

Institut Pertanian Bogor • University of Wisconsin

GRADUATE EDUCATION PROJECT



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BY

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AND

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USAID Project No. 497-0290
IPB/UW Graduate Education Project

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WORKPLAN FOR SEAN C. AHEARN AND LARRY SEIDL
FOR THE NOVEMBER 1, 1984 TO DECEMBER 15, 1984
VISIT TO THE INSTITUT PERTANIAN BOGOR.

Nov. 1 - Dec. 3 - Set up the IBM PC based image processed system and prepare for the IPB Remote Sensing Workshop.

Dec. 3 - Dec. 15 - Teach in the IPB Remote Sensing Workshop and continue development of the image processing lab.

INTRODUCTION

Indonesia is an archipelago that consists of over 12,000 islands traversing three thousand miles of sea and ocean. Accessibility is very restricted even on the most developed island of Java, which contains two-thirds of the nations 150,000,000 people. Natural resources are severely strained on Java and intensive management with frequent monitoring is a necessity for the sustained yield of agricultural products. The outer islands (Sumatra, Borneo, Irian Jaya, etc.), which contain one tenth of the world's tropical forests, are rapidly changing because of logging, shifting agriculture, and transmigration.

In order to develop a better information base for the country's natural resources, the Indonesian government, with the help of various

international organizations, has begun to develop remote sensing and geographic information systems at several government agencies. It has also set up a ground receiving station for remotely sensed data.

While millions of dollars have gone into hardware/software acquisition and infrastructure development, a minimum investment has been made in the training necessary to get the full potential of remote sensing technology. The IPB/UW remote sensing project has begun to remedy this imbalance. It has set up a micro-computer based lab for remote sensing and geographic information systems and expanded IPB curriculum in both of these areas. In December of 1984, a two-week training workshop on "the use of a micro-computer based image processing system for remote sensing and GIS" was given at the IPB remote sensing lab. The workshop was attended by representatives of six government agencies and three major universities. This report will summarize the IPB/UW remote sensing project and detail the November 1, 1985, to December 15, 1985, visit to the Institute Pertanian Bogor by Sean C. Ahearn and Larry Seidl. It also discusses the role of remote sensing geographic information systems in Indonesia and future trends that necessitate a greater commitment by Indonesia to training and research in these fields.

PROJECT BACKGROUND

The Institut Pertanian Bogor (IPB) - University of Wisconsin-Madison (UW) cooperative remote sensing project was initiated in January, 1983. At this time a proposal was developed by a join IPB/UW team at IPB. Four

areas were identified in the plan: (1) curriculum development, (2) personnel exchange, (3) development of a remote sensing image processing lab at IPB, and (4) the planning for cooperative research projects.

In June 1983, work began in the four areas identified above by the IPB/UW team at IPB. In August of 1983 a workshop on curriculum development was given at IPB. Participants in the workshop included the Rector and Vice-Rector of IPB, the IPB Remote Sensing Group, the UW remote sensing team, and representatives from the major government agencies that use remote sensing (BAKOSURTANAL, Public Works, and The Ministry of Agriculture).

Three tasks were accomplished in the first phase of the project (June 1983 through August 1983): (1) a remote sensing curriculum was outlined, (2) a microcomputer based digital image processing system was designed, and (3) a plan for personnel exchange was organized.

The second phase of the project (September 1983 through October 1984) emphasized the IPB personnel exchange and the development of the digital image processing system. The IPB remote sensing director and two staff members visited the University of Wisconsin for a period of one month and nine months respectively. The objectives of the staff members were to take courses that contribute to their degree, to design courses for the IPB remote sensing curriculum, to work on the development of the computer system for digital image processing, and to conduct preliminary research towards their dissertations. By the end of the second phase,

the IPB/UW team had worked jointly in the development of the digital image processing system and the team was in a position to use the system for course labs, curriculum development and the execution of joint research projects.

The period of June 1984 to November 1984 saw further development of the digital image processing system and included a visit to UW by the IPB remote sensing director. During this visit the December 1984 IPB training workshop in remote sensing and GIS was outlined.

In the final phase of the two-year project (November 1984 - March 1985) the IBM based image processing system developed at UW was installed at the IPB remote sensing lab. After installation a two-week training workshop on "the use of a micro-computer based image processing system for remote sensing and GIS" was given by a IPB/UW team.

DEVELOPMENT OF REMOTE SENSING GIS IN INDONESIA

There are three main government centers that have been involved in remote sensing: LAPAN, BAKOSURTANAL, and Public Works. A ground receiving station for Landsat MSS, NOAA AVHRR, and GEMS data is operated by LAPAN. In 1985-86 LAPAN will also be able to receive Landsat TM data and SPOT data. The primary government centers for data analysis are BAKOSURTANAL and Public Works. BAKOSURTANAL with funding from the World Bank, has set up a large system for digital image processing and geographic information systems. Public Works has a smaller image processing system that was set up by the Japanese government.

Most of the training in remote sensing and geographic information systems at these institutions has been done by short-term consultants. While this gives hands on training to personnel, it fails to provide the in-depth knowledge necessary to understand the systems. It also presents the material solely from the perspective of the company that developed the software/hardware system. Growth, research, and development in the areas of remote sensing and GIS are limited in such environments.

An institution is needed that covers the basic theoretical aspects of remote sensing and GIS as well as the application for the theory. This assures the proper use of a technology that can be easily abused. It also provides a fertile environment for research and development.

A logical setting for a training institute in remote sensing and GIS is the university environment. Presently there are only two universities working in this area: the Institut Pertanian Bogor (IPB) in Bogor and Gadjadara University in Yogyakarta. The IPB remote sensing system is a microcomputer-based system that stresses accessibility of software code and continued development and expansion at both IPB and UW. The system at Gadjadara University is a "turnkey" system with protected software that can not be analyzed and expanded by the in-house scientists as readily as the IPB system.

DATA UTILIZATION

At present LAPAN is capable of receiving Landsat MSS, NOAA AVHRR, and GEMS. The MSS data is the only data of the three that is presently being analyzed. The AVHRR and GEMS, which has traditionally been used

for meteorology, is being stored on CCTs. While the tapes continue to accumulate, there has been no training program established to teach users how to analyze the AVHRR or GEMS data. Recently, the personnel at the IPB remote sensing lab have begun to look at calculating a vegetation index from the AVHRR data to assess the vegetation cover of Indonesia.

DATA TRENDS

The greater spatial and spectral resolution of the TM and SPOT remote sensing systems has led to an increase in the detail and volume of information.

The volume of data received by satellites is a function of the resolution of the system, the frequency of transmission and the number of wavelength bands recorded. The shift from the Landsat MSS, which has four bands and has a nominal resolution of 80 meters, to the SPOT system which has 20 meter resolution in three bands and 10 in one, is a thirty-fold increase in the volume of data for a given land area. Unlike the Landsat MSS data, the level of information derived from SPOT and TM is useful for site specific analysis. This makes it appropriate as an input into local and regional information systems.

DATA DECENTRALIZATION

The present structure in Indonesia has placed emphasis on centralized analysis of remotely sensed data. With the increase in spacial resolution of the remote sensing systems and the resulting increase in information and data volume, it must be asked whether it is

feasible or desirable for a central agency to analyze the data. A decentralized approach to data analysis seems necessary.

LOCAL/REGIONAL ANALYSIS AND CENTRALIZED COMPILATION

Decentralization puts the data in the hands of the people who know their region the best and can therefore do a better job of the analysis. The role of the central level would be to gather the information obtained by the local data analysis and compile that information to obtain national trends in natural resource exploitation. This information could then be used at the central level for national projections, planning, and policy formulation and implementation.

SYSTEM UNIFORMITY AND KNOWLEDGEABLE USERS

For the decentralization to work, three ingredients are necessary: A well-trained and knowledgeable team at the local/regional level; consistency in the software/hardware system used by the localities; and a centralized training center that can provide support for training, research, and development of new analysis techniques. Indonesia is in its initial stage of remote sensing/GIS development and is still in a position to establish this type of structure.

INSTITUT PERTANIAN BOGOR A NATIONAL TRAINING CENTER FOR REMOTE SENSING AND GIS

A centralized training center would make the shift in natural resource analysis from the central level to the local/regional level possible. The center would provide training to local/regional and

central level personnel, it would remain state of the art through research, development, and interaction with the international community and it would keep local personnel in touch with central levels of government and with other localities.

The Institut Pertanian Bogor is an ideal setting for a national training center in remote sensing and GIS:

It is the largest agricultural university in Indonesia and has strong departments in soil science, agronomy, forestry, entomology, agrometeorology and other agriculturally related areas.

It is in close geographic proximity to Lapan, BAKOSURTANAL, Public Works, and Transmigration and has a working relationship with all four institutions.

It has developed a microcomputer based image processing/GIS system that would be very appropriate at the local/regional level.

It offers a wide range of courses in remote sensing and GIS and is involved in the expansion of curriculum in these areas.

It has given a training workshop in remote sensing/GIS and has experience in both areas.

It has a strong quantitative base in statistics, computer science and physics.

IPB WORKSHOP: "THE USE OF MICRO-COMPUTERS
FOR IMAGE PROCESSING AND GIS"

The IPB training workshop given from December 3, 1984, to December 14, 1984, demonstrated the role that IPB might play as the central training center for remote sensing and GIS. The primary instructors for the workshop were Dr. Uup Wiradisastra and Abdurrauf Rambe from the Institut Pertanian Bogor, and Sean C. Ahearn and Larry Seidl from the University of Wisconsin-Madison.

Material covered in the workshop included an introduction to the electromagnetic spectrum, manual interpretation of aerial photography, digital image processing, instrumentation, classification theory, the geometry of digital images, and geographic information systems. It also emphasized hands on experience with the micro-computer system in the IPB remote sensing lab and an exercise that include going through the entire classification process. An outline of the workshop is shown in Table 1.

The workshop was attended by 24 participants from three universities and six government institutions. This included the universities of: Gajah Mada, the Institut Teknikal Bandung, and the Institut Pertanian Bogor. The government agencies' representatives attending were from: the Department of Transmigration, LAPAN, BAKOSURTANAL, the Soil Research Center, BIOTROP, and the Department of Forestry. The list of participants is given in Table 2.

Several objectives were achieved by the workshop:

Participants were exposed to theory and application in the areas of remote sensing and image analysis.

It familiarized the IPB remote sensing team with the IPB Image Processing System.

Government participants acquired an appreciation for the capabilities of the system and its relevance to their activities. It is hope that their participation will increase University-Government project work.

The IPB remote sensing group gained experience in the preparation and execution of a remote sensing workshop. The groundwork is laid for an annual workshop or conference at IPB in the area of remote sensing and geographic information systems.

CONCLUSION

The need for a centralized training center in remote sensing and geographic information systems will become greater as data volumes increase and data decentralization becomes the mode of the future. The institution that is presently in the best position to fulfill this role is the Institut Pertanian Bogor, given its strong academic base and extensive experience in the fields of remote sensing and GIS. It is important that the international funding agencies continue to realize the importance of building up human resources in equal proportion to capital resources and support the development of a national training center.

ACKNOWLEDGEMENTS

Many people contributed to the success of the Institut Pertanian Bogor/University of Wisconsin Remote Sensing Project. Probably the key person responsible is Professor John T. Murdock who believed in the idea of initiating the project and gave his constant support throughout the life of the project. Special thanks to Rector Andi Hakim Nasoetion for his encouragement and enthusiasm during the project.

Dr. Uup Wiradisastra is the person responsible for getting the project started and orchestrating its continued development. Abdurrauf Rambe was the critical link in transferring the software developed by the IPB/UW team. Their work and sacrifice is greatly appreciated.

The UW team was directed by Dr. Ralph Kiefer who gave support and guidance to the project. Dr. Pete Weiler made an extraordinary effort in developing the software routines which formed the basis for the image processing software.

Thanks to Lynn Nelson and Loretta Erdahl for getting us and the equipment to and from Indonesia and keeping things working smoothly. Special thanks to Mrs. Guhardja for her hospitality and support during our visits to Indonesia.

Finally, to the United States Agency for International Development for realizing the importance of the development of education in Indonesia.

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Table 1.

WORKSHOP OUTLINE

12/3/84

- 9:00 - 10:00 OPENING CEREMONY
- Introduction to Workshop
- Introduction to I.P.B./U.W
 Remote Sensing Project
- Speech and Formal Opening by the Rector
- 10:00 - 10:30 PROGRAM OUTLINE
- 10:30 - 10:45 Coffee Break
- 10:45 - 12:30 PROGRAM
- Remote Sensing: An Overview
- IPB Digital Image Processing System
- Tour of Image Processing Lab
- 12:30 - 14:00 Lunch
- 14:00 - 16:00 WORKSHOP OUTLINE
- Emphasis
- Objectives

12/4/84

- 8:00 - 10:00 INTRODUCTION TO THE ELECTROMAGNETIC SPECTRUM
 Wavelength bands
- Sensors
- 10:00 - 10:30 Coffee Break
- 10:30 - 12:30 MANUAL INTERPRETATION OF AERIAL PHOTOGRAPHY
- Principles of the Aerial Photograph
- Manual Interpretation Techniques
- 12:30 - 14:00 Lunch
- 14:00 - 15:00 DIGITAL IMAGES
- Scanned Photography
- MSS (Airborne and Satellite)
- French SPOT Remote Sensing System
- 15:00 - 16:00 INSTRUMENTATION
- Introduction to the IBM PC/XT
 and Accessories

12/5/84

8:00 - 9:00 DISCUSSION: Why Digital Data?

9:00 - 10:00 COMPARATIVE ANALYSIS:
- Digital Data Analysis vs.
 Manual Interpretation

10:00 - 10:30 Coffee Break

10:30 - 11:30 SYSTEM DEMONSTRATION: IMAGE DISPLAY
- Spectral Characteristics of
 Different Resources

11:30 - 12:30 STATISTICAL SUMMARY OF SPECTRAL
 CHARACTERISTICS OF DIFFERENT RESOURCES

12:30 - 14:00 Lunch

14:00 - 15:00 INTRODUCTION TO CLASSIFICATION THEORY

15:00 - 16:00 INSTRUMENTATION
- Exploring the IBM PC/XT and Accessories

12/6/85

8:00 - 10:00 CLASSIFICATION THEORY (Continued)

10:00 - 10:30 Coffee Break

10:30 - 12:30 DEMONSTRATION OF CLASSIFICATION ON IPB IMAGE
 PROCESSING SYSTEM

12:30 - 14:00 Lunch

14:00 - 16:00 DISCUSSION: THE APPLICATION OF REMOTE SENSING
TECHNIQUES TO DIFFERENT DISCIPLINES
- Compile list of applications to each field
- Contrast manual and computer assisted techniques

12/7/84

8:00 - 9:00 ASPECTS OF THE GEOMETRY OF THE IMAGE
- Photography
- MSS
- SPOT

9:00 - 10:00 COORDINATE TRANSFORMATION

10:00 - 10:30 Coffee Break

10:30 - 11:30 COORDINATE TRANSFORMATION (Continued)
Lab Demonstration

12:30 - 14:00 Lunch

14:00 - 16:00 GEOGRAPHIC INFORMATION SYSTEMS: Concept and
Requirements

12/8/84

8:00 - 10:00 SUMMARY AND DISCUSSION:
-Applications of Remote Sensing to Natural Resource
Management

10:00 - 10:30 Coffee Break

10:30 - 12:30 COMPUTER SYSTEM INTRODUCTION
- Networking Concept
- Explore Software: DOS, Proofwriter
Image Processing

12:30 - 14:00 Lunch

14:00 - 16:00 COMPUTER SYSTEM INTRODUCTION (Continued)

12/10/84

8:00 - 10:00 DESIGN WORKSHOP PROJECT
- Image registration
- Image analysis and classification
- Summary statistics for each resource

10:00 - 10:30 Coffee Break

10:30 - 12:30 WORKSHOP PROJECT

12:30 - 14:00 Lunch

14:00 - 16:00 WORKSHOP PROJECT

12/11/84

8:00 - 10:00	PROJECT WORK
10:00 - 10:30	Coffee Break
10:30 - 12:30	PROJECT WORK
12:30 - 14:00	Lunch
14:00 - 16:00	PROJECT WORK

12/12/84

8:00 - 10:00	DISCUSSION OF PROJECT RESULTS
10:00 - 10:30	Coffee Break
10:30 - 12:30	DISCUSSION OF PROJECT RESULTS (Continued)
12:30 - 14:00	Lunch
14:00 - 16:00	EVALUATION OF WORKSHOP

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Table 2.

KETERANGAN PESERTA

LOKAKARYA ANALISA DIGITAL CITRA PENGINDERAAN JAUH

DI INSTITUT PERTANIAN BOGOR

BOGOR, 3-16 DESEMBER 1984

No.	Nama	Profesi	Instansi	Alamat Rumah
1	2	3	4	5
1.	Drs. Kartiman Kudonarpodo	Geografi (Pengolahan Data)	Fakultas Geografi Univ. Gajah Mada Bulaksumur Yogyakarta	Nyutran Jl. Taman Siswa d/a Hotel Sallendra Yogyakarta
2.	Drs. Hartono	Penginderaan Jauh	Fakultas Geografi Univ. Gajah Mada Bulaksumur Yogyakarta	Pagunrejo XIII/23 Yogyakarta
3.	Drs. Totok Gunawan	Foto-hydrology	Fakultas Geografi Univ. Gajah Mada Bulaksumur	Banteng Jaya II/10 Jl. Kaliurang Km 8 Yogyakarta
4.	Ir. Moh. Aminoto Idrus	Fotogrametri, Kartografi, Peng- inderaan Jauh	Jurusan Geodesi FTSP-ITB Bandung	Jl. Kanayakan A-14 Bandung
5.	Ir. Budi Hasmanto	Sistem dan Mana- Jemen Pertanian	Dept. Transmigrasi Jl. H. Agus Salim No. 58, Jakarta	Jl. Cisanggiri/20 Kebayoran Baru Jakarta
6.	Ir. M. Nassir Jusuf	Pengukuran dan Perpetaan	Direktorat Bina Program, Ditjen Reboisasi dan Rehabilitasi Lahan Dept. Kehutanan Jakarta	Jl. Kramat Batu No. 21 RT.003/04, Gandaia Selatan kebayoran Baru Jakarta Selatan
7.	Ir. Deslijati Sjarif	Pengolahan Data Remote Sensing	LAPAN Jl. Pemuda Persil No. 1, Jakarta Timur	Kompleks BRI No. 24 Radio Dalam Jakarta 12140
8.	Drs. Hawardi Nur	Pengolahan Data/ Ilmu Pengetahuan Komputer	LAPAN Jl. Pemuda Persil No. 1 Jakarta Timur	Jl. Pulomas Barat XI/4 Jakarta Timur

No.	Nama	Profesi	Instansi	Alamat Rumah
1	2	3	4	5
9.	Drs. Sukendra Martha, MSc.	Geographyc Information System	BAKOSURTANAL P.O. Box 46/CBI Cibinong	Kompleks Pabuaran Cibinong (BAKOSURTANAL)
10.	Dra. Munami	Remote Sensing	BAKOSURTANAL P.O. Box 46/CBI Cibinong	Slaga Ciluwar, Bogor
11.	Dra. Siti Imami Suwondo	Digital Remote Sensing	BAKOSURTANAL P.O. Box 46/CBI Cibinong	Jl. Kopurilud 784 Simpang Cilodong Km 39 Cibinong
12.	Drs. W. J. Surjanto	Penafsiran Potret Udara	Pusat Penelitian Tanah Jl. Ir. H. Juanda 98 Bogor	Komplek Pertanian Sindang Barang, Loji No. 50, Bogor
13.	Ir. Ishak Sumantri, MSc.	Eksplorasi Hutan	Pusat Penelitian dan Pengembangan Hasil Hutan P.O. Box 84, Bogor	Jl. Rimba Baru No. 40 Bojongmenteng Ciomas Bogor, Tlp. 22394
14.	Ir. Upik Rosalina Syafii	Ekologi Hutan	P3BT-BIOTROP Bogor	Jl. Singasari Blok AI No. 3, Cimanggu Permai Bogor
15.	Ir. Imam Santosa, MS.	Agrometeorologi (Meteorologi Satelit)	Jurusan Geofisika dan Meteorologi FMIPA-IPB Jl. Raya Pajajaran Bogor	Jl. A. Yani No. 2 Bogor
16.	Ir. Tjahjono Samigan Msc.	Ekologi Tumbuhan	Lab. Ekologi FMIPA-IPB Jl. Raya Pajajaran Bogor	Jl. Soka No. 16 Kampus IPB Darmaga Bogor
17.	Dr. Ir. Santun R.P. Sitorus	Land Evaluation	Jurusan Tanah Fak. Pertanian IPB Jl. Raya Pajajaran Bogor	Bogor Baru A11/15 Bogor

No.	Nama	Profesi	Instansi	Alamat Rumah
1	2	3	4	5
18.	Ir. IndayatI Lanya	Remote Sensing dan Kartografi	Jurusan Tanah Fak. Pertanian IPB Jl. Raya Pajajaran Bogor	Jl. Raya Luku No. 65 Perumnas Bantar- kemang, Bogor
19.	Ir. Komarsa Gandasasmita	Remote Sensing	Jurusan Tanah Fak. Pertanian IPB Jl. Raya Pajajaran Bogor	Jl. Merdeka Blk. 33 No. 26 Bogor 16112 Tlp. 22828
20.	Ir. Suwarno Sutarahardja	Inventarisasi hutan	Fak. Kehutanan IPB P.O. Box 69 Bogor	J. Mawar No. 2 Kampus IPB Darmaga Bogor
21.	Jannerson Girsang	Ilmu Tanah	Jurusan Tanah Fak. Pertanian IPB Jl. Raya Pajajaran Bogor	Jl. Nusa 1/24 Kramat Jati Jakarta Timur
22.	Budi Prati	Kehutanan	Fak. Kehutanan IPB P.O. Box 69, Bogor	Babakan Darmaga Bogor