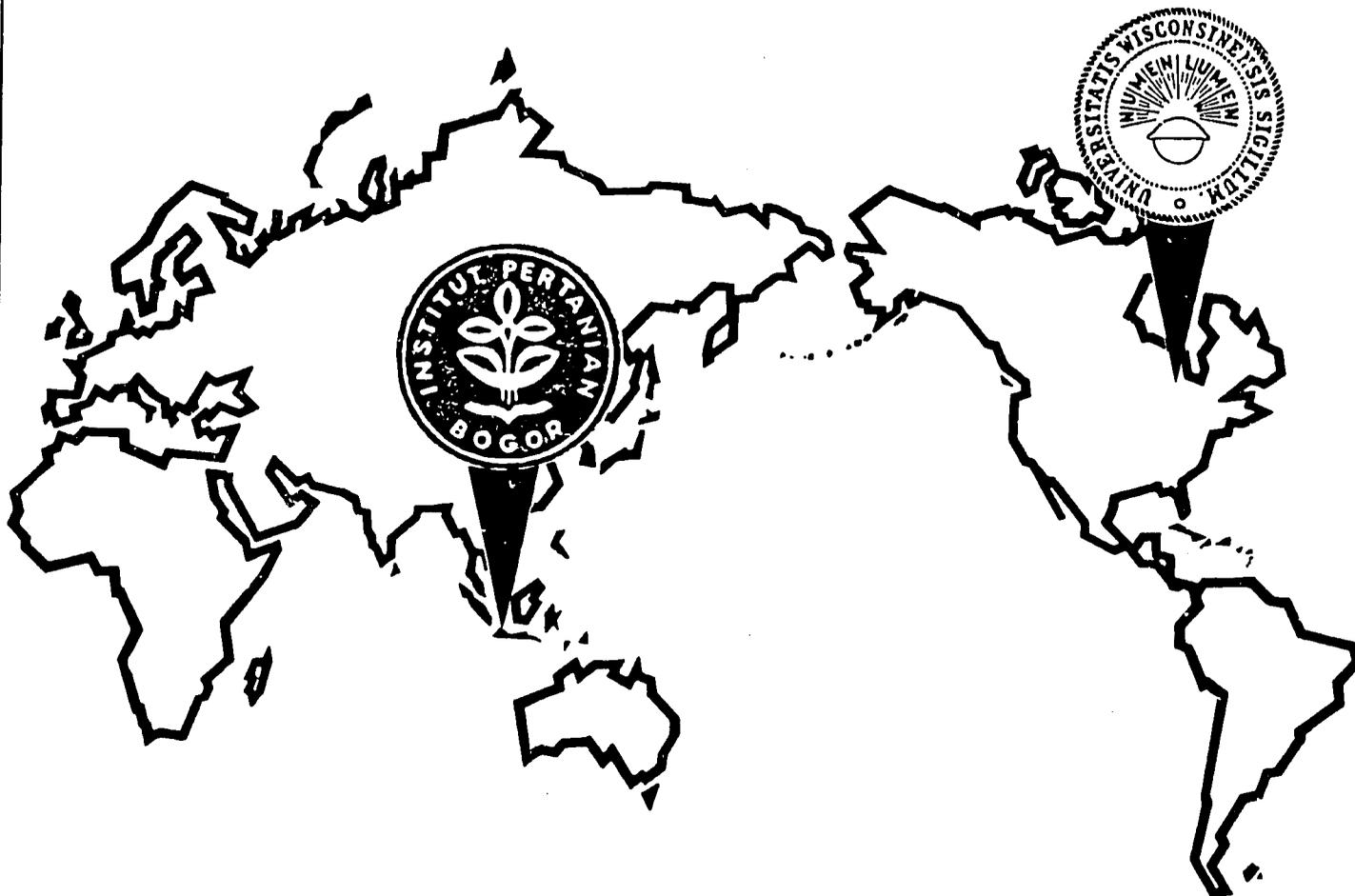


Institut Pertanian Bogor * University of Wisconsin

GRADUATE EDUCATION PROJECT



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REPORT

NO 2

ADAMS

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REVIEW OF THE CENTER FOR NATURAL RESOURCE MANAGEMENT
AND ENVIRONMENTAL STUDIES

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I. PREFACE

The newly defined Center for Natural Resources and Environmental Studies at IPB faces great challenges. In the decades just ahead, Indonesia will confront massive environmental problems as the population increases and resources are impacted and further eroded by man's activities. Institutions such as the new environmental center at IPB can play an important role in performing and coordinating the interdisciplinary research and instruction that can be useful in assisting governmental authorities in making decisions that are based on sound environmental advice. The leadership at institutions such as IPB should be charged with the responsibility of bringing the significant results of relevant environmental research to the attention of planning authorities in the government.

Let us consider specifically the Center at IPB. It will not be sufficient to simply develop a centralized physical facility at IPB and provide it with a permanent staff to conduct research within the constraints of the facility. It will be helpful to have the central facilities, but this alone will not do the job. If the Center is to serve effectively as a focus for broad, interdisciplinary research and training, it must seek to broaden its present scope. The centralized laboratories and offices can serve a function of providing a "locus" and "identity" to the Center, and can be utilized effectively as a base of operations for certain specific, highly defined tasks within the environmental biology and chemical arena. More importantly, the centralized facility can play an important role in providing a base for general ecologists and eventually systems modelers who together are vitally important to the success of the interdisciplinary research programs which should be developed.

Successful program development will require extensive collaboration among staff from a wide range of disciplines, including the social, physical, and biological sciences, agriculture, fisheries, and other organizational structures both from within and outside of the framework of IPB itself. All the collaborators do not need to come from within IPB staff. Interested parties from other institutions within Indonesia, and from other countries should be encouraged to participate. For example, at the present time the mechanism exists for utilizing University of Wisconsin staff and graduate students as coparticipants in joint research programs of limited duration.

Within IPB, mechanisms should be established to develop coordinated interdisciplinary studies in which components of the research are conducted within existing departments and managed through cooperative agreements between the Center and the departments. In some instances it will be useful to fund a portion (15-20%) of an investigator's time from the Center, with the remainder being funded through the departments. This system will allow a given amount of money from the Center to be distributed across a wide range of disciplines. Full-time Center staff can provide the necessary 100% effort needed for much of the coordination work. For large scale projects, small steering committees will need to be established and charged with the responsibility of making policy decisions which involve changes in research plans, and responsibility for appropriate timing of research progress and synthesis.

In my opinion, the single most significant problem with which the Center should concern itself is the matter of the continuing destruction of the natural environment and reduction of the carrying capacity of the land. Destruction of the tropical forests continues in Asia, Africa and Latin

America. Peter Raven, in an article in Bioscience (October, 1977) pointed out that FAO data indicate that about 40% of the world's tropical forests have been destroyed during the past 150 years, and that virtually all the remainder will have been cut before the end of the century. Taken as a whole, the tropical countries' populations may double during the same period of time. Raven estimates that during the next three decades at least a billion people in the tropics will starve to death. During this same period most of the natural communities of the tropics--communities of all kinds--will have been lost to us. Other interesting data were summarized by Constance Holden in Science magazine (25 April 1980), in which is cited Raven's estimate that "of the 4 to 5 million species of plants and animals in the world, 3 million are found in the tropics, and no more than one-sixth of these have been taxonomized."

The Center has an obligation to work vigorously to impress such facts on the government of Indonesia. The results of continued rapid degradation of the environment in Indonesia are potentially a calamity, if it is considered that much of the expanding agriculture on less fertile soils is petroleum-based, in terms of energy. The results of a reduced petroleum base in Indonesia within a third of a century, combined with a much larger population and a significantly worsened natural environment, could be socially destructive. Such observations suggest a need for a wide range of interdisciplinary research programs that should be undertaken by the Center, not limited to the present emphasis on strictly biological, physical and agricultural environmental studies.

To accomplish this and other goals will require extensive training of Indonesians in interdisciplinary studies. This can be accomplished by a

combination of programs involving (1) training of some Indonesians at institutions such as the University of Wisconsin, (2) bringing staff from Wisconsin or similar universities here to IPB to provide training, and (3) the use of trained Indonesian staff in providing instruction to students at IPB.

II. UPLAND RESOURCES PROGRAM

Needs that are foreseen in this program include areas of increased staff trained as generalists and in specific fields, and increased facilities and capital equipment with respect to computing facilities and upland resource inventory capability.

Staffing. Staff trained in the following fields are needed:

- a. General ecologist, Ph.D.
- b. Population biologist, Ph.D.
- c. Systems ecologists, Ph.D. and M.S.
- d. Land resources management, Ph.D.
- e. Remote sensing imagery interpretation and utilization in relation to resource inventory, Ph.D.

Facilities and capital equipment needed most critically:

- a. Mini-computing facilities complete with graphics; and, in later years, terminals to larger computing facilities that should be developed at IPB.
- b. Facilities appropriate for interaction with ASEAN cooperative effort in remote sensing, through the medium of BAKOSURTANAL. The ASEAN countries are involved actively in use of remote sensing technology for development purposes. Indonesia has a national program for inventory and evaluation of

natural resources. The program aims to provide national base mapping through BAKOSURTANAL, the agency in Bogor Regency. Intensive cooperation between the Environmental Center and BAKOSURTANAL is needed. Initial steps directed toward such interaction have been taken by Dr. Uup Sjafei W. of the Mineralogy Faculty at IPB. I have met with Dr. Uup and have discussed possible arrangements which should be undertaken for him to visit the University of Wisconsin Institute for Environmental Studies to work for a short period, perhaps two months in duration. An appropriate counterpart for him in Madison would be either Dr. Frank Scarpace or Dr. Ralph Kiefer.

Integration; The addition of trained staff in the areas indicated, as well as the additional facilities, will serve to increase the capability of the Upland Resources Program in the general field of population biology, predictive modelling and evaluation of alternative strategies for development of resources within an environmentally sound framework. Various alternative policies for the development of the uplands must be evaluated. For example, a watershed management model is being developed for a region in Sumatra, in conjunction with the Japan Society for the Promotion of Science. Deforestation, erosion and siltation are present in the watershed. Conflicts of interest exist among Forestry Service, Public Works Department and sedentary farmers with respect to plans for the region. What is badly needed is the capability to conduct predictive modelling and evaluation of alternative management strategies. Although hydrological modelling is available in the Public Works Department, computing facilities should be available within the Center, to evaluate the social, economic and environmental costs arising from each of several management strategies which could be examined for the region.

III. WATER QUALITY PROGRAM

The water quality program is concerned with research on problems of domestic wastes, pesticides and inorganic pollutants. Program personnel are also interested in research on aquatic plant management, particularly Eichornia and Ceratophyllum infestations. Since flooded fields, seasonal swamps and fish ponds used for intensive production of fish may be impacted by pesticides and other pollutants, the water quality program should work closely with the Faculty of Fisheries in a joint effort to monitor concentrations and fluxes of pollutants into systems used for fish production. If the necessary background data are not readily available in Indonesia, contacts should be established with organizations such as the United States Environmental Protection Agency (EPA) to determine "safe" levels of pollutants in fish or other aquatic organisms. The Water Quality Program is another part of the Center which should make effective use of systems modelling techniques for river basin management. Generalists and modellers should be added to the staff of the Water Quality Program to work with specialists in the Faculty of Fisheries on coordinated plans of environmental research.

Since one of the Water Quality Program staff will be in Europe visiting several water quality laboratories, I suggest that the EAWAG laboratories of the Federal Technical University near Zurich be included on the itinerary. EAWAG is one of the leading research centers on water quality. Prof. Dr. Ambuhl at EAWAG would be an appropriate contact person for the purpose of the visit.

Since Bibiana Lay is a participant in the EPB/Wisconsin project and may attend the University of Wisconsin this fall to start a Ph.D. program, I have suggested to her that she consider both the bacteriology program and the

oceanography/limnology program at Wisconsin in regard to her own interests and those of the Center. She is interested in statistics and mathematical modelling techniques. The Madison campus is strong in these fields and skills in these areas are needed in connection with research to be conducted by the Water Quality Program staff.

The Program should develop research on the practical aspects of the handling of problems of domestic water supply, as witnessed by the almost universal need throughout Indonesia to boil the water before drinking. Research in this field should be coordinated with governmental agencies such as the Public Works Department.

IV. COASTAL ZONE MANAGEMENT PROGRAM

The Coastal Zone Management Program's interdisciplinary study of the south Sumatra peatland ecosystems provides an opportunity to establish close ties with University of Wisconsin Institute for Environmental Studies staff, through mechanism of the DeWitt/Padoch proposal on peatland systems study in Kalimantan. From an environmental standpoint the Indonesian government's program to establish rice culture on coastal peatland in Sumatra has been unwise, due to the loss of many resources such as fish, forest, waterfowl and other components of coastal zone ecosystems. This view is shared by Dr. Koesoebiono and myself. Dr. Koesoebiono also considers the DeWitt/Padoch proposal for Kalimantan to be a very useful adjunct to the activities of the Center, as it would provide useful comparative results and demonstrate the usefulness of a modelling approach to addressing the complex questions of coastal peatland manipulation by man.

To date the Coastal Zone Management Program has concentrated its activities on the semiterrestrial habitat. The Program should be funded sufficiently to extend its scope to include the near-shore habitat, particularly shallow bays. Extensive collaboration with the College of Fisheries at IPB, and the National Institute of Oceanology is needed.

The Program does not need a full-fledged oceanographic research vessel, particularly in view of the cost of maintenance, mooring and crew. The Program needs the use of a smaller vessel with shallow draft suitable for work in bays. Such a boat should be sought from the National Institute of Oceanology. This boat could be kept at the Marine Laboratory in Jakarta. In addition to the boat, a variety of corrosion resistant, marine-type field instruments are badly needed for use directly from the Marine Laboratory. These commodities include Ekman dredges (small scale type and not a marine dredge), Van Dorn water samplers, small box corers or piston corers to sample sediments, conductivity meter, pH meter, dissolved oxygen meter.

The Program has an interesting relationship with the College of Fisheries, in that staff are seconded from the College to work for a period of time in the Center. From the viewpoint of the College, the arrangement constitutes a "drain" of manpower from the current primary mission of the Faculty of Fisheries. It would seem desirable for the Center to establish a permanent staff for the Coastal Zone Management Program. The permanent staff would not only conduct environmental research in concert with the goals of the Center, but could serve to coordinate closely related environmental studies conducted by specialists in the College of Fisheries. This arrangement would hopefully serve to provide for the needed broadening of scope of

studies of the Faculty of Fisheries. Presently, research conducted by the Faculty of Fisheries is mainly on production in fish farms and natural fisheries, and there is a need for increasing the scope of research into the environmental field. An important goal would be to develop more in the way of two-directional interaction between Fisheries and the Center. Fisheries staff should be encouraged to make wide use of the relevant facilities of the developing Center.

Capital equipment and supplies (overlaps with water quality program).

I. Supplies:

- Primary productivity incubation bottles, 500 ml size
- Rubber serum stoppers for incubation flasks
- Disposable syringes; variety of sizes; micropipetors
- C-14 carbonate vials
- C-14 carbonate stock solutions
- Flow meters and drogues; Secchi disks

II. Capital equipment needs:

- Corrosion-resistant Ekman dredge
- Corrosion-resistant Van Dorn water sampler
- Liquid scintillation counting system
- Wilde-type or similar piston corers with 25 kg weight
- Boat suitable for work in bays and estuaries
- Small plexiglass corer for shallow water bodies
- Compound microscope
- Dissecting microscope
- Benthos samplers for stream work if not already available
- Whitney thermistor thermometer
- Small-scale conductivity meter suitable for lakes and shallow bays
- Submersible photon flux density meter made by Lambda Instruments Corp.
- Millipore vacuum pump and manifold assembly for filtering (phytoplankton)
- Van Slyke wet oxidation assembly
- Beckman UV-visible double beam recording spectrophotometer
- Motorized shaker assembly for sediment nutrient studies and similar needs
- PHS Standard Methods text
- Standard fume hood and perchloric acid digestion hood

V. COORDINATION OF CENTER ACTIVITIES WITH WORK IN OTHER DEPARTMENT AND AGENCIES

The Center should serve as a point of central coordination for environmental research conducted on the campus, in other departments, and areas such as, but not limited to, soils and fisheries. Such a mechanism will optimize existing and new facilities, including space and capital equipment, and serve to reduce overlapping tasks and duplication of research. Clear arrangements should be made at the level of Deans and Department Chairman in terms of task assignment and effort sharing between the Center and associated departments. This will be necessary to avoid misunderstandings regarding staff responsibilities and work priorities. The use of the Center as a central coordinating unit for environmental research at IPB will facilitate the work of general ecologists with the Center, who must work closely with specialists from other departments.

On June 4 I met with Prof. Dr. Ir. Ishemat Soerianegara, Director of BIOTROP, and discussed Center program needs in relation to interests at BIOTROP. Clearly, the two organizations are working on related problems if but from a somewhat different vantage point. We concluded that a common ground of interest is the area of environmental biology systems modelling, and that an appropriate goal would be to try to develop systems approach capabilities within the Center, with cooperative biological science input from BIOTROP in the case of problems of joint interest. Such interests again support the need for further mathematical and statistical training of Center staff. We also discussed interests of Wisconsin tropical plant taxonomists, since BIOTROP is interested in taxonomizing as many species of the tropical rain forests as possible before they are lost to science through activities

of commercial logging and transmigration. Prof. Soerianegara feels that transmigration and commercial logging are each reducing the tropical forests at about the same rate. Previously protected "reserve" forests are now being logged extensively, contributing to Indonesian tropical forest destruction. Much greater attention needs to be given to conservation ethics. Prof. Soerianegara indicated that BIOTROP could consider an application from a Wisconsin plant taxonomist for support for trans-Pacific air fare and local travel, lodging and meals. Such an individual might also help to serve the needs of the Center by coordinating taxonomic studies with environmental gradients.

As a result of my meeting with Prof. Dr. Rifai, Director of the National Biological Institute (LBN), it appears that LBN Project 5 (Forest ecosystems and the role of their flora and fauna) offers an excellent opportunity for cooperation between LBN and the Center. In Project 5, special attention is being paid to the effects of human disturbance to forest ecosystems. LBN will provide a reference point for analysis of effects of human influence such as logging and shifting cultivation. Project 5 of LBN is related to some of the work of the Land Resources Program of the Center, and offers a fine opportunity for coordinated efforts in research, which should be encouraged.

I have also had the opportunity to meet with Prof. Dr. Kardono Darmoyuwono, Deputy Chairman of BAKOSURTANAL, the Indonesian national remote sensing center in Cibinong. BAKOSURTANAL is the agency in charge of the national base mapping component of the Indonesian Inventory Program. Dr. Celso Roque, in his paper on the ASEAN remote sensing program, points out that BAKOSURTANAL has perhaps the most complete and impressive facilities for remote sensing

among the ASEAN member countries. Through the use of a COMARC computer, stereo plotters, orthophoto facilities, semiautomatic stereo plotters, line digitizers and other equipment, the agency can work effectively with both aerial photos and LANDSAT imagery to produce excellent maps of land use category and to calculate areas based on land use, slope and vegetation. Within the year BAKOSURTANAL expects to install an automatic digital data processing system for use with LANDSAT imagery to facilitate automatic calculation of land use category. The facilities at BAKOSURTANAL provide an outstanding resource which can be effectively used cooperatively by the staff of the Center, particularly staff associated with the upland resource program and the coastal zone program. Prof. Kardono indicated there will be excellent opportunities for cooperative work. For example, BAKORSURTANAL's research on determining rates of loss of primary forest cover in Indonesia graphically demonstrated to me a highly relevant area of overlapping interest between the two institutions. In addition, the Institute for Environmental Studies at the University of Wisconsin is very interested in making the necessary arrangements for Mr. Sean Ahearn to have a one or two year appointment to Indonesia, in a combined activity with the Center and BAKOSURTANAL. Mr. Ahearn's M.S. thesis topic was "The Classification of Forest Species Types using Gradient Analysis and Spectral Data in the Cascade Mountains of Washington State." The Institute for Environmental Studies at Wisconsin would like for Mr. Ahearn's primary appointment to be in conjunction with the Center, with opportunity to work at BAKOSURTANAL, with combined effort coordinated with all three organizations (IES Wisconsin, IPB, and BAKOSURTANAL) and leading to a doctoral dissertation at the University of Wisconsin. We would like to explore arrangements for funding this project through the Center. As a corollary to

Sean Ahearn's work, Prof. Kardono would like to arrange for a staff member from BAKOSURTANAL to spend some time in Madison in the Environmental Remote Sensing Center.

One of the research topics of Prof. Kardono's which will be of particular interest to environmental biologists is that of identifying regions on some of the islands which have floras transitional to those east and west of the Wallace Line.

The Department of Soils can perform a very important role in acting as a speciality department to conduct research coordinated in conjunction with the Center, and attention should be given to increasing the communication with government agencies with respect to decision-making processes which should be affected by the research findings of this department in the areas of environmental studies. The Soils Department at IPB is conducting research that is important in determining the use of secondary tidal swamps for agriculture. Serious environmental questions which should be addressed include: (1) the potential for acid sulfate problems; (2) fertility changes with time; (3) changes in salinity associated with water table changes; and (4) subsidence, on sites with deep peat soils on which peatland draining is expected. The proposal from DeWitt and Padoch, Wisconsin staff, is relevant to the environmental questions associated with tidal swamp soils, but perhaps should not be limited to studies on peat alone but be broadened to include study of other types of tidal swamp soils. A modified proposal from the Wisconsin group should not be weakened by suggestions that research on transmigration be limited to dryland sites. The DeWitt/Padoch proposal should be coordinated with work of the IPB Soils Department.

The general subject of the problems of tidal swamp soils in relation to agricultural use in Indonesia is a complex question, and has merit as a dissertation subject for a graduate student. Such a student should be selected from the IPB Soils Department through cooperation with the Center, and a component part of the general problem of tidal swamp soils in agriculture be used as a dissertation topic for study at an American university such as the University of Wisconsin. Wisconsin would be the logical choice since the student's work could be coordinated with the proposal of DeWitt and Padoch of the Institute for Environmental Studies at UW, through the IES Center for Biotic Systems. Mr. Sahat Matondang coordinates the soil classification work in the Department of Soil Sciences at IPB, and would be a strong candidate for degree work in this field.

Dr. Koswara and Dr. Soeratono suggest that Drs. DeWitt and Padoch consider siting their research on Sumatra near the Soils Department field station, in lieu of or in addition to a site on Kalimantan. This suggestion will need to be discussed further.

VI. FUTURE PROGRAM NEEDS THAT SHOULD BE UNDERTAKEN BY THE CENTER

The environmental programs report by R. Goodland (Office of Environmental Affairs, The World Bank) draws attention to several environmental problems of Indonesia which I feel should be addressed by the Center. These include population pressures which have resulted in cultivation of steep slopes, and damaged irrigation systems which have resulted from overutilized water supplies and siltation. Intensive efforts should be undertaken to restore

critical lands where overpopulation, steep slopes and heavy rains have combined to cause extensive loss of productive capacity.

Goodland estimates tropical rainforest in Indonesia at 600,000 to 917,000 km². Tropical rainforests are the world's richest ecosystems and are being rapidly destroyed throughout the tropics. It is probable that the Indonesian forests are the richest of all tropical rainforests. Goodland cites evidence that the Indonesian forests are being depleted rapidly, and are not being managed on a sustained yield basis; there was a 13-fold increase in timber production from 1968 to 1977 alone. A report by Wiersum (1978) is cited by Goodland to attest to the dangers of the present emphasis on exploitation for short term yields as contrasted to sustained yield management.

The Center should plan research efforts in concert with the Indonesian National Conservation Masterplan, that is prepared from satellite imagery and ground truth surveys. Efforts should be intensified to protect existing tropical rainforest ecosystems and their component species. It is not sufficient to simply identify and protect a minimum number of samples of important rainforest, in light of the destruction of such forests which already has occurred. Some estimates are that most of the world's remaining tropical rainforest will be gone within 25 years. Untold numbers of species of plants will become extinct as a consequence of this rapidly progressing environmental disaster.

The Center should further develop research programs and training of staff necessary to adequately evaluate environmental problems associated with transmigration. According to Goodland, most transmigration that had occurred up until 1980 had been on forested areas. It is encouraging that Indonesia

has banned clear cutting of primary forests for transmigration (as of November 6, 1979) and has encouraged further transmigration on the 20 million hectares of alang-alang grasslands, once cut-over secondary forests. The Center should attempt to evaluate further the economic and ecological consequences of manual felling and burning as contrasted with mechanical procedures which are more damaging to the soil, on transmigration sites with secondary growth of forest. Interdisciplinary study teams should be assigned the task of thoroughly evaluating the effects of transmigration to alang-alang grasslands, secondary forests, and tidal wetlands. A proposal outline from Drs. DeWitt and Padoch of the University of Wisconsin Institute for Environmental Studies, relevant to the transmigration to tidal wetlands, is attached as an addendum to this report (see attachment #1). Agriculturally related environmental programs of the Center should include studies on pest resistance, and movement of pesticides through agricultural and natural ecosystems. The Center should encourage research on integrated pest management including biological control methods.

VII. RECOMMENDATIONS ON TRAINING AND RESEARCH INVOLVING CENTER PERSONNEL AND UNIVERSITY OF WISCONSIN STAFF

It is recommended that Prof. Calvin B. DeWitt, Professor of Environmental Studies at Wisconsin, spend a semester at IPB and give his course in "Field Investigations in Wetland Ecology." The suggestion from Prof. DeWitt regarding this course, and a brief description of what is included during the semester, is attached. A teaching assistant is needed for this graduate level course, and this person might be either Mr. Manuwoto of the Indonesian

Public Works Department (Mr. Manuwoto is currently a graduate student at the University of Wisconsin) or another Indonesian who could come to Madison to enroll in the course during the fall semester.

Possible arrangements could include the exchange of another staff member from IPB who would come to Madison to teach a course during Professor DeWitt's absence from the Madison campus. Suggestions for such a course are also included in the attached memorandum from Professor DeWitt.

Long-term direction of training conducted by the Center should concentrate on developing integrated interdisciplinary professionals who could understand the many long-term components of planning decisions, as they relate to environmental consequences and scenarios. This goal will not be achieved easily. Required will be exchanges of staff between the Center and other universities in both the teaching and research sectors, and training of future staff for the Center.

The Center could study possible arrangements to take advantage of several advanced degree program offerings at Wisconsin. These include the Ph.D. and Masters level training available in the Land Resources Program, the Masters level Water Resources Management Program, and the Ph.D. level Oceanography and Limnology program, in particular.

There is a need within the Center for a very basic environmental systems modelling course to be taught at IPB. Professor DeWitt from Madison could teach such a course, and it should be explored whether he would be interested in conducting a basic systems modelling course in addition to the course on wetland ecology. A basic modelling course would be helpful to all three program areas within the Center.

Summary of recommended exchanges between Wisconsin and IPB, involving environmental studies, during 1982-83:

I. From Wisconsin to IPB.

1. Drs. Calvin DeWitt and Christine Padoch. Purpose: to conduct interdisciplinary research in concert with needs of IPB Soils Department and the Center's Coastal Zone Management Program. Plans should be made to work with Dr. Koswara and M. Koesobiono. Dates: Not before April, 1982.

2. Dr. Calvin DeWitt. Purpose: to teach a course in wetland ecology and a course in basic systems ecology principles. Dates: February, 1982, or September 1982.

3. Mr. Sean Ahearn. Purpose: to work on a remote sensing project in concert with needs of IPB; to conduct the work primarily at BAKUSURTANAL with Dr. Kardono. Dates: not specified, but for a 1-2 year period.

4. Mr. Manuwoto (member of Indonesian Public Works Department). Purpose: to serve as the teaching assistant for Professor DeWitt. Dates: same as for Professor DeWitt.

5. Mr. Dennis Grossman. Purpose: to work with IPB Center staff on an interdisciplinary study of transmigration (Upland Resources Program possible). Dates: not specified.

6. A plant taxonomist from the UW Botany Department. Purpose: to work with the Director of BIOTROP, Dr. Ishemat Soerianegara, in collecting tropical plant specimens threatened with extinction. I have discussed this with the BIOTROP Director and with A. Tonny Ungerer, Director of the Research Institute in IPB. Candidate to contact the BIOTROP Director for future consideration.

II. From IPB to Wisconsin.

1. Ms. Bibiana Lay. Purpose: to work on a Ph.D. program with Dr. Brock, in the field of bacteriology or oceanography-limnology. Dates: September, 1981. (GRE exams still need to be taken; we will explore the possibility for her to take the exam in Wisconsin in October, 1981.)

2. Mr. Sahat Matondang. Purpose: to work on a Ph.D. in soil science. Dates: not determined.

3. Dr. Uup, from the Mineralogy Faculty. Purpose: to spend two months working with Frank Scarpace in environmental remote sensing. This training would be helpful in furthering the needs of IPB Center for Environmental Studies in use of remote sensing imagery in terms of evaluation of natural resources. Dates: suggested are two months in 1982.

VIII. RECOMMENDATIONS ON THE BUILDING CONSTRUCTION

General comments on the plan of facilities for the environmental studies center.

1. A small radioisotope laboratory separate from the other labs should be considered (with a hood).

2. A small dark room and photography center, for developing and printing, would be useful.

3. Volatile solvents storage facility is needed (with ventilation).

4. Perhaps add a small balance room for the analytical balances; this room should have temperature and humidity control and stone-topped tables insulated from disturbances from people walking in the room.

5. At least 2 to 3 regular fume hoods should be included in the design, not just one. Exhaust fans for the hoods must be installed at the roof level to maintain a negative pressure in the ducts. Hoods should be located in such a way so as to minimize the number of turns and joints in the duct work. Straight vertical ventilation is best, if possible. In addition to the regular hoods there should be one hood suitable for perchloric acid digestions, etc., with facilities for washing the walls of the hood.

6. It is probable that more drying ovens would be needed, depending on the nature of the research that develops.

7. Some controlled growth rooms such as "reach-in" growth chambers might be added. These will require adequate electric and water service depending on whether they are water-cooled or air-cooled types. (They could be added elsewhere on campus).

8. I do not find plans for electrical outlets and other service in the labs. Many labs have been constructed in the past with insufficient 115 V and 240 V service to meet the needs of equipment purchased after the building is in operation. It is better to plan for excess capacity in the beginning than to have too little.

9. In each of the various labs there should be adequate desk space for technicians and others to work, complete with drawers.

10. In general, the laboratories should be provided with adequate storage space in the form of drawers, glass-fronted cabinets for glassware, and low cabinets for larger heavier items, etc.

11. Current building plans are inadequate in that electrical service, gas, air, distilled water, hot and cold tap water, and dimensions of rooms

are not shown. This makes it difficult to evaluate the plans thoroughly.

12. For general purpose use, more microscopes should be provided, (dissecting scopes and compound scopes).

13. The sinks should be large, double sinks with drainboard space on both sides or at least one side, complete with drying racks. Current plans do not indicate this clearly.

14. The upland resources program staff will be interested in simulation modelling in the future. In examining the plans for the Environmental Center Laboratory, it is not clear that sufficient attention has been given to the question of locating minicomputers and associated needs. Although such equipment is now quite modest in size, its use is not compatible with wet laboratory work, etc., so attention should be directed toward deciding where to locate such equipment. Perhaps the minicomputers should be located on the floor with the staff offices. Also, if there is consideration of larger computer facilities to be purchased for general campus use in the future, plans should be made for placement of a terminal to be used by the Center.

15. Current plans indicate that a number of window air conditioners are to be installed. A decision should be made as to whether it would be more efficient to install a central air conditioning system for the rooms which are to be air conditioned. I suggest that a central system at least be considered.

16. The Center staff most likely will interact with remote sensing projects in progress at BAKOSURTANAL, so it would be useful to designate a room (perhaps on the office floor) complete with map tables and other equipment relevant to handling aerial photos, topographic maps, and reconstituted imagery from LANDSAT (obtained through cooperation with BAKOSURTANAL).

17. I think it would be best to maximize use of the central library for the entire campus, to avoid duplication of journals and space requirements. The staff reading room as now detailed is adequate, but I have learned from meeting with the program managers that the library stock of journals represented currently on the campus is grossly unsatisfactory for their needs. Very high priority should be given toward increasing the subscriptions to journals in the environmental field; such new journals should be kept in the main campus library.

THE GENERAL BIOLOGY CURRICULUM

I. A SUGGESTED BIOLOGY CORE CURRICULUM

The following suggested curriculum is based on the program at Wisconsin, and does not constitute a major in itself but prepares the student for further advanced work in the various biological discipline areas (as well as interdisciplinary). The whole spectrum of living organisms is used to develop an understanding of the basic organization and function of biological systems. The curriculum is designed to offer an integrated approach to biology and permits the student to attain a relatively high level of general sophistication and complete flexibility of choice for later specialization.

The basic curriculum consists of four courses: biological diversity, cellular, organismal; and population biology. Each could be taken for three credits (lecture only) or five credits (lecture and lab), if credits or equivalent measure of effort were used that were equivalent to "measure of effort" used at Wisconsin. The students who would enroll in this program would not take any other basic courses in elementary zoology, botany, bacteriology or other specialized biology areas--these areas are to be included in the basic set of four courses provided by the core curriculum. Students in the core curriculum should plan to take at least two of the four laboratory courses offered. As later specializations are developed, students could be expected to achieve basic (four year study equivalent to B.S. degrees in the United States) degrees in botany, zoology, bacteriology, molecular biology and so forth as these more specialized degree programs evolve over the years ahead.

Course 1. Cellular biology. 3 cr. Cellular basis of life, organization and structure of cells, energy metabolism, storage, expression and transmission of information, macromolecular organization, sexual reproduction and inheritance. Students enrolling in this course should already have taken a course in inorganic chemistry and have had some mathematics; at the same time they take the cellular biology they should enroll in a course in organic chemistry or physics or should already have taken one or both such courses.

Course 1a. Cellular biology laboratory. 2 cr. Experimental approach to major topics covered in Course 2. Stresses techniques in microscopy, biochemistry, microbial genetics and molecular biology.

Course 2. Biological diversity. 3 cr. This course as taught at Wisconsin covers the range of variability of life forms from bacterial to flowers and primates. Functional form and developmental patterns of organisms viewed as evolved solutions to the environment through time; phylogeny and ontogeny. Course to be modified as appropriate to the needs of the particular students.

Course 2a. Biological diversity laboratory. 2 cr. Observation of a wide range of organisms in natural habitats and use of specimens. Laboratory study of variety of bacteria forms, embryological development in selected organisms, and anatomy and structural variation in plants and animals.

Course 3. Organismal biology. 3 cr. Examination of principles underlying the organization and function of multicellular organisms--plants and animals.

Course 3a. Organismal biology laboratory. 2 cr. Experiment oriented lab, with an emphasis on physiology.

Course 4. Population biology. 3 cr. Population genetics, evolution, properties of populations and biotic communities, behavior, conservation. Basically an ecology course.

Course 4a. Population biology laboratory. 2 cr. Lab and field studies illustrating principles of population genetics, natural selection, and exercises in the measurement of ecological variables and illustrations of their effect on plant and animal communities.

II. SUGGESTIONS ON THE EXISTING BIOLOGY CURRICULUM

1. Move genetics and statistics 1 to semester #3 from semester #4.
2. Add a laboratory to the genetics course to increase the number of credits to 5.
3. Move geology and climatology later in the program (electives?).
4. Change the evolution course to 3 credits from 2.
5. Require a population biology course of all students.
6. Separate plant anatomy and plant morphology into two separate courses.
7. Separate Kimia Analitik into two courses: quantitative analysis and advanced course in analytic chemistry (the latter to be an elective).
8. Add lab sections to general botany and general zoology and require the labs, raising the credits for each from 3 to 5.
9. Change floristics (taxonomy) to 4 credits.
10. For a major such as botany, I suggest the students take intermediate or advanced courses in 5 of 6 areas: genetics, cryptogamic botany (algae or fungi), anatomy or morphology (each a separate course), taxonomy (not including the dendrology, but a rigorous course in theoretical taxonomy), plant

physiology (with laboratory), and ecology. All the courses to include a lab.

11. Item #10 above could be incorporated either with the existing program or integrated with the suggestion of adding the biology core curriculum, in which case item #10 follows the core curriculum series of three basic courses with their laboratories.

III. CONSIDERATION OF AN ENVIRONMENTAL STUDIES CERTIFICATE PROGRAM

In addition to the further development of the undergraduate biological sciences curriculum through modification of the present program of classes and consideration of adapting a "biology core curriculum," Dr. Zakaria and I discussed the possibility of establishing an undergraduate certificate program in environmental studies. An undergraduate certificate program in environmental studies would be incorporated along with a student's regular degree program, such that during the course of a four-year period the student would earn both a degree in a specific field as well as a certificate in environmental studies. The program in environmental studies at Wisconsin would serve as a generalized model, but a more specific program would be designed at IPB relevant to the needs in Indonesia. This type of four-year program of environmental studies integrated closely with a degree program at level 1 differs markedly from the short-course programs in environmental fields offered at institutions such as BIOTROP, as it can develop the student's background in environmental studies in much more depth.

A Suggestion for a Cooperative Research Project on

An Integrated Analysis of the Environ-
mental, Human, Agricultural, and Aspects
of Transmigration into Tidal Peatlands
of Indonesia.

Transmigration from heavily populated areas of Indonesia into reclaimed tidal wetlands has interrelated human, agricultural and environmental aspects. In order to plan for (future transmigration) management of present and future reclaimed sites, an integrated system perspective is necessary. Application of the expertise of but a single discipline is not only inadequate, but also may lead to serious undesired results.

Our proposal is to cooperate with faculty at Bogor in developing and carrying out an integrated system level study of development and settlement of a coastal peatland site, with comparisons and applications made to other coastal peatland sites. System techniques developed at the Institute in Madison, together with the expertise of Dr. Christine Padoch in Indonesian Societies and the expertise of Dr. Calvin B. DeWitt in peatland ecosystems will be combined with the expertise of the Bogor faculty to develop and complete the proposed project. Mr. Manuwoto, an Indonesian graduate student of Wisconsin and a member of the Indonesian Department of Public Works will use much of this research for his doctoral program and for future application to transmigration policy and coastal wetland development and management.

A major objective of the proposed research will be to evaluate existing data, obtain new data, and to apply these data in determining procedures and methods of achieving long-term sustained support of human populations in reclaimed coastal wetlands. Factors to be considered in this research will be problems and methods of sustained agricultural production, problems and

management of groundwater hydrology including sea water incursion, problems and management of peat soil oxidation and subsidence, assessment and management of human use of reclaimed lands, and socio-cultural responses to settlement, development, and management.

The research would begin with conceptual modeling of the various important interacting components of the reclaimed coastal peatland system. The conceptual model developed from this would be used to identify needed data. Data would be obtained from published sources when available and directly from the site(s) under investigation. Research would proceed from conceptual model development and data acquisition to progressive refinement of the model. This refinement would be achieved through the generation and subsequent testing of hypotheses based upon the model as it is formulated by a given state of development.

The goal of the progressive refinement of the conceptual model would be to arrive at a good description of the coastal peatland ecosystem response through time to human settlement and use, and the degree to which this response is supportive of sustained human and agricultural use. From this description, guidelines for management of coastal peatland development sites would be developed and refined to the point where they are administratively practical.

This research would involve faculty of both the Institute at Bogor and the Institute at Madison. In addition, Indonesian officials responsible for coastal peatland development site selection and management would be involved from the start of the project, and would become increasingly involved in the later stages of the project dealing with development of practical procedures for administration.

The research would be focused on a specific primary site, such as one in West Kalimantan to provide the opportunity to deal critically with the various interacting factors. The results would be generalized to be applicable

to other coastal peatland sites following some limited comparative work on other sites as governed by carefully formulated hypotheses based upon experience gained at the primary site.

An objective of the project would be the full transfer of knowledge and techniques and general systems analysis, wetland ecosystem analysis, and socio-cultural analysis from Wisconsin faculty to Indonesian faculty and officials. A further objective is to provide Wisconsin faculty the opportunity to extend their knowledge to include the tropical coastal wetland ecosystems and their inhabitants, knowledge which can be obtained from Bogor faculty, Indonesian officials, and from field experience and data analysis.

The occasion for this proposal is an unusual set of circumstances which have recently brought together at Wisconsin an anthropologist (Dr. Padoch) with expertise in Indonesia, a wetland ecologist (Dr. DeWitt) with expertise in modeling of peatlands and food production and an Indonesian public official (Mr. Manuwoto) involved in the planning and management of Indonesian regional development.

Dr. Padoch has worked in Indonesia with various cultural groups, particularly several in Kalimantan, and speaks Indonesian as well as various tribal dialects. Dr. DeWitt, together with his students has developed techniques for 3-dimensional modeling and analysis of peatland ecosystems, has done extensive work in wetland ecology, and has developed various systems techniques including modeling of food production and distribution. Mr. Manuwoto has been an official with the Indonesian Department of Public Works working in regional planning, has a Masters Degree in Planning from the University of Wisconsin and is working on his doctorate in Land Resources at Wisconsin with his thesis work directed at Indonesian transmigration in coastal peatlands.

A Suggestion
for
Exchange of Faculty Between the Institutes
at Bogor and Madison

The mutual interests of the Institutes at Bogor and Madison might be served in part by an exchange of faculty between the two institutions.

Because of the importance of the coastal wetlands of Indonesia both environmentally and in their transformation into agricultural uses in response to transmigration programs, the topic of coastal wetlands would be an excellent one upon which a first exchange of faculty could be focused.

More specifically, Dr. Calvin B. DeWitt, Professor of Environmental Studies could give his graduate-level course in "Field Investigations in Wetland Ecology" at Bogor, making use of coastal wetland field sites which are within reasonable traveling distance from Bogor. The course would include integrative methods of systems analysis, methods of scientific investigation of coastal wetlands, including measurement and analysis of data on wetland hydrology, rainfall, peat composition and formation, and vegetation. Also included would be instrumental analysis and air photo interpretation.

A graduate student from Bogor might first take this course as it is taught at field sites in Wisconsin in the fall semester, and subsequently serve as a teaching assistant and interpreter for the same course as it is given in Indonesia. Alternatively, Mr. Manuwoto, a native Indonesia graduate student at Madison, could fill this position.

The purpose of this course would be to transfer instrumental techniques, data analysis techniques, spatial modeling techniques, and other recently-developed methods of wetland investigation to Indonesian students at field sites in Indonesia. This information then would be used by these Indonesian students as they, together with their professors at Bogor, develop research programs at the Bogor Institute.

In exchange, a professor from Bogor would give a course at Madison. The topic for such a course should be selected as a result of discussions between Bogor and Madison, but conceivably could deal with coastal land development, transmigration, coastal wetlands, and/or tropical agriculture and forestry.

Such an exchange could include the exchange of graduate students for a semester in addition to the faculty. Exchange of faculty residences might also be included, which in the case of an exchange involving Prof. DeWitt, would provide the opportunity for an Indonesian faculty member to live at the edge of Waubesa wetlands, a major peatland eight miles south of Madison.