

REMOTE SENSING ACTIVITIES IN VIETNAM :
1980 - 1991

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Abstract:

Presently, like many other developing countries, the increasing needs for sustainable natural resources and environmental management have significantly promoted the development of remote sensing technology in Vietnam. This report covers the main activities in development and application of remote sensing since 1980. Several national projects in remote sensing field are described. The training and manpower development as well as infrastructure development in the field are also presented.

"Key Words:" Manuscripts, Proceeding, Archives, Typing, Camera-Ready.

1. INTRODUCTION

Like many other developing countries, the increasing needs for sustainable natural resources and environmental management have significantly promoted the development of remote sensing technology in Vietnam.

This report covers the activities and development in remote sensing since 1980.

Most significant segment has been the application of remote sensing in different areas of natural resource and environmental management. Several applications related to economic planning, soil erosion, ground water potential zone mapping have received attention. Remote sensing has now become operational in landuse mapping, mapping of water resources (flood affected areas, ground water potential), soil erosion mapping (both potential and hazard), shoreline change detection mapping, regional geology and geomorphology and forest/vegetation mapping.

The benefits resulting from the use of remotely sensed data to monitor, map and manage the natural resources and environment of the country are well documented and have led to the extensive use of these data.

2. REMOTE SENSING HAS BECOME AN IMPORTANT TOOL
FOR RESOURCES AND ENVIRONMENTAL MANAGEMENT
IN VIETNAM

Vietnam is a developing country covering a long territory of about 30 millions Ha with a coast line of more than 3200 Km. The landscape type of the country range from coastal zone, to plain, plateau and high mountains. The country is confronted with two problems : how to utilize more reasonably the very limited natural resources for social-economic development, and how to deal with recent environmental degradation. The main problems in Vietnam are as follows :

Deforestation:

The percent forest cover in the country recently has been decreasing. This has caused deterioration of the environment, especially in the Northern region, central plateau and coastal areas of Red and Mekong river plains. There has also been desertification, serious soil erosion in high land region, salinity and shoreline erosion in coastal areas. The forested areas are reducing from year to year.

From a study carried out in 1989 by the Ministry of Forestry and General Department for Land Use Management, it was estimated that in 1945 the total forest area of the country was 14.5 millions Ha (about 47.8% of Vietnam's territory) but in 1975 this area had reduced to 29.2 % and by 1983 it was only 23.6 %. Since 1950s the desertified land has expanded with a speed averaging 10.000 Ha/year. The total area of desertified land in Vietnam has reached about 10 millions Ha or 33 % of the country's territory and the total area affected by salinity caused by mangrove deforestation is about 716.000 Ha.

Degradation and decrease of land resource:

Vietnam is situated in a monsoon humid tropical environment and 3/4 of its total area is high land. Thus soil erosion is a major concern.

From a study carried out by the State Committee for Vietnam Soil Mapping, it was estimated that about 8 million Ha of midland and mountainous areas are so seriously eroded, that they can't be used for agricultural purposes.

Soil erosion and poor land use practices have caused a rapid decrease in agricultural land.

Natural disasters:

Disasters such as flooding, forest fires, landslides, shoreline erosion, mud-rock flows, tropical cyclones, etc. have caused enormous losses of property and life, seriously affecting the social-economic development of the country.

Most of the resource and environmental problems noted above result from excessive human activities over Vietnam's long history, especially over the recent period. To protect the environment, we urgently need information on the current situation as well as to understand dynamic changes, and their spatial distribution. Remote sensing is an effective means to provide this information. Remote sensing development in Vietnam has been focused on applications geared to social-economic development of the country and environmental monitoring. In this connection, several remote sensing application projects and technology of national importance have been organized and carried out. Hundreds of researchers from institutions, universities and remote sensing organizations are involved.

3. RECENT DEVELOPMENTS IN REMOTE SENSING

Recognizing the benefits from the use of remotely sensed data in natural resource management, social-economic planning development and environmental management, the National Scientific Project for Remote Sensing was organized by National Centre for Scientific Research (NCSR). It had a duration of 5 years 1980 - 1985.

The Project on Cartography and Remote Sensing was carried out between 1986 and 1990 when another scientific Project for Remote Sensing Application supported by NCSR was begun.

These projects focussed on the development of remote sensing and GIS technology as well as remote sensing applications for natural resource and environmental management.

The activities under these projects are described below.

3.1 Development in Remote Sensing and GIS Technology.

3.1.1 3-layered Experiment

To effectively use remote sensed data for thematic mapping, interpretation keys are needed. In connection with this the 3-layered experiments were carried out on 5 polygons located in different geographical areas of the country in 1980 and 1985 with multispectral photocameras MKF-6 and MKF-4. Many institutions/organizations were involved. Among these were the Space Research Centre (now Remote Sensing Application Division), Centre of Geography and Natural Resources, Institute of Forest Planning, Institute of Agricultural Planning, Institute of Geology and Mineral Resources, Institute of Pedology and Fertilizer, General Department for Land Use Management.

3.1.2 Study Optical Characteristics of Landscape

The spectral reflectance curves in VIS and NIR regions of electromagnetic spectrum of more than 100 natural objects distributed in different geographical areas of the country were studied by Remote Sensing Application Division (RSAD) and Centre for Space Physics and Remote Sensing Techniques. Several hand-held spectrometers made in Germany, Hungary and Vietnam with spectral resolution ranging from 8 to 10 nm were used for the study.

In addition, some related studies such as " Influence of sun altitude on spectral reflectance ability of some natural objects in Vietnam ", " Influence of humidity on spectral reflectance curves of some Vietnam soil kinds ", etc. were also carried out by RSAD.

The obtained results are available not only for thematic interpretation using remotely sensed data but also for development of low cost optical, optoelectronic equipment needed for ground measurement as well as to assist both visual and digital interpretation.

3.1.3 Microwave Remote Sensing Action Experiment

The experiment was done in 1989 with the purpose of applying a new sensor to certain natural conditions such as soil moisture and salinity for coastal land use management.

The experiment was carried out jointly by researchers from the Institute of Physics and Institute of Oceanography in cooperation with the Space Research Centre (Academy of Sciences, USSR).

3.1.4 Development of Images Processing and GIS Software Systems

Several image processing and GIS software system have been developed by Institutions/Centres

MIPS - Multipurpose Image Processing System, which can be used for general image processing, thematic and statistic mapping, multivariate image analysis, is based on IBM PC/AT compatible microcomputers. This software system has been developed by RSAD.

DIPS - Digital Image Processing System developed by Institute of Physics, Centre for Space Physics and Remote Sensing Techniques. The system is also based on PC/AT compatible microcomputers and can be used for general image processing, especially for land use analysis.

GESSE- Geo-Expert System for Soil Evaluation is an expert GIS software system with an English version user interface. The system is based on an IBM PC/AT compatible microcomputer. It consists of a knowledge base, thematic data base and graphic data base. The system was developed by RSAD and Advanced Information Technology Corporation. Recently it was applied to soil erosion assessment and to potential soil erosion and soil erosion hazard mapping for the northern mountainous region in the country. The system is expected to be further developed in the coming years.

GIS - The RSAD Geographic Information System is a general GIS based on IBM PC/AT compatible microcomputers, consisting of data digitization and editing, manipulating (polygon based overlay, merge, map join, clip, and select), map drawing and DTM processing. The system development began in 1990 by RSAD and the Remote Sensing Data Centre (RSDC). Its development is expected to be continued over the next two years.

3.2 Remote Sensing Application for Resource and Environmental Management

Beside the above mentioned remote sensing application projects, several projects covering various fields of natural resources and environment in which remote sensing applications have been operationalised were carried out at both the national and regional levels. The main areas where remote sensing is effectively applied are as follows: land use mapping, flood mapping and damage assessment, geological and geomorphological mapping, soil mapping, ground water potential zone mapping, forest mapping, tropical cyclone forecast, etc. The activities are future described below.

3.2.1 Tropical Cyclone Forecast Using NOAA, METEOR and GMS

Under the first National Project for Remote Sensing (1980-1985) a study on tropical cyclone development determination, and movement detection of the cyclone "eye" using remotely sensed data such as NOAA METEOR and GMS was completed by the State Department for Hydro-Meteorological Forecast. Together with other traditional forecasting methods, the analyzed results of this study are effectively used in forecasting of tropical cyclone development and movement in the East Sea region, which directly influences Vietnam weather.

3.2.2 Land Use Mapping

Based on research results obtained from the first Project for Remote Sensing, in 1984 a land use map of Lam Dong province 1/250,000 was made by RSAD using Landsat images combined with ground data.

Following that the land use of different geographical regions such as the central plateau Tay Nguyen, northern mountainous provinces, coastal zone, as well as a great number of provinces and districts in the country have been mapped on scale ranging from 1/500,000 to 1/50,000 using remotely sensed data such as Landsat, SPOT, Soyuz and air-photos.

Today the technology for land use mapping using remote sensing is widely applied and has transferred to some user organizations in the country.

By the end of 1990, the Project supported by Government for land use mapping for the entire country at a scale of 1/250,000 using high resolution satellite data was carried out jointly by RSAD, RSDC General Department for Land Use Management, Institute of Forest Planning and Institute of Agricultural Planning. This Project is expected to be completed in 1991.

3.2.3 Forest Mapping

Based on research results obtained from the first National Project for Remote Sensing, forest mapping for the entire country was done. This included forest cover estimation and forest classification at scale ranging from 1/250,000 to 1/500,000 using remotely sensed data acquired in 1985, 1987, and 1990. This was carried out by the Institute of Forest Planning in cooperation with RSAD.

3.2.4 Soil Erosion Mapping

In 1990 a soil erosion mapping project was carried out under the Remote Sensing Application Project supported by the National Centre for Scientific Research. The study on potential soil erosion and soil erosion hazard mapping was carried out by RSAD in cooperation with the Institute for Pedology and Fertilizer, Institute of Agricultural Planning, Institute of Forest, Centre of Geography and Natural Resources, and Centre for Forest Data Processing.

The study uses multi-level remote sensing information for producing several thematic maps needed for soil loss analysis using the Universal Soil Loss Equation of Wischmeier and Smith and for maps of potential soil erosion and soil hazard. The Geo-Expert System for Soil Evaluation is a very important part of this study.

The first results obtained show that remote sensing combined with other data sources can provide unique and useful information to determine soil erosion risks at scales ranging between 1/50,000 to 1/250,000.

3.2.5 Flood Mapping

Most of the major floods in the country in 1988 were mapped in near real-time using Landsat data. Maps given to State governments/user agencies, provided necessary data such as flood affected areas and assessment of damage due to floods. The operational mapping of floods has been carried out for the last four to five years using satellite remote sensing data.

3.2.6 Ground Water Potential Zone Mapping

About one-third of the provinces and cities in the

country have been mapped at 1/250,000 scale for ground water potential zones in framework of several projects supported by government/local user agencies. Several organizations including the Centre of Geography and Natural Resources, the Institute of Water Resources, the Ha noi College of Mining and Geology and others are involved in this work.

3.2.7 Coastal Management

Information on coastal land use, coastal processes and sediment dynamics are vital for coastal management. Coastal environments are made very dynamic by human and marine activities, and hence require periodic monitoring. In view of this, a study was done on the application of multitemporal satellite data covering the entire coastal zone. Resulting were land use, shoreline change and turbidity/suspended sediment distribution maps at the scale of 1/250,000. This work was done jointly by RSAD, State Department for Geodesy and Cartography, General Department for Land Use Management, Remote Sensing Data Centre, Centre for Sea and River Dynamics and Institute of Oceanography. This has been done in the framework of the National Scientific Programme for Marine and Coastal Research coded 48-B.

3.2.8 Integrated Assessment of Natural Resource and Natural Conditions for Planning Development

The limitation of conventional methods used for integrated assessment of natural resources and natural conditions are several :

- Multiplicity of agencies generating similar but incompatible data sets.
- No regular procedures for periodically updating the data.
- Practices of storing data are not amenable to efficient retrieval.

The advantages of remote sensing data, such as synoptic view and repetitive coverage, help overcome these limitations. It is not surprising, therefore that some integrated studies for development planning at the district level have been done using high resolution satellite and airborne data combined with other information. Many scientists from RSAD, Centre of Geography and Natural Resources, Institute of Agricultural Planning, Institute of Forest Planning, Institute of Pedology and Fertilized, General Department for Land Use Management were involved in these studies.

In 1989, under the Project RAS/86/141 supported by Regional Remote Sensing Programme RRSP/ESCAP the similar study on " Analysis of Remote Sensing Data for Assessment of Natural Conditions and Natural Resources and Their Dynamic on Some Coastal Zones for Inventory and Economic Development and for Environment " was done jointly by RSAD, Centre of Geography and Natural Resources, and the Institute of Physics.

The obtained results such as methodology of integrated assessment using remotely sensed data, thematic mapping by remote sensing technique for coastal zone, etc. have been presented and assessed on Regional Seminar on " Application of Remote Sensing Techniques to Coastal Studies and Environmental Monitoring " held in Ha noi from 12 to 15 September 1989. The Seminar was organized by RRSP/ESCAP in cooperation with National Committee for Space Research and Application of Vietnam.

3.2.9 Environment

Recently, safeguarding the environment has been a matter of concern for scientists, politicians and the public. As a result, many projects have been initiated to study the impact of hydro-electric power stations, deforestation, coastal erosion, etc on the environment. The use of remote sensing techniques has been well demonstrated in these studies. Five such projects have been approved by RSAD, Centre of Geography and Natural Resources, Centre of Environment, and Institute of Forestry. These projects include :

a/ Environmental impact assessment due to hydro-electric power stations situated in Hoa binh and Tri an.

b/ Environmental impact assessment due to deforestation in (i) the northern mountainous area, (ii) the central plateau Tay Nguyen and (iii) the mangrove forest area Minh hai.

c/ Changes in coastal environment due to coastal erosion by sea and pollution by industries situated near coast of Red river delta.

4. REMOTELY SENSED DATA RECEIVING AND SUPPLY

Although Vietnam was interested in remote sensing for natural resources management and environmental monitoring at an early date, only receiving stations for meteorological satellites have been in operation.

The first such ground station, APT, was built in Ha noi in 1975 with technical cooperation between Vietnam and USSR. Up to 1983 this APT was unique.

By the end of 1987 the autoreceiving station GMS to operate in framework of Project VIE/83/004 signed by UNDP and the National Centre for Scientific Research of Vietnam. The GMS station can receive only the LR/FAX images. These images are produced by sampling and relocating original VISSR images. The primary spatial resolution of GMS VISSR is 5 x 5 km for the infrared channel at nadir.

Since 1988, under Project VIE/87/015 signed by UNDP and General Department of Meteorology and Hydrology, another three similar stations were built in Ha noi, Da nang, and Ho Chi Minh cities. They began to operate by the end of this year.

Presently in Vietnam, every day several images of cloud field and ground surface in VIS and IR regions of electromagnetic spectrum from meteorosatellites such as NOAA 10-11, METEOR-16, GMS, COSMOS-1939 are received.

The processing and data supply of these meteorosatellite images are carrying out directly by the receiving stations.

Because of the lack of ground receiving stations, some kinds of earth resource satellite images/photos such as Landsat, SPOT, Soyuz, etc. are primarily supplied by international cooperation through scientific-technical projects. Satellite data in the form of positive/negative false color or B and W film or printed copies are chemically processed by the RSAD photo laboratory, which was equipped through Project VIE/83/004. The produced copies data can be supplied to user organizations by their proposals. Soyuz photos are available at State Department of Geodegy and Cartography.

CCT data can be copied or recorded on floppy disks at National Centre for Scientific Research for supply to users using Digital Image Analysis System

A6471 " Robotron " (Made in Germany) and Digital Image Processing System " Pericolor 2001 " (Made in France). The mentioned systems were equipped by Project VIE/83/004. From beginning of 1991 another Digital Image Processing System " DIDACTIM " (Made in France) of Institute of Geology has been available. A Canadian-made system, PCI's EASI-Pace, has been supplied through the FAO.

According to national plans, B and W air photography at scales ranging from 1/20,000 to 1/75,000 of the country are done regularly by State Department of Geodegy and Cartography. From 1985, air photography from a Hasselblad multispectral camera has been made available through RSAD by Project VIE/83/004. The multispectral photos in VIS and IR are available to users at RSAD.

5. TRAINING AND MANPOWER DEVELOPMENT

Training in remote sensing has been an important activity to encourage the use of remote sensing technology. However, due to economic, educational and administrative problems, activity in this field is limited. To date, under project VIE/83/004, activities have included two official training courses on the background of remote sensing and remote sensing application organized by RSAD in 1983 and 1984. In these there has been participation of remote sensing specialists from Germany, the Netherlands and India. Later, during the period from 1985 to 1990, some local training courses (ten days each) were organized by RSAD in cooperation with the RSDC in the field of aerial and satellite remote sensing application in various natural resources themes. Although educational courses in remote sensing are not offered by Universities, specialized themes on the introduction of remote sensing have been organized jointly by scientists from RSAD, Centre of Geography and Natural Resources, Institute of Agricultural Planning and State Department of Geodegy and Cartography.

To meet long term trained manpower requirements for remote sensing personnel, the Ha noi College of Mining and Geology was the first to have started teaching remote sensing as a part of an already existing course dealing with natural resources and allied fields. Many of other universities are expected to include remote sensing courses in their own curricula in the near future.

To increase the knowledge level in remote sensing during the last decade, about 50 scientists from remote sensing and user organizations have been sent abroad to train at remote sensing Institution /Organizations. Some have returned with M.Tech. Degree in remote sensing.

6. INFRASTRUCTURE DEVELOPMENT

To effectively use remote sensing for different application fields in natural resources and environment, institutions and departments such as Institute of Agricultural Planning, Institute of Forest Planning, Institute of Meteorology and Hydrology, State Department of Geodegy and Cartography etc. have established their own remote sensing centres. There are now four such centres in operation. They have taken part in major applications projects such as land use mapping, coastal management, etc. In addition, they are also carrying out projects covering several application themes of specific importance to the institute's or department's specialized fields.

7. CONCLUSION

Remote Sensing in Vietnam during the past decade has made remarkable progress. In brief, significant progress has been made towards the use of remote sensing in many natural resources fields in the country for economic planning development and for environmental management at national and local levels.

The promotion of remote sensing to achieve optimum application in the country must be undertaken with an integrated approach that includes a review of existing resources, the development of greater awareness—particularly through education and training— and the provision of adequate data sources. Recognizing the above mentioned problems and in order to accelerate the number of users and realized benefits of remote sensing in Vietnam, it is therefore recommended :

(i) As a matter of critical and immediate importance, that an inventory of existing remote sensing resources be undertaken.

(ii) That public awareness projects/programmes supported by Government for remote sensing applications, research and training must be continued in the coming years.

(iii) That remote sensing applications, image processing, and Geographic Information System (GIS) be included in university and high school curricula.

(iv) That agreements between Vietnam and remote sensing provider countries, especially Thailand, be put in place to assure data availability.

(v) That international cooperation covering information and experience exchange, joint research projects, regional, international seminars/workshops/conferences as well as support from United Nations and Industrial countries should be further developed.

In the coming years remote sensing is expected to play an important role in all major decision related to national planning, development and use of natural resources in Vietnam.

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