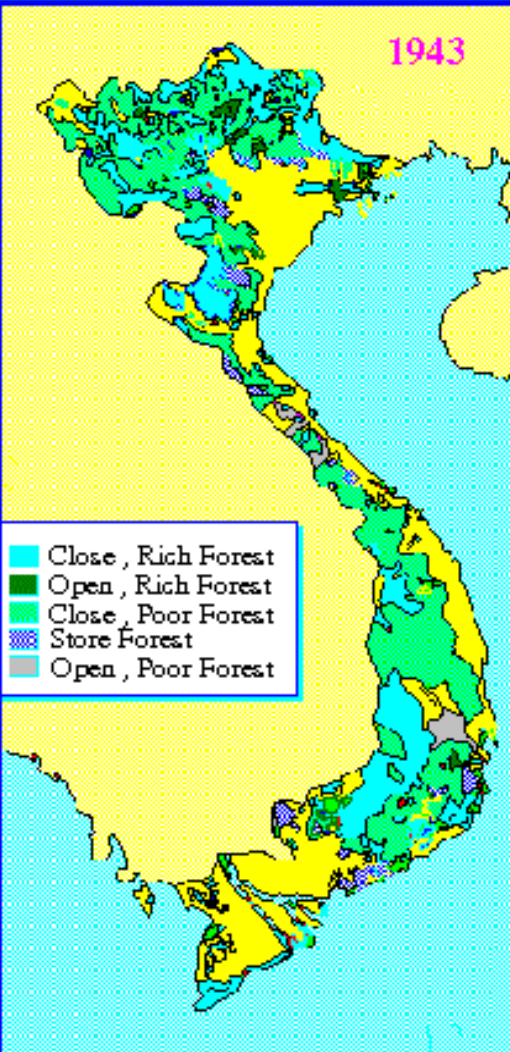
Study of Forest change in viet nam

IV. RS and GIS Application
4.2. Natural Resource management

BẢN ĐỒ HIỆN TRẠNG RỪNG VIỆT NAM
Kết quả kiểm kê theo chỉ thị 286/TTG ngày 2-5-1997
TỶ LỆ 1: 6.500.000

year	conopy cover (%)
1943	43,2
1976	33,7
1990	27,7
1997	28,1
2000	33,2
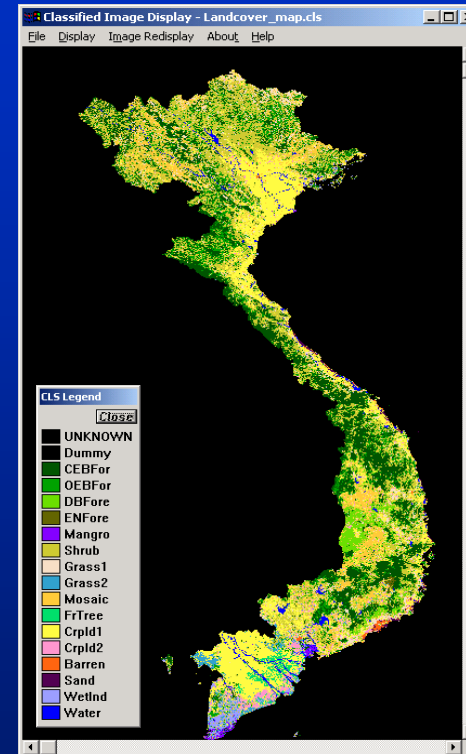
Statistic of forest change in Vietnam by GS and RS

IV. RS and GIS Application

4.2. Natural Resource management

**Study of
Forest
change caused
by Orange agent
and human
activities at
Ngoc Hien
Ca Mau area**

BIẾN ĐỘNG RỪNG NGẬP MẶN - H. NGỌC HIỂN - CÀ MÂU

1965 — Có rừng 95,7 % / Không rừng 4,3 %

1973 — Có rừng 46,4 % / Không rừng 53,6 %

1979 — Có rừng 62,0 % / Không rừng 38,0 %

1989 — Có rừng 59.9 % / Không rừng 40,1 %

1993 — Có rừng 43,8 % / Không rừng 56,2 %

1996 — Có rừng 28,7 % / Không rừng 71,3 %
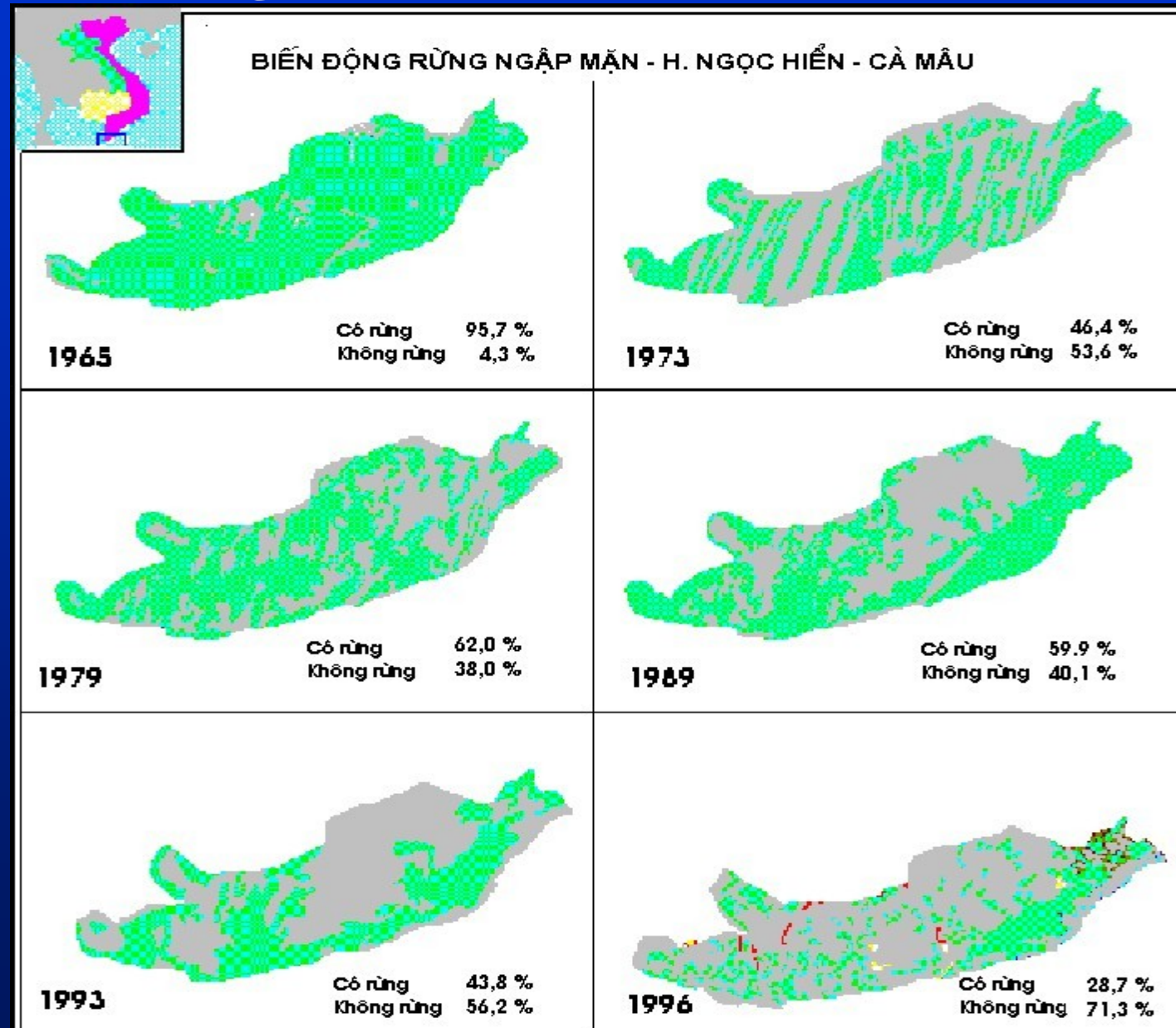
IV. RS and GIS Application
4.2. Natural Resource management

Mineral prediction by using RS and GIS at the North of Da lat area
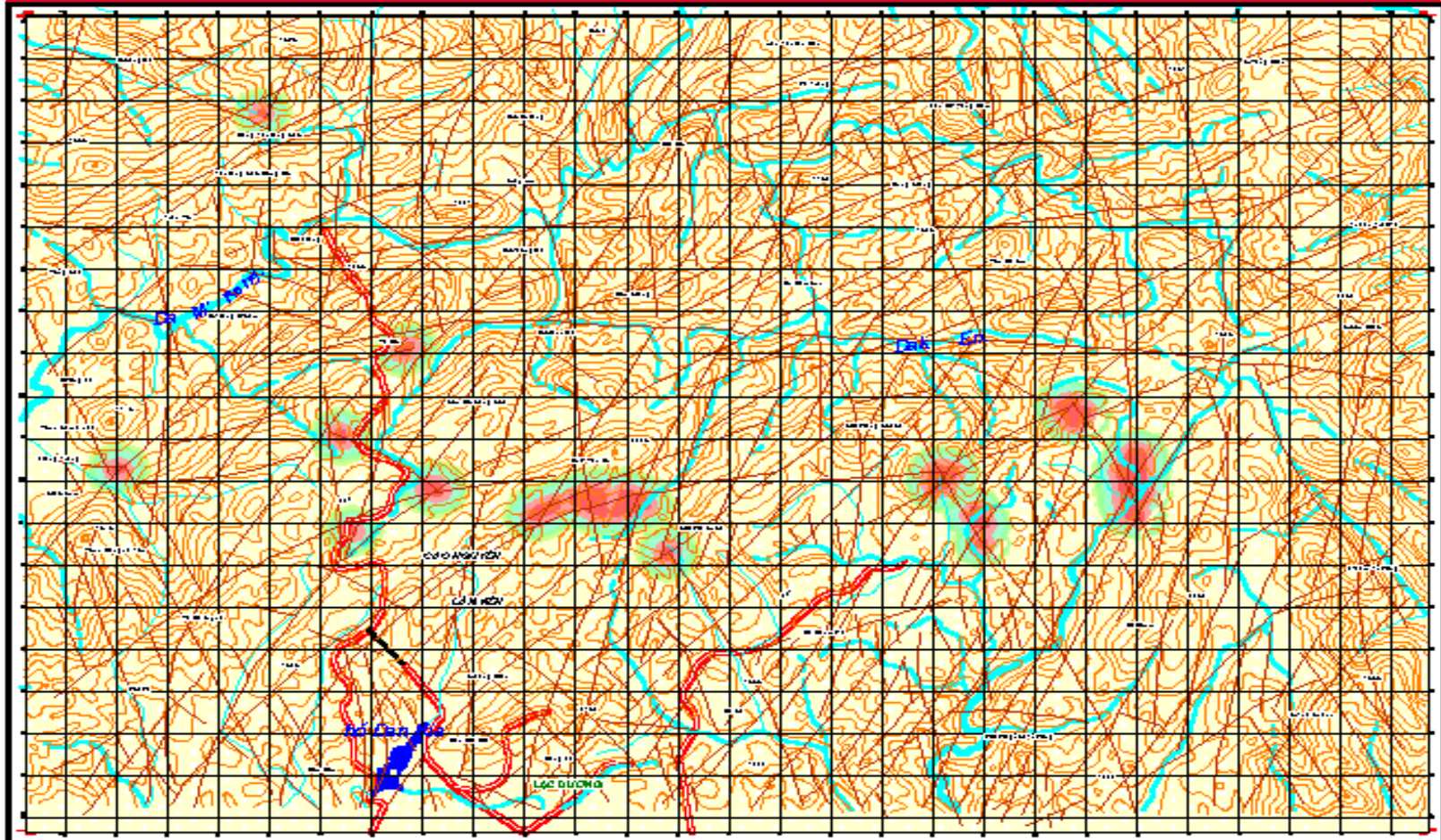
IV. RS and GIS application
4.3 Environment monitoring and planning

Marine and coastal water pollution

Marine and coastal sediment pollution

Eutrophication

Air pollution

Waste disposal
Pollution sources

…

Pollution of Cu and Zn in coastal sea water

Ben Goi Gulf
Ttc (Cu): 1.1-5.1
Ttc (Zn): 1.0-9.1

Dam Mon Gulf
Ttc (Cu): 1.4-3.8
Ttc (Zn): 1.0-1.5

Van Phong Gulf
Ttc (Cu): 1.1-3.9
Ttc (Zn): 1.0-5.8

Pollution of Cu, Pb, Zn in coastal sediment

Ben Goi Gulf
Ttc (Hg): 1.54-3.85

Dam Mon Gulf
Ttc (Pb): 4.69
Ttc (Zn): 1.34-2.29

Van Phong Gulf
Ttc (Hg): 1.54-3.08

Pollution of Cu and Zn in coastal sea water

Ben Goi Gulf
Ttc (Cu): 1.1-5.1
Ttc (Zn): 1.0-9.1

Dam Mon Gulf
Ttc (Cu): 1.4-3.8
Ttc (Zn): 1.0-1.5

Van Phong Gulf
Ttc (Cu): 1.1-3.9
Ttc (Zn): 1.0-5.8

IV. RS and GIS Application

4.3. Environment monitoring

Spot image of Cat Hai-Cat Ba area. 10/2001

IV. RS and GIS application

4.4 Sustainable development

-Urbanization,

- Population and Imigration management

- Spatial development monitoring   and planning

- Rural development monitoring and planning

- Integrated management: coastal, mountainous, rural and urban areas

IV. RS and GIS Application
4.4 Sustainable development

Coastal zone planning for suitable development at Van phong bay area

EASTERN SEA

Tu Bong

Vinh Giat

Van Gia

Ben goi bay

Xuan Tu

D.M Thuong

D.M Ha

Hon Lon

Xuan My

Van phong bay

My Giang

LEGEND

- Forestry land area
- Forest resevation area
- Agriculture area
- Urban area
- Inland aquaculture area
- Tourist area
- Near shore aquaculture area
- Reforestation area
- Sea ecotourist area
- Area for far shore aquaculture
- Area for navigation activities
- Industry area
- Area for port development
- Transfer port no habour

0km   3km

Processed at NERIC - VN
CZERMP-VN

V. Perspectives
5.1. Research

- To initiate fundamental research in geoinformatics;

- To develop integration of RS & GIS with ecological, environmental modeling;

- To build national standards of the geoinformatics data;

- Integrated & customized software development (open-source);

V. Perspectives
5.2.Training & Infrastructure development

- Human resources training:
  - Better interdisciplinary and up-to-date training curriculum;
  - Enforce the connection with industry;
  - Multi-level training & re-training;
  - International joint training;
- Geoinformatics infrastructure building:
  - National database (web-based) and Clearing House
  - Ground stations;
  - Participation to int'l earth observation satellite programs (sensor design, calibration, …)

V. Perspectives
5.3. International Cooperation

- Collaborative joint research projects with Japan and other countries;

- Multi-latteral international programs (through APN, STAR, ESCAP, …);

- Joint international training & international symposium;

- Technology transfer (including international industrial sector).

V. Perspectives
5.4. Applications

To operationalize geoinformatics application in:

- Natural disaster management (forest fires, flood, landslides,…);
- Short- to long-term environmental monitoring;
- Natural resources management: coastal & ocean, urban studies;
- Socio-economics (development problems);
- Cultural studies (historical GIS);
- New sensor technology (LIDAR, hyper spectral, Radar);
- Dissemination of information to wide public;

VI. Conclusions
1. RS and GIS research

- Present:
- Mainly focusing on application and technology transferring
- Less fundamental researches
- Not enough scientific basic for more effective application

- Future:
- To initiate fundamental and interdisciplinary researches
- To develop integration of RS and GIS with ecological and environmental modeling
- To develop national standards of the geoinformatics data;
- To develop software

VI. Conclusions
2. RS and GIS application

- Present:
- Most applications are project-based.
- Large fields:
  disaster mitigation,
  natural resource management
  weather forecasting
  environment monitoring
  geological structure study
-

- Future:
- To operationalize RS & GIS application in :
  disaster mitigation,
  sustainable management of natural resource
  weather forecasting; environment monitoring
  socio- economic; cultural studies(historical GIS), Sustainable Devel.
- New technology with high resolution satellite and advanced sensors of LINDAR, RADAR, hyper spectral RS
- Dissemination of information to the wide public

...

VI. Conclusions
3. RS and GIS training

- Present:
- Many non degree training programs
- Some degree training programs:
  undergraduate (BS)
  graduate (MS, PhD)
- Less practical skills
- Limited to specialization, less interdisciplinary
- Many training institutions, less high qualification trainers
-

- Future:
- Standardization of RS & GIS training
- Better interdisciplinary curriculum
- Deeper in theory and better in practice
- Closer and more effective link of RS &GIS research and training
- Multilevel training and re-training
- Industry connection
- International joint training

VI. Conclusions

4. RS and GIS infrastructure development

- Present:
- Rather good but not enough
- Many training institutions,
less high qualification trainers,
poor facilities

-

- Future:
- National   RS & GIS database (web-based)
- Ground stations
- Participation in the international   earth satellite programs
- Modernization of RS and GIS infrastructures

VI. Conclusions

5. RS and GIS international cooperation

- Present:
- Limited to project
- Capacity building (including Human recourse training)
- Application, research,

- Future:
- Collaborative joint RS & GIS projects with Japan and other countries
- Multilateral international programs (InWent, ESCAP, CCOP, FAO…)
- DREAM project (Japan-VN)
- International symposium, conferences
- …