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Institut Pertanian Bogor * University of Wisconsin

GRADUATE EDUCATION PROJECT

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Report No. 25

DeWitt & Paddock

January 19, 1983

COOPERATIVE RESEARCH AND TRAINING PROJECT

GENERAL PROGRAM STATEMENT

A DRAFT PROPOSAL PREPARED BY

INSTITUT PERTANIAN BOGOR

AND

UNIVERSITY OF WISCONSIN-MADISON

This preliminary copy is for use by staff at the Institut Pertanian Bogor, the University of Wisconsin-Madison, government agencies of Indonesia, and funding agencies, to provide a means for suggested revision, corrections, additions, and deletions. If possible, suggestions and text to be added to the proposal should be prepared in English and submitted to PUSDI-PSL, Institut Pertanian Bogor.

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1 INTRODUCTION

During 1981, 1982, and 1983, correspondence has been exchanged between PUSDI-PSL, Institut Pertanian Bogor, and the Institute for Environmental Studies, University of Wisconsin-Madison relating to development of a cooperative research and training program. This correspondence identified three areas of common interest and need: Land Resources Development of the coastal Wetlands of Sumatra, Land Resources Development of the alang-alang dominated uplands of Sumatra and Java, and Remote Sensing as a technique for evaluation of Wetland and Upland Resources.

During January 3 to 19, 1983, a workshop was held in Indonesia to develop plans for a research and training program related to these three areas. University of Wisconsin participation in this workshop involved: Prof. Calvin B. DeWitt, whose interests and expertise are in Systems Analysis and Wetlands Ecosystems; Prof. Christine Padoch, whose interests and expertise are in Anthropology, Social Science, and Human Settlements and Agricultural Practices; and Mr. Sean Ahearn, whose interests are in Remote Sensing. IPB participation involved approximately 20 faculty members from the several disciplines which relate to the project, with this participation being coordinated by Prof. Soeratno, Chairman of PUSDI-PSL, IPB. Participation by the Indonesian Department of Public Works included Mr. Manuwoto. Prof. John Murdock, with the assistance of USAID, arranged for travel of the UW team to Indonesia.

As part of the January, 1983 workshop, a 3-day trip to the coastal swampland area in and around Delta Upang and Delta Telang was made by a group of eleven faculty and staff, including the three from UW. The purpose of this trip was to engage in on-site discussions and make first-hand observations of

natural coastal swampland, spontaneous settlements, and transmigration settlement sites in every stage of development from newly-cleared swamp forest to settlements of 10 to 12 years.

As a consequence of the work conducted in the workshop and numerous meetings held with various faculty members in several departments, much information on the three project areas was obtained. This information in turn was used to develop this first draft of a proposal for a cooperative research and training program.

II. PURPOSE

The overall purpose of the proposed work is to develop the means for a continued and integrated study of land resources development in Indonesian uplands and wetlands with a view to providing the scientific basis for their continued upgrading and enhancement. While the project proposes to produce research results of importance to upgrading human settlements in development areas, its primary function is to further and foster the development of a base of scientific breadth and depth which will allow an integrated analysis of development situations in the years and decades ahead. Transmigration has taken place in development areas and will continue to take place. This project helps to develop the strengths necessary for contributing to the sustainability and continuing upgrading of these developments resulting from this transmigration.

III. BACKGROUND AND HISTORY OF RECENT LAND DEVELOPMENT IN INDONESIA

This brief section is to be developed by IPB staff and will be included in a subsequent draft of this document.

IV. PROJECT COMPONENTS

The project consists of three components:

1. Land resources development of the coastal wetlands of Sumatra
2. Land resources development of the alang alang dominated uplands of Sumatra and Java
3. Remote sensing as a technique for evaluation of wetland and upland resources.

V. TIMETABLE

Details on the timetable are given in each of the three parts of the proposal. Generally, the project will be conducted in four stages. The first is presently planned to continue for the remainder of 1983. The final three phases of the project consist of calendar years, 1984, 1985, and 1986. In general, 1984 will be used for initial and preparatory work, including technique development and basic data collection and analysis; 1985 will be used for continued technique development and data collection and higher levels of analysis; 1986 will be used for finalizing project goals and preparing results in published form. This phasing varies with the specific project and project component, and thus details should be obtained from the separate documents for each of the three project areas.

VI. PERSONNEL

See each of the three project area proposals.

VII. EQUIPMENT

See each of the three project area proposals.

VIII. BUDGET

See each of the three project area proposals.

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DRAFT COPY

January 19, 1983

COOPERATIVE RESEARCH AND TRAINING PROJECT

Part One:

Upgrading of Human Settlements in the Coastal Wetlands of Sumatra

A DRAFT PROPOSAL PREPARED BY

INSTITUT PERTANIAN BOGOR

AND

UNIVERSITY OF WISCONSIN-MADISON

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Summary

Development of the coastal swamplands in South Sumatra is well underway. However, new information may be needed to provide a basis for its upgrading. An overall integrated approach is desirable in obtaining this information.

This project develops an integrated research and graduate training program which may result in strengthening the scientific base from which a continued assessment of this and similar environments can be conducted. It hopes further to build the expertise necessary to evaluate new situations as these arise in the future.

II. Goal, Purpose and Product of the Research

A. Goal

To upgrade human well-being in coastal swampland settlements.

B. Purposes

1. To develop a research program to upgrade the well-being of the human populations in areas now under development in Indonesia. These areas include the coastal swampland areas of Sumatra and upland areas dominated by alang-alang grass.
2. To develop a training program for staff and graduate students at IPB in this area of research which will provide a base from which practical studies can be conducted now and in the future.

C. Product of the Research

At the conclusion of the project we expect to have the following accomplished as a result of the research and training program.

1. Scientific Training:

   Training of Indonesian scientists and U.S. scientists in rigorous data gathering methods, analytical procedures, and integrative systems techniques applicable to the upgrading of tropical coastal development areas. These scientists will have both the skills to conduct such research and to train others in the conduct of such research. They will be skilled in dealing with complex problems both in coastal swamplands and other environments.

NOTE TO REVIEWERS: Please specify the ways and areas in which such strenghtening will occur, kind and number of courses, etc.

2. Institution Building and IPB:
   Strengthening and development of the graduate program of Institut Pertanian Bogor.
3. Integrated knowlege of coastal swampland development:
   Provision of an integrated description of important variables of the tropical coastal swamp settlement system.
4. Management and Policy Model:
   Provision of a quantitative dynamic spatial model of the water/soil/crop relationships of a coastal swampland settlement system constructed in such a way that water management policy and procedures can be effectively tested prior to actual implementation.
5. Knowledge of Specific Systems:
   Provision of detailed descriptions of: (1) the dynamics and flexibility of the coastal swamp settlement system to accommodate diversification of human social and economic activity; (2) the dynamics and nature of intercommunity and intracommunity interactions in the coastal swampland; (3) the daily and seasonal dynamic of water regimes of soil, canals, and rivers in a spatial context; (4) the relation of ground water and water regimes on the pH of the soils and the consequences for agriculture; (5) the production and post-production system for crops, domestic livestock, and aquaculture; and (6) the nature and dynamics of fisheries with respect to water quality and fishing regulative policy

III. BACKGROUND AND HISTORY OF RECENT COASTAL LAND DEVELOPMENT IN INDONESIA

This section may be about 1 1/2 pages. We would like to ask that this section be written by an IPB staff member.

IV. STRUCTURE OF THE RESEARCH

Research conducted in this project is practical and problem-oriented. It is integrated research done from a systems perspective, is rooted in specific "In-Depth Micro Studies," and is field-oriented. These features are described in more detail below.

A. Problem Orientation of this Research

The research of this project proceeds from problem identification to selection of approaches and techniques best suited for dealing with the problems identified. Project orientation is toward upgrading the welfare of people living in the coastal swamplands. All aspects of the research are directed toward this practical purpose.

B. Integrated Approach of this Research

This project investigates in depth, by means of "Micro-Studies," several areas important to understanding the current well-being of coastal swampland settlements and the requirements and method for their upgrading. But the micro studies are done within a general framework which unifies all micro studies. The general framework of the study is an overall perspective of the system, including its human and biophysical elements. A framework which is aided in its development by modern techniques of systems analysis, conceptual model building, and for the biophysical aspect, by quantitative modeling.

An early form of the general framework is developed at the start of the project by the systems team in what may be called a "macro study" or systems analysis. This preceeds and informs the selection of specific studies. And, as specific studies are done, they assist in refining the general framework including both its temporal and spatial aspects.

C. The "Micro Studies" Component of the Research

The following areas of study have been identified as the micro studies of this project. Each of them is a systems study in itself and each employs the expertise of more than one discipline. Yet each micro study also contributes toward an understanding of the coastal swampland settlement system as a whole by the application of study design criteria which assure the development of information and linkages which allow an overall systems perspective.

These areas of study are as follows: (1) Resource Use Flexibility, (2) Human Interactions, (3) Water Resources and Use, (4) Soil Resource Base Improvement, (5) Production System Alternatives, and (6) Fisheries.

D. Field Emphasis of the Research

The proposed research is designed to provide practical information about settlements of the coastal swamplands and their upgrading. Because of this orientation, the major part of this project will be conducted on site in field situations.

V. PROJECT COMPONENTS

A. Introduction

A key feature of this project is its integrated systems perspective and the governance of all aspects of the project by this perspective. Project management techniques which will assign specific reponsibility and accountability to project staff include the identification of 6 interdisciplinary areas each of which involves the need for a systems perspective and cooperative systems analysis by more than one discipline.

1. Resource Use Flexibility

Households of transmigrants have been undergoing major changes in their sizes, needs and abilities since they arrived. With time, diversification of the use of resources increasingly appears. We thus assume that families of transmigrants whose needs may have been rather similar upon arrival, now may be considerably different. We believe it is important to assess whether the system of which these people are a part can accommodate the differences that have arisen. If there are needs that cannot be accommodated, then it is necessary to know what alternatives can be made available in order to upgrade their well-being. We assume that the degree to which such diversity develops is a measure of the maturity and well-being of the community and is important to assess as work is done to improve the public welfare;

Methods of participant observation and interviewing will be used in data gathering. The focus in this subproject is on gathering data which may indicate to what degree the administrative, economic, and environmental situation in which settlers find themselves is flexible enough to allow them to satisfy changing and increasingly differing needs. Among the kinds of data that will be collected are household censuses; data on economic activities, both agricultural and non-agricultural; per capita and per worker access to land and other important resources and the mobility of households.

In this work an attempt will be made to cooperate to the greatest degree possible with the Directorate General of Transmigration, P4S of the Department of Public Works and the University of Sriwijaya at Pelambang.

2. Human Interactions

The human populations of the Musi-Banyuasin area include groups with greatly differing cultural and economic backgrounds, differing lengths of experiences in the area, and differing patterns of resource use. We assume that increased interactions of a positive nature among these diverse groups is desirable as it leads to the greater well-being of the region as a whole.

In this study we will focus on investigation of the interactions between members of differing groups including those of farmers with merchants, new transmigrants with long-settled ones, groups from Java and Bali with those from the Sulawesi and

the indigenous groups. Methods of participant observation and interviewing will be used to determine the degrees and kinds of interaction. Information on the frequency, nature, and results of such interactions will be obtained and attention will be paid to the role of differing resource use patterns in enhancing or reducing the probability of positive group interactions. In this work, an attempt will be made to cooperate to the greatest degree possible with the directorate general of transmigration, P4S of the Department of Public Works and the University of Sriwijaya at Pelambang

3. Water Resources and Use

A primary and fundamental factor in the coastal swampland is water and its relationship to the soil. The initial task of tidal swampland development for human settlements is to remove water from the soil by drainage. This removal of water must be of the right magnitude. If not drained enough, the soils will not sustain agricultural use and human settlement. If drained too much, the soils oxidize in the presence of air with resultant formation of acids, lowering the PH below levels suitable for plant growth and reducing values of PH in adjacent waters below levels suitable for sustaining fish.

In addition to the degree of drainage, the hydrology of the soils, canals, and rivers depends upon the dynamics of the ocean tides, the effects of these dynamics on river water levels, the daily and seasonal pattern of rainfall, transpiration from

vegetation, evaporation from plants and other surfaces, and the permeability of the various soil types. Understanding of relationships of water dynamics to plant water supply, to flushing of acids and salinity from the soils, to sanitation, to drinking water supplies, and to water transportation all depends upon a substantial understanding of the hydrology of the coastal swamplands.

Needed for this understanding are continuous records of waterlevels in river, canal, and soil water table. Although some data are being recorded on these water levels, data are insufficient for description of the regional hydrology. The four water table recorders used by the IPB hydrologists are insufficient for effective study of hydrology at the farm level.

The proposed research on the study of water resources of the study area includes continuous monitoring of rainfall at key stations in the area, and continuous monitoring of the regional hydrology at the river, canal, tidal levels, and farm levels. This monitoring will be done using recording tipping-bucket rain gauges and transmitting and nontransmitting Leupold-Stevens water level recorders. Measurements will be coordinated with data from the recording stations of the Department of Public Works which are distributed through the wider region.

These data will be used to describe the dynamic pattern of water movement through the system and to help assess the effects of this dynamic pattern on crop production, transportation, water

supply, human waste disposal, social interaction, fishing, and public health. These data will be presented in seminars and small group meetings between the water resources team and each of the other teams.

These data will also provide the primary basis for the development of an overall spatial/dynamic model of regional hydrology under the integration portion of this proposal to be conducted by the systems team as described in a later section of this proposal.

Personnel involved in the water resources aspect of the project include hydrologists of the agricultural mechanization department. Training in this aspect of the project will involve the teaching by these IPB hydrologists of graduate students proper field techniques of hyrological measurement, methods of data analysis and interpretation, and, in cooperation with the systems team, techniques of dynamic hydrological system simulation.

Following development of the computer simulation of the hydrology of the system by the systems team, the model will be used to predict weekly and seasonal water levels in the region as a function of various rainfall scenarios. These predictions will be tested by the water resources team using field data collected by them subsequent to the predictions. Disparities between predicted and actual system behavior will be used by the systems team for model refinement.

The model developed by the systems team will also be used by the water resource team to determine means and strategies for better water management, including considerations of kinds and placement of gates and drainage pattern alteration devices. The results of this work will be presented in meetings with the Indonesian Department of Public Works together with others interested in water management for the upgrading of the human settlements in the coastal wetlands.

4. Soil Resource Base Improvement

Drainage of swamplands in south Sumatra replaces conditions which prevented oxidation to conditions in which oxidation occurs. Such oxidizing conditions brought about by drainage results in the pyrite which is present in the soil being converted to sulfite and then to sulfate. The resulting release of hydrogen ion during this oxidation process can drive soil pH down so low that crops no longer can be grown, and fish no longer can live in adjacent affected waters. Thus, the supportability of crop and fish production is closely linked with the hydrology of the region. From experience in similar situations in Thailand and Vietnam where the dry season lasts about 4 months and during which no rain normally falls, the pH of the soil may fall as low as pH 1. Thus far in south Sumatra, such very low levels of PH have not occurred due perhaps to the shorter dry season of about 3 months and also to the occurrence of about 60mm of rain during the dry season. The amount and distribution of water is a very

important consideration, and soil quality for plant production is very closely related to the hydrology of the region. Leaching rates of the soil, which also are a function of the hydrology, are an important consideration. If the rate of oxidation is equal to or less than the rate of leaching, than acid soils fail to develop. But if the rate of oxidation is more than the rate of leaching, acid soils develop and crops and fisheries are seriously threatened.

Besides the pyrite soils so prevalent in the region, peat deposits also occur. These are found inland from the alluvial deposits of the rivers and have formed in depressions of an alluvium which was more heavily deposited near the river boundaries. In these depressions, the rate of peat formation has exceeded the rate of peat oxidation and thus the peat has steadily increased in thickness, even rising above the regional water table as rain water falling into the peat soils created anaerobic conditions thereby reducing rates of peat decomposition. Such peat soils formed from swamp forests of past centuries pose peculiar problems to human settlement and uses of drained swamplands. Structurally, they present problems of support for superstuctures. They decay rapidly when exposed to the air as a consequence of drainage and thus are characterized by subsidence, and they are low in soil nutrients necessary for agricultral production. In areas where peat soils are only a few decimeters thick, they pose little problem since they soon

disappear due to oxidation, and crops can be ground on the mineral soils which lay beneath. In some areas however, such peats are from one to a few meters depth, excluding agriculture.

Given the situation in this region with its problem-posting sulfate soils and its unsuitable peat soils, one objective of the proposed research in the area of soil upgrading and development is to better understand these different types of soil at the farm and regional levels, including their relationship to groundwater level, anaerobic and aerobic conditions, leaching rates, and agricultural production. This work will involve critical investigation of specific sites using chemical analysis of soils, and determination of the effects of anaerobic and aerobic conditions as functions of ground water level.

A second objective of the soil improvement aspect of the proposed research is to investigate alternative ways of managing ground water levels and soils in order to facilitate development of both subsistence and cash crops.

Results of the soil distribution and chemical study will be presented in the form of seminars to the water resource team with the objective of jointly working out a water level management strategy for upgrading the soils in the region for agricultural production. This collaborative work will be used by the water resources team as part of the input to the selection of alternative water diversion and gate systems which they will test using the hydrological model developed by the systems team.

Results of the work will be presented to the Department of Public Works and to the Directorate General of Transmigration as inputs to their planning processes.

The soil improvement team will, as part of their work, describe the characteristics of acid sulfate soils as one of the limiting factors in the area and determine the processes of formation under different types of water regulation. They will also determine the level of toxicity to various crop types, with a view toward selecting species and varieties which are more tolerant of poorer conditions and which are yet marketable products.

Also, as part of their work, this team will tabulate and analyze the various cultivation methods being used, including assessment of inputs applied and cultivation methods employed. The impacts of these methods on water table, soil characteristics, and interrelations of soil hydrology with chemistry will be investigated.

Results of the soil distribution and chemical study will be presented in the form of seminars to the social flexibility team with the objective of reviewing the relationships between chemical properties of soils, ground water levels, and agricultural productivity. A joint determination will be made by the two teams of the relationship of well being of residents to the distribution of various soil types and soil conditions. The results of the seminar will be written in the form of a working paper for distribution to all other teams.

Finally, the soil improvement team will develop a model management strategy for upgrading the soils in the region for agricultural production. This collaborative work will be used by the water resources team as part of the input to the selection of alternative water diversion and gate systems. Results of the work will be presented in written and seminar form to the Department of Public Works and to the Directorate General of Trasmigration as inputs to their planning processes.

5. Production and Post-Production System Alternatives

MISSING

6. Fisheries

MISSING

7. Macro Studies

NOTE: This work has a pre-project component and because it might be already implemented during 1983, this work is explained in somewhat more detail. Comments, suggestions, and expressions of interest are needed very soon on this part of the proposal.

The entire project, as well as its several components are characterized by the use of an integrated approach. Throughout the effort, teams not only interact with other teams, but also work out the interrelations between the project components. In this sense, all those

participating in the project are employing an integrative systems approach. In addition to this however, one component of the project is explicitly responsible for overall project integration. This component is the systems analysis, or "Macro-Studies" component.

The Macro Studies component of the project consists of two major parts: (1) pre-project work, and (2) project work.

A. Pre-Project Work

This work will be accomplished in 1983, to be finished by December 31, and consists of the following:

1. Initial Literature Review

This work will assemble all existing literature on the tidal swampland development project being undertaken in south Sumatra. Materials will be collected from libraries and reference collections of the various universities and agencies. One or two graduate students would assist in this work.

2. Conceptual Model Development

The literature review will be used as the basis for the development of a conceptual model for land resources development for South Sumatra. This conceptual model will be so structured as to show the interlinkages and interdependences between the components of the system, both biophysical and social.

3. Preparation of Systems Review Paper

The conceptual model will be used together with

the collected literature to formulate a review paper whose purpose it is to illustrate the system components, their behavior, and their interlinkages. Papers from the literature review will be carefully selected to develop a holistic understanding of the tidal swamp development system following the method and approach employed by Heliotis (1982). This integrated review paper will also identify key linkages and components which are essential for system definition, but which are inadequately described in the literature. It thus identifies the "holes" in research which must be filled in order to significantly increase understanding of system operation.

4. Presentation and Distribution of the Integrative Systems Review Paper

The systems review paper will be formally presented at IPB to staff who will be or are engaged in the project. This review paper will provide a key coordinating reference for project.

5. Teaching of a Basic Systems Course

Dependent upon funding availability, this part of the work would have Prof. Calvin B. De Witt of the University of Wisconsin-Madison teach a graduate level course in systems and integrative techniques in semester Pertania 1983 (29 August 1983 to 7 January 1984). This

course would introduce the basic systems techniques of problem identification. Conceptual model building, flow-charting, and quantitative model development. It also would introduce basic systems tools for group organization and inter-agency and inter-disciplinary cooperation. The coastal swamplands would serve as a case study in this course and would be used by the class as a topic application of practical systems analysis and modeling. Some students in this course would likely be motivated to select problems in the coastal wetlands project for their graduate research. This course would be followed by an intense short course on systems given by Prof. De Witt for faculty in January of 1984. This would serve any interested IPB staff, but particularly those staff members who participate in the coastal wetlands project. This course would, among other things, provide a common base for much of the research to be conducted during the course of the swamplands development project.

Teaching of both these courses would be done with IPB systems staff members participating in some of the teaching.

B. Project Work

This work uses two types of models as a tool for integration of the various subprojects: (1) a conceptual model

which involves all aspects of the project and which results in a qualitative description of the components of the system and their interactions, and (2) a quantitative computer model which involves the quantifiable aspects of the project, particualarly the hydrology, soils, and productivity of the land.

The conceptual model is basically the concept of the investigators on how the subsystems and system under study behave and function. It includes identification of the important features and components and describes how and to what degree these components relate to one another. Such concepts are based upon direct observations and observations of others as presented in the literature, and are a kind of hypothesis which one tentatively holds and which is tested against further observations. It is a qualitative description of how things behave.

The quantitative computer model is the translation of those aspects of the conceptual model which can be quantified into equations and computer statements. These equations and statements together form a model whose behavior can be studied and compared with the behavior of the system under study. In this project, quantitative computer modeling will have water and hydrology as its focal point, and will quantitatively describe the relationship of water and hydrology to soil quality as defined by the soil improvement team. The function of this model

will be to allow testing of water management strategies for upgrading the productive potential for crops, domestic animals, and fisheries. All project team members will participate in model development to assure that it describes the system well and provides results useful for every subproject. Team members will be assisted by technicians who have computer programming expertise.

The following is an approximate timetable for this part of the project.

1984

a) Research methods course: possibly one entitled "Field Investigations in Swampland Ecology."

b) Conceptual model refinement: based upon the conceptual model developed in the pre-project period, contributions from all subteams, and the literature review.

c) Preliminary work on quantitative computer model development, including preliminary estimation of model parameters from field observations.

1985

a) Swampland quantitative systems computer model development

b) Systems model refinement

c) Concluding work on parameter estimation from field measurements

d) Quantitative computer model evaluation and testing

1986

a) Quantitative computer model refinement

b) Conceptual model development: a complete restructuring of the conceptual model with all project subteams participating and based upon field data anaylsis and published literature. This conceptual

model will be qualitative, and likely will take the form of flow diagrams showing components and their interrelationships. Each subteam will be responsible for contributing a flow chart and written description of the system components and interlinkages they have under study in their subprojects. In addition each subteam will have reponsibility as a member of the team as a whole in participating in development of the overall concept (conceptual model) of the dynamics of the system to the extent of their knowledge.

c) Application of quantitative computer model to resource management scenarios by related subteams.

d) Testing of scenario output of computer model against field measurements

e) Identification of further areas of investigation for ongoing research programs.

I. PROJECT INTEGRATION

NOTE: The following is a very tentative statement, and comments are needed on its workability. Additional ideas on assuring project integration are very welcome.

Based upon the cooperative stance toward this project taken by the various staff and departments at IPB, the following procedure will be an appropriate one to help assure that persons participating in the project are available and committed to carry out the research:

1. All staff with potential for contribution to the objectives off the project will be given copies of the proposal.
2. Staff who express an interest and commitment to the project or a portion of the project will be invited to submit a proposal for the research they plan to conduct. Preference will be given to

proposals which are prepared in consultation with other participating staff and which have plans and procedures defined for building effective linkages between other aspects of the project.

3. Proposals will be reviewed for their consistency with overall project goals and goals for specific studies. Following receipt of all or most of the anticipated proposals, suggestions will be made to the authors on changes and refinements which will bring specific pojects into proper linkage with each other.

4. Revised proposals will be submitted by participating staff, and reviewed to determine whether further revisions are necessary or if they are in final form. Those in final form will be approved for execution.

5. Progress on work conducted on all approved proposals will be monitored, including assessment of consistency with the specific proposed research and overall project goals. This monitoring will be used to keep all work in line with the stated objectives of the overall project.

6. Final written reports will be required from all specific studies in a form which shows clearly the interlinkages between specific sudies and the overall tidal swamp settlement system. The report of the systems team will be available as on basis for unifying the written reports around a holistic systems perspective of this settlement system.

7. These final reports will be used to refine the overall concept of the nature and dynamics of the system under study and will be used as a

basis for development of a final project report. All reports will be distributed to the various governmental and university departments whose interests are included and affected by the results of the study. Throughout the project, these departments will be apprised of the progress of the project, particularly as it is relevant to areas of their jurisdiction, will be asked for suggestions, data, and comments, and will be informed of the objective of the project in upgrading the quality of swampland settlements.

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Draft Copy

January 19, 1983

Cooperative Research and Training Project

Part Two:

Upgrading of Human Settlements in Alang-Alang Uplands of Sumatra

A Draft Proposal prepared by

Institut Pertanian Bogor

and

University of Wisconsin-Madison

This preliminary copy is for use by faculty at the Institut Pertanian Bogor, the University of Wisconsin-Madison, government agencies of Indonesia, and funding agencies, to provide a means for suggested revisions, corrections, additions, and deletions. If possible, suggestions and text to be added to the proposal should be prepared in english and submitted to PUSDI-PSL, Institut Pertanian Bogor.

This part of the proposal is not yet developed. A possible approach to this development is as follows:

1. Preparation of a literature review (see proposal of December 1983 on this topic and proposal submitted by Manuwoto and Christine Padoch).
2. A field site visit similar to that made in development of the coastal swamplands proposal might be a reasonable approach to consider.

Proposal Outline

Title

Abstract

I. Introduction

II. Purpose

III. Backround and history of recent land development in Indonesia

IV. Procedural structure of the research

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RESEARCH PROPOSAL

MULTISECTORAL APPROACH IN THE UTILIZATION OF ALANG-ALANG DOMINATED LAND

PREPARED

by

DR. B. SOEWARDI

CENTER FOR NATURAL RESOURCE MANAGEMENT AND ENVIRONMENTAL STUDIES

BOGOR AGRICULTURAL UNIVERSITY

1983

RESEARCH PROPOSAL*

TITLE: MULTISECTORAL APPROACH IN THE UTILIZATION OF ALANG-ALANG DOMINATED LAND

OBJECTIVES:

1. To explore the synergistic interactions among development activities of converting alang-alang dominated lands into more productive agricultural lands.
2. To explore the opportunities for the creation of post harvest technology towards the development of agro-industry.
3. To increase development efficiency through maximization of internal processes.

BASIC CONSIDERATIONS:

1. The alang-alang grasslands are not only very potential (16-20 million hectares) but ever increasing (150-200 thousand hectares a year).
2. The alang-alang grasslands are still under utilized and versatile (see Diagram 1).
3. Conflict of interest develops since there are many kinds of projects involved and have jurisdictions over the use of the alang-alang dominated lands: transmigration, regreening and reforestrations, estate crop development, ranching, food production, etc.
4. So far the approach is partial and piecemeal. New approaches must be developed: comprehensive, holistic, and synergistic.

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*Prepared by Dr. B. Soewardi to be presented to the meeting of Persiapan Penelitian Pertanian, sponsored by Ford Foundation and Litbang Pertanian, 12-15 January, Songgoriti Malang.

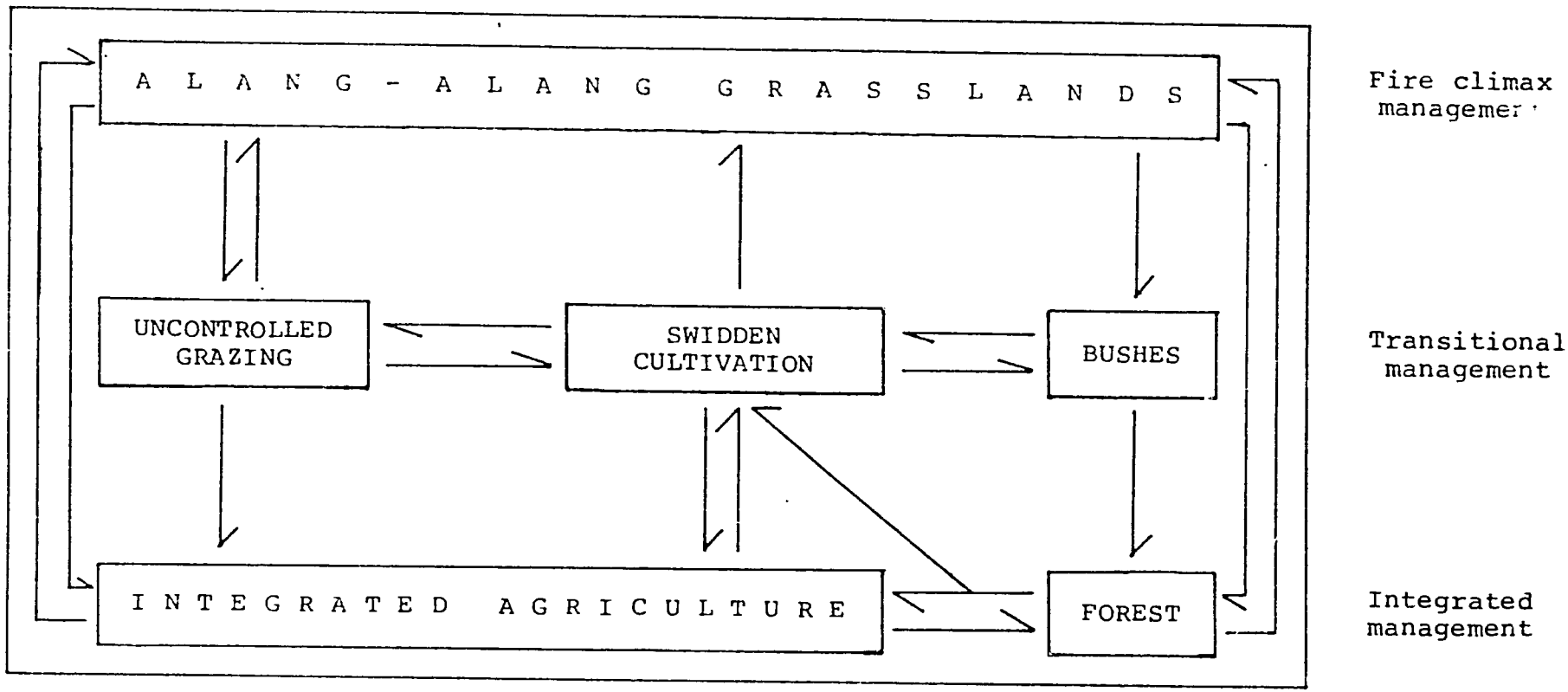

Diagram 1. The Dynamic of System Management

5. Such systemic approaches will not only accomodate most of the development activities, but it will also simultaneously facilitate conflict resolutions.
6. A research umbrella along this idea should be worked out in cooperation with the resource managers and policy makers to make the results effectively used to support development.

WHAT TO DO?

The following diagram illustrates one possible alternative (see Diagram 2).

HOW TO DO?

1. Anticipate future conditions through the analysis of future needs
2. Formulate the role and functions of agriculture
3. Design new structure
4. Set up new research strategies
5. Develop communication with resource managers and policy makers along the processes

CONSEQUENCES

1. Creating more job opportunities
2. Generating higher income
3. Reducing risks
4. Increasing efficiency of resource use

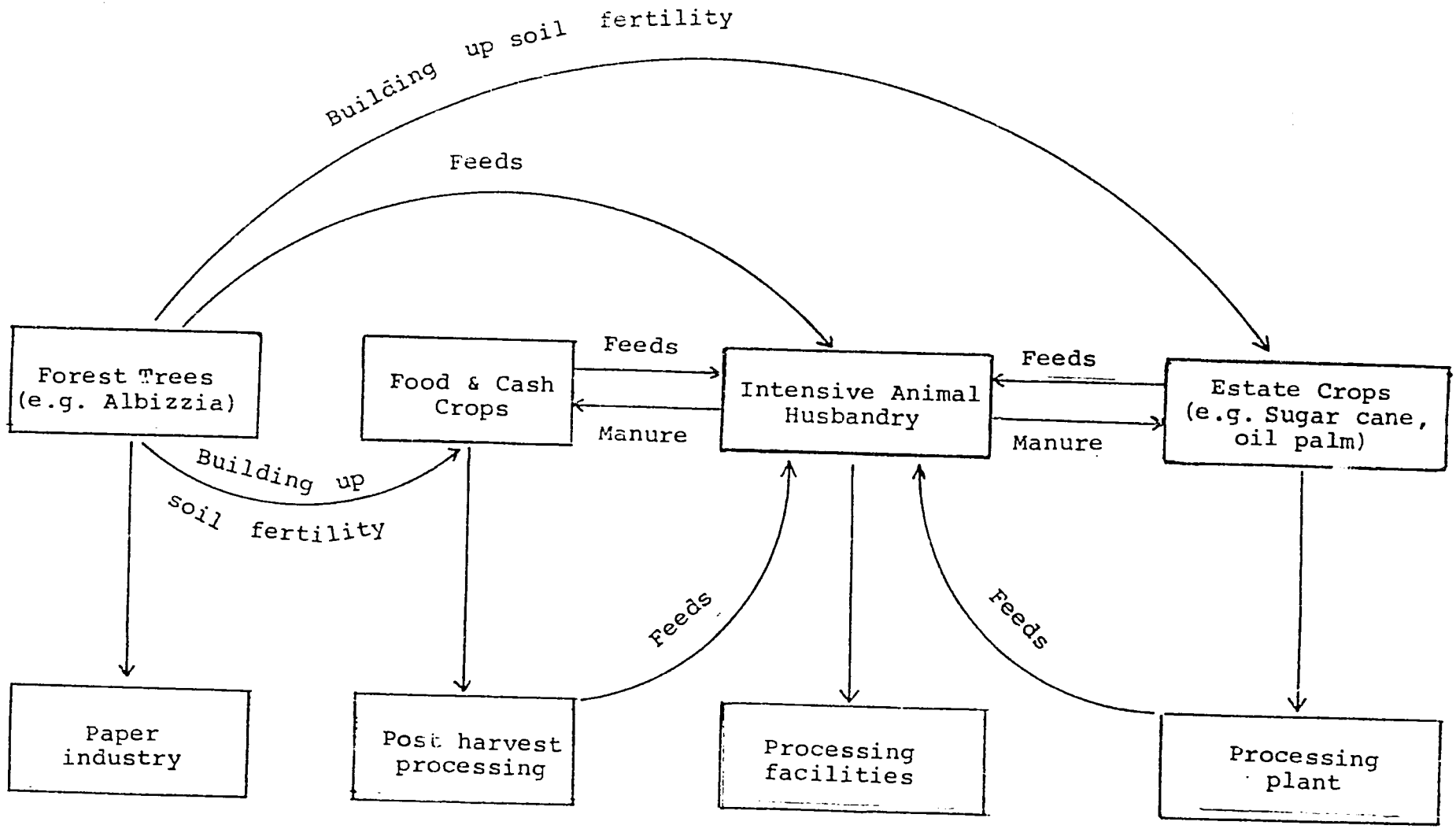

Diagram 2. Multisectoral Development Activities

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Draft Copy

January 19, 1983

Cooperative Research and Training Project

Part Three: Remote Sensing

A Draft Proposal Prepared by

Institut Pertanian Bogor

and

University of Wisconsin-Madison

This preliminary copy is for use by faculty at the Institut Pertanian Bogor, the University of Wisconsin-Madison, government agencies of Indonesia, and funding agencies, to provide a means for suggested revisions, corrections, additions, and deletions. If possible, suggestions and text to be added to the proposal should be prepared in English and submitted to PUSDI-PSL, Institut Pertanian Bogor.

Introduction

In Indonesia remote sensing has been used in many disciplines for several decades in the form of conventional black-and-white aerial photographs. This has been reflected at IPB in the course of basic aerial/photo interpretation in forestry since 1950. However, until the mid-seventies, the development has been very slow. In 1969, the Department of Soil Sciences introduced the same course to its students.

During the past decade, newer forms of remote sensing and improved methods of data analysis have been widely available. To catch up with this fast development, IPB has sent staff to study remote sensing particularly in the application aspects. In the beginning, interested staff were taking courses in remote sensing to support research projects, and emphasizing forest mapping, cartography, and land evaluation. Only recently, more interests has been given to the technology itself. For example, one of the staff has taken radar system of r.s. as his main interest. IPB staff were and still are taking courses in the U. S., International Training Center-The Netherlands (I.T.C.), England (UNESCO Sponsored applied geomorphology course), University of Ghent, Germany and in-country training such as BIOTROP and ITB. Photogrammetry has also received more interest.

In 1978, IPB set up a committee by the name of Tim Pengembangan dan Aplikasi Penginderaan Jauh-or Team for the Development of the Application of Remote Sensing (TPAPJ) which has the main task of promoting the development of remote sensing at IPB and to make contact with outside organizations dealing with remote sensing.

The Team has been very active especially in participating with the activity of national organizations such as the Surveyor Association of Indonesia (ISI), and National Agencies, such as the National Institute for Aeronautics and Space Science (LAPAN) and the National Agency for Survey and Mapping (BAKOSURTANAL). As a result, IPB at present has a relatively outstanding position in remote sensing. Nevertheless, this has great consequences.

IPB has been participating in almost all activities of BAKOSURTANAL dealing with remote sensing and natural resource information systems, attending workshops and seminars, discussions, and in 1981, hosted a national seminar in remote sensing application to support development planning. IPB staff have been teaching a course at the Centre for Image Interpretation and Integrated Survey (PUSPICS) which is a training centre at Gajah Mada University sponsored by BAKOSURTANAL.

LAPAN through the National Committee for the Utilization of Space (PANTARNAS) has invited IPB to sit as a member. Regular meetings have been carried out to discuss matters related with the role of Indonesia in space activities, e. g. preparation of UNISPACE II in 1982, discussion on French team (SPOT) and Tropical Earth Resource Satellite-The Netherlands (TERS), and many others.

In IPB itself, all of these activities have stimulated a tremendous development of interests in the use of remote sensing in research, particularly to staff members of different disciplines and post graduate students. Five to six staff are now having their research programs which include remote sensing, lead to master and doctor degrees. Five to seven

students are also taking remote sensing as major subjects. Both groups have very wide fields of application, e. g. in forestry (forest monitoring and product), soil mapping, land-use mapping, ecology, crop yield forecasting and regional planning.

Those wide varieties of interest are encouraging but are a big problem to be solved, since IPB still has very limited resources in terms of staff (this relates to course offering), funds, and equipment. At the workshops, due to this, the discussions were concentrated on subject matters related to those mentioned problems.

I. Curriculum Development

II. Staff Development

III. Research Projects

IV. Laboratory Equipment

V. Funding Sources

IPB-UW Cooperative Project-Remote Sensing

This report outlines the preliminary plans for the development of curriculum, training and research for the remote sensing program at IPB. It was prepared after participation in the IPB-UW workshop during the time period of January 2, 1983 to January 13, 1983.

I. CURRICULUM DEVELOPMENT

Dr. Ralph Kiefer and Mr. Sean Ahearn will give a short course in selected remote sensing topics in June of 1983.

Course designing and curriculum development will be discussed with the departments that use remote sensing techniques. The discussion will result in a formal proposal for a remote sensing curriculum.

A. General Requirements:

Expertise in a discipline that uses remote sensing techniques

Statistics I

Computer Science I

B. Proposed courses:

S1 Level

Airphoto Interpretation and Introduction to Remote Sensing

This course will be offered in each of the major departments that use remote sensing. Emphasis is on air photo interpretation as applied to the individual fields. An introduction to remote sensing principles is given.

S2 Level

Principles of Remote Sensing

This course will be cross listed with each of the departments and given by the remote sensing center. Subject matter will include: energy interaction with the earth and atmosphere, radiometric characteristics of aerial photography, aerial thermography, multispectral scanners, radar, spectral pattern recognition and remote sensing from space.

Photogrammetry

This course will be cross listed with each of the departments and offered by the remote sensing center. Subject matter will include: optics, geometry of aerial photography, ground control, flight planning, stereoscopic plotting instruments and analytic photogrammetry.

Remote Sensing Applications

This course will also be cross listed by the appropriate departments and offered by the remote sensing center. Students will design and execute a project that applies remote sensing techniques to

their field of specialization. Field work analysis of data and final report writing is required. Final reports will be presented before the entire class for discussion and recommendations. These projects could be used as a basis for a master's thesis or a dissertation.

Special Topic Courses

These courses could be offered by the appropriate departments or by the remote sensing center. They are a means of focusing on more detailed applications of remote sensing to the individual disciplines. Possible courses may include: remote sensing instrumentation, computer assisted cartopgraphy, advanced photogrammetry, Geographic information systems and advanced statistical techniques for remote sensing.

II. PERSONNEL EXCHANGE

The purpose of this program is to exchange knowledge and transfer technology between IPB and UW. The development of curriculum, the training of personnel, the design of research, and the identification of equipment needs are the primary considerations.

III. RESEARCH PROJECTS

The objectives of the research programs are to advance the training of IPB personnel, provide a medium for the exchange of technology and scientific technique and to help fulfill the environmental and management goals of the Indonesian Government.

A. Phase I--June 1, 1983-August 15, 1983

This time period will be spent on the refinement of research topics, the identification of participants in the projects, the selection of test sites and the writing of formal proposals for further research.

RESEARCH TOPICS

1. Transmigration--Site Selection & Maintenance

One of the primary objectives of the transmigration program is to settle people on lands that can provide them with a prosperous livelihood. The selection of such sites presents the government with a tremendous task. If the government is to fulfill its ambitious quotas for transmigration settlement, it must develop the capability to accurately and efficiently select optimal areas for transmigration sites.

a. Pasang-Surut - site location in these areas depend on soil characteristics, hydrology, forest cover and the absence of human settlement. Remote sensing is used to delineate drainage patterns, measure the water turbidity, distinguish between primary and secondary forests, locate present settlements and by using indicator species to determine soil type, moisture conditions and salinity.

b. Upland Areas - site selection in the upland areas depends on the slope of the ground, the soils, the hydrology, the forest cover and the access to transportation. Remote sensing and photogrammetry techniques can detemine the elevation and slope of the land, the forest cover type, give an indication of soils, determine drainage patterns and show possible access routes.

2. Alang-alang

Alang-alang is increasingly becoming a problem in Indonesia and throughout South East Asia. It is important to access the aerial extent and rate of expansion of alang-alang in order to develop a management plan for its control.

Landsat satelites may provide the capability to evaluate the extent and rate of expansion of alang-alang. Change detection techniques can identify not only the areas of expansion of alang-alang, but also determine the previous land use that led to its expansion.

3. Pilot Project - Watershed Study

This project would be an interdisciplinary study which would set up an integrated management system for an entire watershed.

An integrated remote sensing and photogrammetric system will provide the input for a geographically based information system. Some areas of study might include crop yield forecasting, irrigation monitoring, erosion evaluation, plant pathology, forest inventory, and human interaction with the environment.

Pasang-Surut - Case Study

A site visit of the pasang-surut area in the delta occurred during the time period of January 5, 1983 to January 8, 1983. Four transmigration sites in different stages of development and with different site conditions were observed.

The major factors effecting the site condition are the soil characteristics, the hydrology, and the forest cover.

- One of the first steps in understanding the dynamics of the pasang-surut is to map its drainage pattern. This is important when determining the location and structure of the canals and in understanding the interaction between the present canal system and the natural drainage pattern. The drainage pattern can be mapped directly by remote sensing of the water and indirectly by mapping species that indicate open water enclosed by a canopy cover.

- The hydrologic head or rate of flow can be estimated by looking at the turbidity of the water. By knowing the tidal stages and observing the plume that is created by influx of more turbid streams or channels into the rivers, some estimate of flow rate or hydrologic head may be obtained.

The next factor to consider is the soil moisture-salinity condition. The change of the soil moisture regime from a saline to a fresh water to dryer soils is a gradient that also influences the composition and distribution of tree species. As the salinity decreases and the soil moisture changes from a saturated stage to a dryer condition so too will the species change. Remote sensing can identify this change in species which in turn can be used to map out the salinity intrusion and the soil moisture regimes.

This analysis must be done in the context of the ecological succession and human disturbance which can alter the gradient-species relationship. The successional stage and the human settlement can be determined by remote sensing techniques.

The potential for acid-sulfate soil is often associated with certain tree species (Geloms). Identification of these species with remote sensing is important when deciding on a transmigration site.

The result of the remote sensing survey would provide a geographically referenced data base containing the land cover, the soil moisture regime, soil types, the drainage pattern, the hydologic flow rates, and the location of human settlements.

An integration of this data could answer questions like: What is the appropriate design for canals? What areas are most suitable for transmigration sites? What factor may be contributing to the variable prosperity of different communities? Why did the spontaneous transmigrants settle only in certain areas?

A pilot project to test these research techniques will be very useful to improve and maintain present transmigration sites and provide a technique for selection of new sites in the unopened areas.

IV. FUNDING SOURCES (possible)

	SOURCES
Curriculum Development	USAID/Ford Foundation
Personnel Training	World Bank
Equipment	United Nations
Research	

V. LABORATORY EQUIPMENT

1. Basic Equipment: Remote sensing, photogrammetry and surveying.

   Stereoscopes, glass slides, parralax bars

2. Advanced Equipment

   a. Micro Computer-Apple II for instructional use.

   b. Mini Computer-selection criteria

      (1) serviceability-use a system that can be serviced in Jakarta

      (2) compatability-use hardware that is adaptable to ERSC-Unit operating system

      (3) flexibility-have a system that can be used by other disciplines in IES.

   c. Scanning Microdensitometer

   d. Stereoplotter

   e. Theodolite

   f. Graphics terminal

Personnel	Area of Interest	To	Date
Dr. Uup	Remote Sensing Soils	UW	May 1983
Dr. Kiefer	Remote Sensing	IPB	June 1, 1983 to June 14, 1983
Mr. Ahearn	Remote Sensing Resource Management	IPB	June 1, 1983 to August 15, 1983
IPB Staff Members	Remote Sensing Applications to -Soils -Forestry -Plant Pathology -Crop Yield Forecasting	UW	Sept. 1, 1983 to June 1, 1984
UW	Computer Science Remote Sensing	IPB	Jan. 1, 1984 to June 1, 1984
Mr. Ahearn	Remote Sensing Resource Management		June 15, 1984 to June 1, 1985