DEVELOPING A REGIONAL NETWORK FOR INTERDISCIPLINARY RESEARCH ON RURAL ECOLOGY: THE SOUTHEAST ASIAN UNIVERSITIES AGROECOSYSTEM NETWORK (SUAN) EXPERIENCE

A. Terry Rambo
East-West Center

Percy E. Sajise
University of the Philippines at Los Baños

ABSTRACT. In March of 1985, 67 scientists and policymakers took part in the Second SUAN-EAPI Regional Symposium on Agroecosystem Research in Baguio City, the Philippines. The theme of the symposium, which was co-hosted by the Program on Environmental Science and Management (PESAM) of the University of the Philippines at Los Baños and the Cordillera Studies Center (CSC) of the University of the Philippines, College, Baguio, was "agroecosystem research in rural resource management and development." Twenty-one papers were presented by individuals from 13 institutions in China, Indonesia, the Philippines, Thailand and the United States. The Baguio Symposium marks the real coming of age of the Southeast Asian Universities Agroecosystem Network (SUAN) as a regional grouping promoting high-quality, interdisciplinary human ecology research having direct relevance to policymaking regarding development and management of renewable natural resources in tropical Asia. As one of the few successful examples of interdisciplinary research networking in the region, it may be worthwhile to examine the SUAN experience to see if it contains lessons that may be more generally applicable to research efforts on environmental management elsewhere in the developing world.

In this paper we begin by describing the human ecological context for rural resource development in tropical Asia. The special demands that this context makes on applied research efforts in support of environmental management are then examined. We then describe the Southeast Asian Universities Agroecosystem Network (SUAN) as a vehicle for promoting interdisciplinary rural ecology research in the region. Finally, we attempt to draw out some "lessons learned" in the long trial and error effort to establish this network.

A. Terry Rambo is an anthropologist; human ecology is his primary professional concern. He has done extensive field research on human interactions with the environment in Central America and Southeast Asia. Since 1980, he has coordinated the East-West Environment and Policy Institute's joint activities with the Southeast Asian Universities Agroecosystem Network. He and Percy Sajise are co-editors of a recently published book, *An Introduction to Human Ecology Research on Agricultural Systems in Southeast Asia.*

Percy Sajise is a plant ecologist who initiated an interdisciplinary program at the University of the Philippines at Los Baños (UPLB) on upland resource management. He has been Director of its Program on Environmental Science and Management (UPLB-PESAM) from 1978 to the present. He has played an active role in the development of the Southeast Asian Universities Agroecosystem Network (SUAN) and was its coordinator for 1984-1985.

Although both authors have been involved with SUAN since its beginning, the views presented in this paper are their personal ones and should not be taken as representing an official statement of the network. They would like to acknowledge, however, the contributions made to their thinking by senior scientists in all of the SUAN groups, notably Terd Charoenwatana, Kanok Rerkasem and Otto Soemarwoto. Gordon Conway and Jeff Romm have also provided useful insights on the growth of agroecosystem research in Southeast Asia.

Requests for reprints may be addressed to A. Terry Rambo, Research Associate, East-West Center, Environment and Policy Institute, 1777 East-West Road, Honolulu, HI 96848.

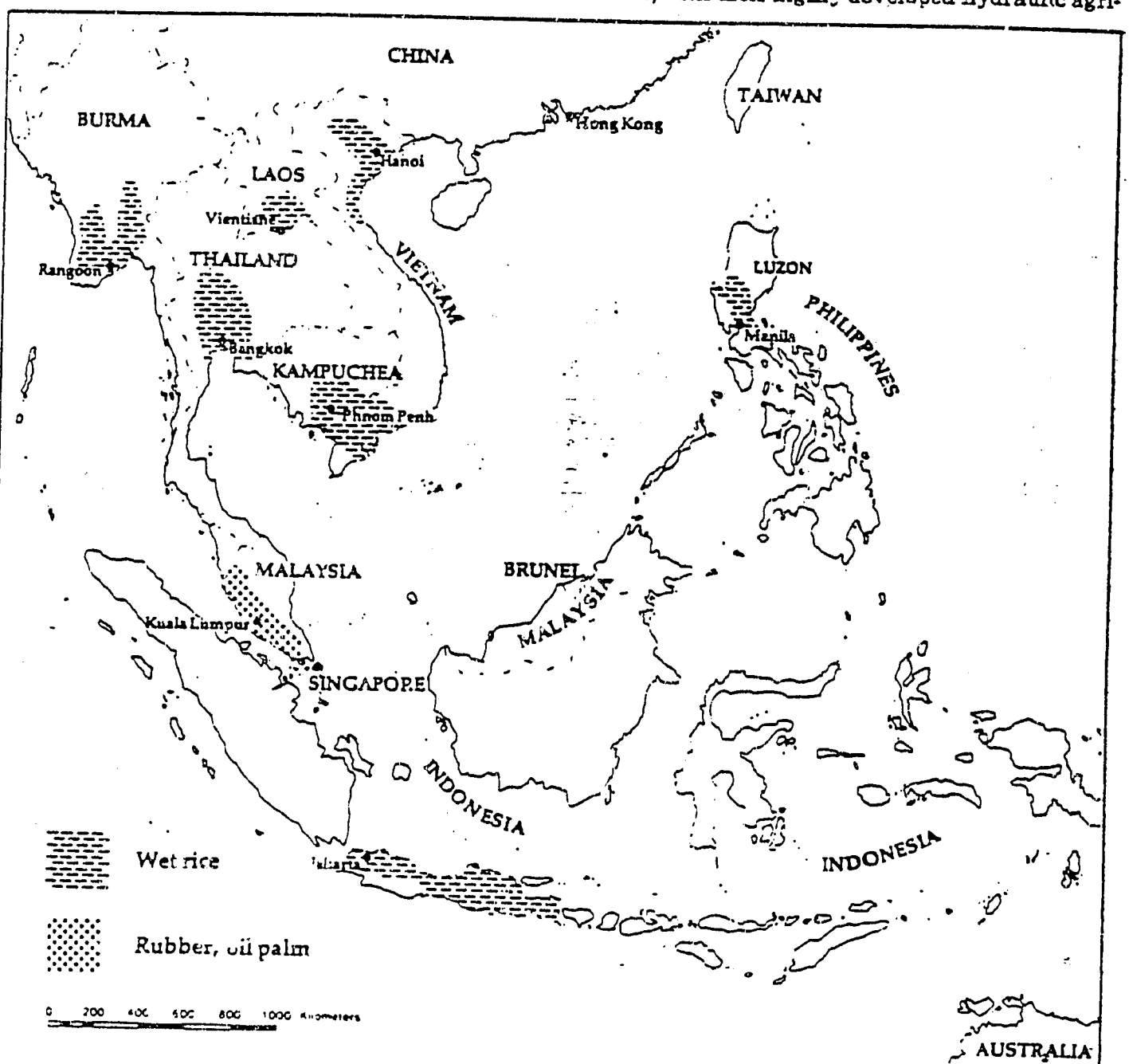
THE ENVIRONMENTAL PROFESSIONAL, Vol. 7, pp. 289-298, 1985. Printed in the USA.

0191-5398/85 $3.00 + .00

THE HUMAN ECOLOGY OF RURAL RESOURCE DEVELOPMENT IN SOUTHEAST ASIA

The agricultural landscape of Southeast Asia can be divided into two basic zones: areas devoted to large-scale intensive monocultural rice production on the one hand and areas devoted to small scale mixed farming, grazing and forestry on the other. These may be referred to for the sake of simplicity as the core areas and the hinterlands (Figure 1). The distinction between these areas is of fundamental significance for understanding rural development in modern Southeast Asia. Development strategies that have been successful in the core areas have generally failed to produce desired results in the hinterlands.

The core areas are the densely populated and highly productive alluvial lowlands such as the Red River and Mekong Deltas of Vietnam, the Central Plain of Thailand and the Irrawaddy Delta of Burma. (Peninsular Malaysia represents an exception: rubber and oil palm plantations constitute its core area.) Although they cover less than 5% of the total surface area, it is the core areas, with their highly developed hydraulic agri-



Source of agricultural distribution data: *World Atlas of Agriculture*. Novara, Italy. Instituto Geografico de Agostino, 1969. plates 27-29.

Source of base map: Osborne, Milton. *Southeast Asia: An Introductory History*. 2nd ed. Sydney: George Allen and Unwin, 1983. end paper map.

Figure 1. Core areas of Southeast Asian nations.

cultural systems, that produce most of Southeast Asia's food (Gourou, 1974). It is in these areas that the green revolution has achieved its successes. Much of what can possibly be done has already been done and further dramatic yield increases are unlikely or will be long in coming.

The hinterlands are geomorphologically and ecologically diverse. Uplands constitute much of the total area but intermontane basins, river valleys and lowland swamps are also included. These areas are generally less densely populated and less productive than the core areas. Historically, hinterland social systems have been small, fragmented and politically subordinate to the core area states. Yet the former cover most of the region's surface area and are inhabited by economically impoverished and often politically restive populations. Many of the insurgencies that have unsettled the region since 1945 have originated in these areas.

Core Areas and Hinterlands

The definition of core areas and hinterlands is not a static, geographically determined one. Instead, whether an area is considered to be part of the core or not reflects the complex historical interplay between social and political organization, the existing state of technology and environmental factors. In past historical periods, different areas have had core status. For example, before its incorporation into the Kingdom of Thailand in the 19th century, the Chiang Mai Valley was the core area of the autonomous Lan Na kingdom. Today, the same valley is part of the hinterlands of the modern Kingdom of Thailand which has the Chao Phraya delta as its core area.

The basic contrast between the areas is between simplicity and diversity, both ecological and cultural. In spite of often considerable microenvironmental variations, the core areas offer a relatively homogeneous biophysical setting for wet rice agriculture (Figure 2). Social institutions, particularly those affecting the management of irrigation systems (Coward, 1980), also may vary from community to community, but the predominant social formation is that of peasants producing rice for the market economy (Firth, 1950). The productive technologies and the administrative institutions of modern Southeast Asian states have evolved in the core areas and are consequently adapted to the environmental and social conditions characterizing these areas. Extending these technologies and institutions into the very different conditions of the hinterlands is a major problem. Its solution is made far more difficult because the hinterlands are not a single uniform entity. Instead, the hinterlands encompass hundreds of distinctive local ecosystems which are overlaid by equally diverse human social systems.

Figure 2. Core area — wet rice agriculture

Figure 3. Hinterland:ecological diversity — terraced hill slopes in Java.

This difference between the two areas can be illustrated by comparing the physical environments they provide for growing crops. A glance at a soil map for Southeast Asia reveals that most of the core areas share a few kinds of alluvial soils having similar chemical and physical properties. The hinterlands have a vast array of soil types characterized by radically different agronomic properties. In upland areas, the situation is further complicated by the existence of different degrees of slope which create a mosaic of environmental gradients in terms of solar radiation, rainfall and temperatures (Figure 3).

Moving from this macro-view to the level at which individual farmers work, Figure 4 shows the ecological dversity found on a single farm in the hinterland of northeast Thailand. Within an area scarcely larger than a football field are three major different types of agroecosystem, each with its own productive potential and distinctive management requirements (KKU-Ford, 1982). A comparable profile of a farm in the Lower Mekong Delta of Vietnam would be essentially a horizontal line representing the paddy fields that extend in an unbroken plane to the horizon (Rambo, 1973).

When social and cultural factors are taken into account, the contrast between core and hinterland is compounded a thousandfold. The core areas are inhabited by a few major ethnic groups: Vietnamese, Thai, Burmese etc. Although there are many linguistic and cultural differences among these groups, and among local communities within groups, there are also many economic and social commonalities among these peasant farmers. Technology developed to meet the needs of one group is likely to also be usable in other core areas.

The diversity of socio-cultural patterns in the hinterlands is much greater. In the interior mountains and forests of Peninsular Malaysia alone there are at least 20 different aboriginal cultural groups, each of which can be further subdivided into literally dozens of distinctive local communities. Each community has its own knowledge, beliefs and values about how to manage the natural environment. For example, Malaysian aborigines living in communities separated by as little as ten miles may share common terms for only 50% to 80% of the mammals found within their forest environment (Dunn, 1975). Such cultural differences strongly affect the selection of appropriate resource management practices and technology.

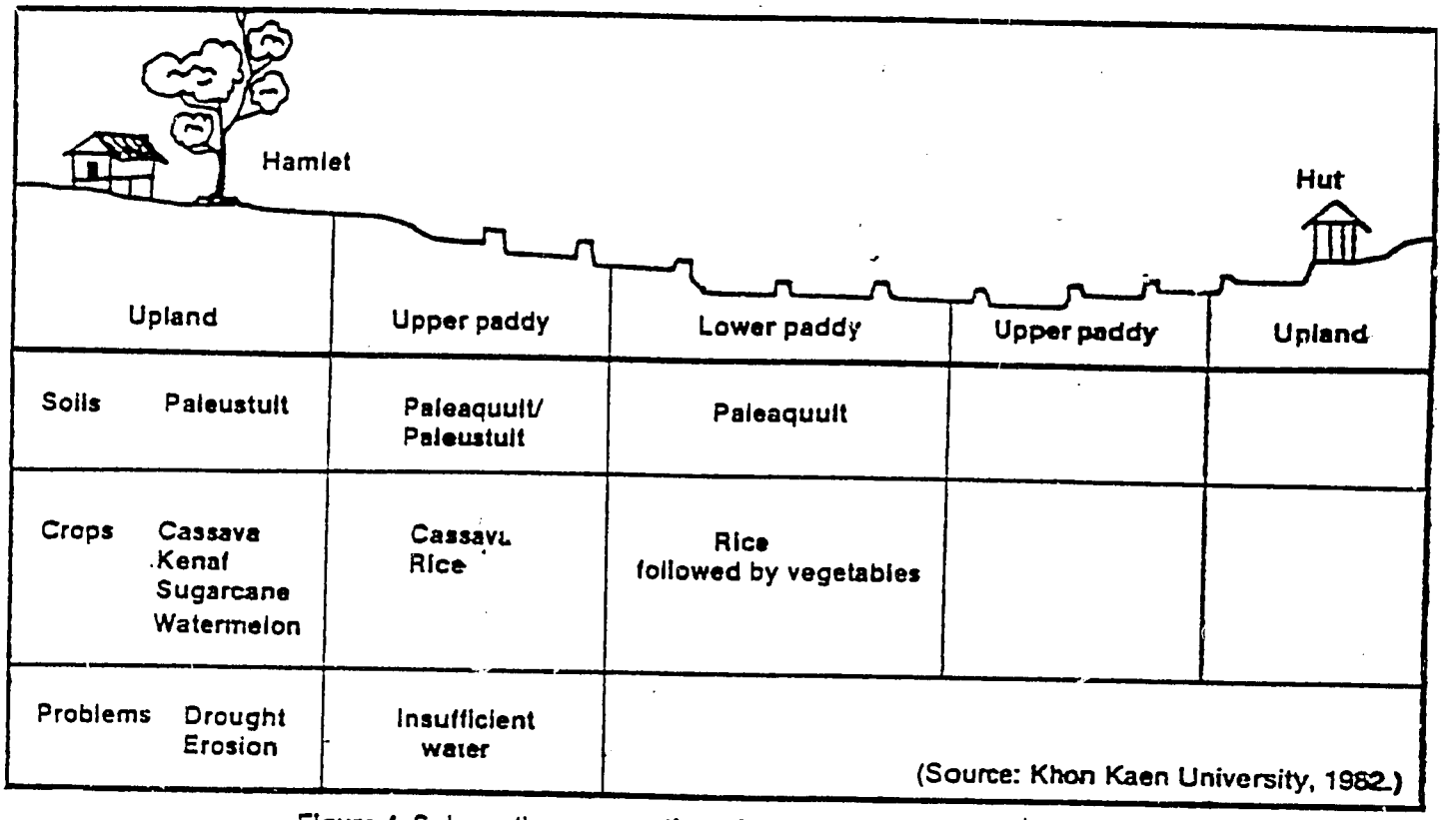


Figure 4. Schematic cross section of a farm in northeast Thailand.

COPING WITH DIVERSITY IN RURAL RESOURCE DEVELOPMENT RESEARCH

This distinction between the ecological and cultural homogeneity of the core areas and the corresponding diversity of the hinterlands has profound implications for research in support of rural resource development: a single technology package can be designed to fit virtually the entirety of the core areas but no single package can possibly be applicable to the diversity of the hinterlands. Instead, each local rural ecosystem requires its own unique resource management strategy, and, consequently, must be the subject of highly focused site-specific research.

An example of the problems associated with hinterlands research is provided by the work of the Multiple Cropping Project at Chiang Mai University in northern Thailand. Since the adoption of double and triple cropping 20 years ago, there has been a steady decline in rice yields in intensively managed plots in the Chiang Mai valley. This decline is caused by the shortage of a trace element, boron, in the overworked soils (Kanok Rerkasem, personal communication). The remedy for boron deficiency is both simple and cheap and efforts to solve this problem are already underway.

But this case illustrates a much larger problem in developing the hinterlands. It took years of intensive work by several highly trained Thai scientists, using state-of-the-art methods, to identify one constraint to production on one small set of fields in one small area in northern Thailand. Unfortunately, given the diversity of soils in Asia's hinterlands, there is no way to generalize findings from plots in Chiang Mai to soils in other areas. Each area has its own unique problems and each requires its own solutions.

It should now be clear why the technology of the green revolution has extended about as far in Southeast Asia as it can. It is possible for a single, centralized research institution, such as the International Rice Research Institute (IRRI), to develop one or a few technology packages suitable for all the core areas in Asia. An institution like IRRI is extremely capital and labor intensive but it also enjoys a tremendous economy of scale when it focuses on developing technology suited to the core areas. A single IRRI variety may be adopted almost overnight by literally millions of farmers, as happened with IR36 in Java (Herdt and Capule, 1983). But no centralized research institute, however large and well funded, can possibly cope with diverse human ecology of the hinterlands.

Scientists at Chiang Mai University have discovered, for example, that farmers in one valley there grow more than 40 varieties of rice. Each variety fits a specific agroecological niche; each is adapted to different soil and water conditions and to meeting different human requirements (Rerkasem and Rerkasem, 1984). They cannot be replaced with one, or even one dozen, standard improved varieties without lowering the total productivity of the system. Moreover, even if IRRI could somehow breed enough varieties to meet the needs of

different niches of the hundreds of other agroecosystems in the hinterlands.

Developing the resource potential of the hinterlands thus requires a very different strategy from that employed in the green revolution. Research and planning must be decentralized with operational responsibility devolved onto locally-based institutions having intimate knowledge of the specific rural ecosystems of their own immediate areas.

This raises the obvious question of how scientists based in American institutions can effectively contribute to a decentralized research effort. Clearly, researchers working thousands of miles away from the scene cannot hope to directly solve the specific problems facing individual farmers scattered across Asia's hinterlands. Instead, one feasible role is to assist locally based research groups in developing their own capabilities to do the necessary work. It is such a decentralized approach that the East-West Environment and Policy Institute has employed in its collaborative work with the Southeast Asian Universities Agroecosystem Network.

THE SOUTHEAST ASIAN UNIVERSITIES AGROECOSYSTEM NETWORK

The Southeast Asian Universities Agroecosystem Network was established in June, 1982. Usually referred to by its acronym of SUAN, which means "garden" in Thai, this network is a loose and informal association of university-based research groups in Indonesia, the Philippines and Thailand. These groups share a common concern with interdisciplinary human ecology research on the management of rural resources in the hinterlands of Southeast Asia. The network was established in order to promote the sharing of information among scientists at these widely scattered institutions.

Leadership for SUAN is provided by an informal council composed of senior scientists from its founding institutions.

- The Multiple Cropping Project (MCP) at Chiang Mai University, Chiang Mai, Thailand.
- The Farming Systems Program (FSP) at Khon Kaen University, Khon Kaen, Thailand.
- The Center for Natural Resources Management and Environmental Studies at Institute Pertanian Bogor, Bogor Indonesia.
- The Institute of Ecology (IOE) at Padjadjaran University, Bandung, Indonesia.
- The Program on Environmental Science and Management (PESAM) at the University of the Philippines at Los Baños, Philippines.
- The Cordillera Studies Center (CSC) at the University of the Philippines, College at Baguio, Baguio City, Philippines.

Chairmanship of the network rotates every 18 months with the new chairman being drawn from the institution selected to host the next scientific meeting of the network. The current chairman is Dr. Kanok Rerkasem of the Multiple Cropping Project of Chiang Mai University, Thailand. Chiang Mai University will host the Third SUAN-EAPI Regional Symposium on Agroecosystem Research in November, 1986. EAPI is the East-West Environment and Policy Institute. In addition to its six core members, SUAN welcomes the participation of interested scientists from other Asian institutions concerned with rural ecology research. Scientists from China, Bangladesh, Nepal and Vietnam have also taken part in SUAN activities.

SUAN also works closely with institutions and individual scientists outside of Asia. Gordon Conway, an agricultural ecologist who is the Director of the Centre for Environmental Technology of the Imperial College of Science and Technology in London, has made a major contribution to the organization and intellectual evolution of the network. Financial support for many SUAN activities has been generously provided by the Ford Foundation.

The East-West Environment and Policy Institute (EAPI) has contributed in several ways to the development of SUAN. First, staff researchers have formulated new conceptual frameworks for doing applied human ecology research on tropical agricultural systems (Marten, 1986; Rambo, 1982, 1983; Rambo, Dixon and Wu, 1984; Rambo and Sajise, 1984). Second, a variety of mechanisms have been employed to disseminate these frameworks to younger Asian scientists and to encourage them to adapt them to their own research settings. Third, EAPI has worked together with SUAN to develop a long range collaborative research agenda. Priority areas for research have been identified and a number of related joint research activities planned. Finally, EAPI has actively sought to attract major external funding to support this joint work.

Within its overall concern with applied human ecology research on rural resource management, five major topics have been identified as having highest priority to SUAN:

1. Agricultural intensification and the stability and sustainability of multiple cropping systems. Throughout the hinterlands of Southeast Asia, exploitation of rural resources is being intensified. Typically, this takes the form of adoption of multiple cropping systems. For example, farmers in the Chiang Mai Valley are now growing three crops a year where 20 years ago they grew only one. This has increased productivity in the short term but raises worrisome questions about agroecosystem stability and sustainability in the long term (Multiple Cropping Project, 1980). As was mentioned above, unexpected soil nutrient

6

deficiencies are appearing under the stress of multiple cropping. Pest problems also appear to be increasing. The social system is also suffering disruption as increasing wealth inequalities appear between large landholders and less well-endowed villagers (Ganjanapan, 1984). Similar ecological and social consequences are accompanying agricultural intensification in Indonesia and the Philippines and are the subject of study by SUAN member groups there as well.

2. Viable agricultural systems for marginal areas. Not only are Southeast Asian farmers working existing lands harder, they are also extending cultivation into areas less well suited to agriculture, ranging from upland slopes to tidal swamps. Scientists at the Program on Environmental Science and Management (PESAM) of the University of the Philippines at Los Baños have been investigating the impacts on soil erosion and hydrology of various upland farming systems. Use of hedgerows of *Leucaena leucocephala* planted along the contours of the slope fields has been found to reduce erosion to acceptable levels, while providing a source of nutrients for the annual crops which are planted between the hedgerows. Unfortunately rice grown under this system gives depressed yields due to *Leucaena's* alleopathic suppression of rice seed germination (Medina, in press). PESAM and other groups in SUAN continue to seek viable alternatives.

3. Role of non-rice crops in agroecosystems. Most agricultural research in Southeast Asia has been on rice. Many other crops are important in hinterland agroecosystems, even where rice is grown as the primary food staple. The Institute of Ecology in Bandung, Indonesia, has done pioneering research on the complex, multi-species home gardens that surround Javanese village houses (Soemarwoto and Soemarwoto, 1984). Although they occupy only a small proportion of the cultivated area in comparison to rice paddies, the 30 or more fruit and vegetable species grown in these home gardens make vital contributions to the nutritional well-being of the villagers (Abdoellah and Marten, in press). Researchers at the Cordillera Studies Center, University of the Philippines, College, Baguio, are studying how traditional upland rice farmers in the Loo Valley have adapted to becoming commercial vegetable producers (DeRaedt, in press; Fiagoy, in press).

4. Access to and control of common resources. Although crop lands are generally under private ownership and management in Southeast Asia, other rural resources, particularly forest, pasture lands and surface waters, regardless of their formal ownership status, may be treated as common property of everyone in the community. Researchers in the Farming Systems Project at Khon Kaen University are keeping detailed records on village household resource use patterns including determining what kinds of resources are derived from different components of the village agroecosystem. Much of the work of the PESAM group focuses on the problem of subsistence farmers living inside upland areas that are officially considered to be forest reserves under the management of the Bureau of Forest Development.

5. Alleviation of population pressure on the rural resource base. Throughout Southeast Asia, rural population densities are increasing rapidly. Even in what appear to be sparsely inhabited regions, such as the Korat Plateau of northeast Thailand, the carrying capacity of the ecosystem under traditional management techniques is being exceeded. In the latter case, researchers at Khon Kaen University are examining the contributions that off-farm employment, including temporary migration of laborers to the Middle East, can make to alleviating pressure on local resources (Subhadhira, in press). The Institute of Ecology has looked at the possible value of increased use of biomass to meet rural energy needs in order to reduce pressure on forest areas to supply badly needed cooking fuel. Their conclusions are far from optimistic as they find that large-scale energy farming would directly compete with production of food and other crops (Soemarwoto and Asdak, in press).

THE PROCESS OF NETWORK BUILDING

The development of SUAN has been a long and not wholly smooth process. The network did not simply spring into existence overnight. Instead, SUAN represents the outcome of more than a decade of hard work by dozens of individuals in a large number of institutions. The origins of what is now called SUAN are to be found in the early 1970s when the Ford Foundation began providing support to several newly established groups in Indonesia, Malaysia, the Philippines, Thailand and Vietnam that were concerned with doing interdisciplinary research on rural ecology.

The Ford Foundation invested millions of dollars over a 15-year period in nurturing the growth of these individual research groups. Some thrived while others, notably the groups in Malaysia and Vietnam, did not. The willingness of a single funding agency to provide sustained support over a prolonged period for what was clearly a high risk effort is a key factor in the successful formation of SUAN. Mention should also be made of the vital role played by Jeff Romm, then the Ford Foundation Program Officer for Resources and the Environment in Southeast Asia, who did so much to encourage scientists in the region to undertake interdisciplinary investigations in poorly known areas of inquiry.

Scientists in Southeast Asia were also, as Romm (1981) has observed, uniquely ready to undertake interdisciplinary research on environmental problems. Researchers working in the new provincial

universities had begun to recognize that conventional disciplinary research was not producing solutions compatible with the complex human ecology of the hinterlands.

The experience of agronomists at Khon Kaen University is typical of the forces that produced the SUAN approach to rural ecology research. These well trained and highly motivated agricultural researchers were frustrated at the failure of farmers to adopt new multiple cropping systems that they had developed on the university experimental plots. Recognizing that the problem was a social one as much as an agronomic one, they sought the help of social scientists to explain why the farmers rejected their technical packages. The social scientists found that the new cropping systems required heavy labor inputs at precisely the time when the farmers traditionally undertook seasonal migrations to engage in wage labor in Bangkok. The opportunity cost of staying on the farm was not offset by the returns of the new cropping patterns.

The group at Khon Kaen University came to recognize that in order to improve cropping patterns they had to understand not just the soil-climate-crop interactions usually considered by agronomists but also the cultural, social and economic factors influencing farmer decision making. The human ecology approach to the study of agroecosystems then being developed at EAPI offered them a usable framework for integrating their research on natural and social factors.

It was only in 1980 that efforts began to link the diverse local research groups into a regional network. EAPI organized a workshop in which scientists from the groups that now constitute SUAN visited each institution in turn in order to plan a joint training workshop on human ecology for project researchers, particularly social scientists. Shortly after this, Chiang Mai and Khon Kaen Universities co-sponsored a workshop on agroecosystem analysis which was attended by scientists from several of the core groups. This was followed in 1981 by a six-week workshop on human ecology research at EAPI in Honolulu which brought scientists from all of the SUAN institutions together for an extended period for the first time. Additional workshops were then held both in Honolulu and at UPLB. Finally, in June 1982, leaders of the major groups met in Indonesia and agreed to establish SUAN.

The development of SUAN involved several important steps:

- Getting acquainted. It took many meetings over a long period to develop the mutual respect and trust among scientists from different disciplinary, national and cultural backgrounds that are basic prerequisites for successful regional networking.
- Coming to share a sense of the commonality of problems and the research frameworks for solving these problems. SUAN scientists all now speak of the human ecology perspective on agroecosystem analysis, but at the beginning we did not all share the same concepts or even vocabulary. The important role played by Gordon Conway in propagating the agroecosystem framework (Conway, 1984) deserves acknowledgment in this regard.
- Increasing the flow of ideas and information among groups. In the past the different groups and individual scientists within them worked in isolation from one another so that it was difficult to identify common interests. Frequent regional workshops and scientific meetings have helped to break down these barriers and enhance the flow of information among scientists concerned with rural ecology research throughout Southeast Asia. Now, SUAN is reaching out to establish links with agroecosystem researchers in east and south Asia. In the future, information exchanges may also be established with scientists studying tropical rural ecology in Africa and Latin America as well.

Because of its nature as a loose association of independent national projects, SUAN has not attempted to formulate a single, uniform definition of agroecosystem research. Each member institution has pursued its research in its own unique way. There are, however, common aspects to research within SUAN that give a certain unity to the work of its members. These include use of a systems approach, incorporation of social, cultural and economic factors into the analysis of rural ecosystems, employment of an interdisciplinary team approach, and concern with formulating the results of scientific research into rural resource development and management policies.

These aspects are described in much greater depth in a recently published book containing chapters contributed by scientists from the SUAN groups (Rambo and Sajise, 1984). Scientific findings of SUAN scientists are presented both in numerous publications put out by member groups (e.g., KKU-Ford, 1982; Multiple Cropping Project, 1980) and in the proceedings volumes of the First and Second SUAN-EAPI Regional Symposia on Agroecosystem Research (Sajise and Rambo, in press; Soemarwoto and Rambo, in press).

Although SUAN has rapidly become one of the few successful examples of regional scientific networking in the field of natural resources management research, we are under no illusion that it offers an ideal model for others to follow. There are still a number of problems that must be dealt with if SUAN is to continue evolving along the path it has chosen for itself:

1. There is a need to become increasingly self-critical of the conceptual frameworks employed in

rural ecology research. How, for example, are agroecosystems to be defined, what are their boundaries, how do they interact with other systems? We all agree that productivity, stability and sustainability are significant properties of agroecosystems but we have yet to arrive at mutually acceptable operational definitions of these terms. The key properties of rural social systems have yet to be clearly identified, although "equitability" (Conway, 1984) and "autonomy" and "solidarity" (Rambo, 1985) have been suggested as being of central concern.

2. There is a need for increased quality control in empirical work. Even the best conceptual framework is of little value if data collection is deficient or if analysis is sloppy. Both competent scientific personnel and research funds are in very limited supply in Southeast Asia and it is difficult to carry out the kind of intensive, long-term field research needed to adequately test and verify the many hypotheses that have been generated in the exploratory phase of agroecosystem research. The frequently expressed concern with development of rapid rural assessment techniques reflects this felt need to find economical ways of generating better empirical data for use in agroecosystem analyses.

3. There is a need to make the results of agroecosystem analysis accessible to a wider audience, both policymakers and the general public. At present, many presentations employ a style intelligible only to other agroecosystem researchers already familiar with the special jargon of systems analysis. The gap between university scientists and government policymakers is wider in most Southeast Asian countries than it is in the United States. There is an even greater separation between researchers and the farmers who ultimately must make use of new approaches to agroecosystem management if these are to have more than mere curiosity value. SUAN projects are exploring ways to bridge these gaps. The Farming Systems Project at Khon Kaen University has now incorporated government extension workers into its research team so that they can keep abreast of the latest findings and immediately make these available to the farmers. The Program on Environmental Science and Management at the University of the Philippines at Los Baños has helped to organize a national upland farmers association. This association provides a vehicle for two-way communication between researchers and farmers.

CONCLUSIONS

Although there are still many problems to be solved, the continued growth of SUAN demonstrates the fundamentally healthy state of human ecology research on agroecosystems in Southeast Asia. In the view of a number of western specialists, there is more work and better work going on in this complex field in Southeast Asia than there is in the United States or Europe. New information is beginning to flow from SUAN researchers to western specialists concerned with similar problems. For example, Dr. Terd Charoenwatana, leader of the Khon Kaen University group, recently presented a paper at the annual U.S. National Farming Systems Research Symposium at Kansas State University (Charoenwatana, 1984), and he and Dr. Percy Sajise of UPLB were also invited to make presentations to a major international conference on Agricultural Systems Education held at the University of Hawaii College of Tropical Agriculture in July, 1985.

The process of developing SUAN offers a useful model to help achieve the decolonization of science in the Third World. Initially, growth of the network was heavily dependent on outside assistance, both financial support provided by American foundations such as the Ford Foundation, and technical assistance provided by the staff of the East-West Environment and Policy Institute and other western institutions. As SUAN has matured, the relationship has become increasingly symmetrical. Southeast Asian scientists now provide much of the expertise for EAPI research projects and are increasingly involved in other international scholarly activities. Their research findings are now influencing the way in which agroecosystem research is pursued in the West. A new partnership is emerging, one based on mutual respect among scientists who, regardless of national identity, have come to share a common vision of what agroecosystem research can achieve.

REFERENCES

Abdoellah, O.S. and Marten, G. Production of human nutrients from homegarden, upland-field (kebun), and ricefield agricultural systems in the Jatigede area (West Java). In O. Soemarwoto and A.T. Rambo (see below). (In press).

Charoenwatana, T. 1984. The Rainfed Farming Systems Research in Northeast Thailand: A Ten-Year Experience. Paper presented at the Farming Systems Research Symposium. Kansas State University. Manhattan, Kansas. October 7-10.

Conway, G. 1984. What is an agroecosystem and why is it worthy of study? In *An Introduction to Human Ecology Research on Agricultural Systems in Southeast Asia*, A.T. Rambo and P.E. Sajise, Eds. College, Laguna. University of the Philippines at Los Baños. pp. 25-38.

Coward, E.W., Ed. 1980. *Irrigation and Agricultural Development in Asia*. Cornell University Press, Ithaca, N.Y.

DeRaedt, C. Resource access in the development of an upland commercial farming village. In O. Soemarwoto and A.T. Rambo (see below). (In press).

Dunn, F.L. 1975. Rain-forest Collectors and Traders: A Study of Resource Utilization in Modern and Ancient Malaya. Malaysian Branch of the Royal Asiatic Society. Monograph No. 5. Kuala Lumpur.

Fiagoy, G. Cash vegetable cropping in Loo Valley: Trading and change. In O. Soemarwoto and A.T. Rambo (see below). (In press).

Firth, R. 1950. The peasantry of Southeast Asia. *International Affairs* (October): 503-514.

Ganjanapan, A. 1984. The Partial Commercialization of Rice Production in Northern Thailand (1900-1981). Unpublished Ph.D. Dissertation. Cornell University. Ithaca, N.Y.

Gourou, P. 1974. Deltas as population centres. Natural Resources of Humid Tropical Asia. UNESCO. Paris. 439-447.

Herdt, R.W. and Capule, C. 1983. Adopting, Spread, and Production Impact of Modern Rice Varieties in Asia. International Rice Research Institute. Los Baños, the Philippines.

KKU-Ford Cropping Systems Project. 1982. An Agroecosystem Analysis of Northeast Thailand. Faculty of Agriculture. Khon Kaen University. Khon Kaen, Thailand.

Marten, G., Ed. 1986. *Traditional Agriculture in Southeast Asia: A Human Ecology Perspective.* Westview Press, Boulder, Colo. (In press).

Medina, C.P. Evaluation of Ipil-Ipil (*Leucaena leucocephala*) and Kakawate (*Gliricidia sepium*) as biological contour strips for productive and protective upland farming. In O. Soemarwoto and A.T. Rambo (see below). (In press).

Multiple Cropping Project. 1980. An Interdisciplinary Perspective of Cropping Systems in the Chiang Mai Valley: Key Questions for Research. Faculty of Agriculture. Chiang Mai University. Chiang Mai, Thailand.

Rambo, A.T. 1973. A Comparison of Peasant Social Systems of Northern and Southern Viet-Nam. Southern Illinois University Center for Vietnamese Studies. Monograph Series III. Carbondale, Ill.

———— 1982. Human ecology research on tropical agroecosystems in Southeast Asia. *Singapore J. Tropical Geography* 3(1): 86-99.

———— 1983. Conceptual Approaches to Human Ecology. East-West Environment and Policy Institute. Research Report No. 14. Honolulu, Hawaii.

———— 1985. Applied human ecology research on agricultural systems in Southeast Asia. Paper presented at the University of Hawaii College of Tropical Agriculture and Human Resources Workshop on Agricultural Systems Education. Honolulu, July 15-22.

Rambo, A.T., Dixon, J.A. and Tsechin, W. 1984. Ecosystem Models for Development. East-West Environment and Policy Institute. Honolulu, Hawaii.

Rambo, A.T. and Sajise, P.E., Eds. 1984. *An Introduction to Human Ecology Research on Agricultural Systems in Southeast Asia.* College, Laguna, Philippines: University of the Philippines at Los Baños.

Rerkasem, B. and Rerkasem, K. 1984. The agroecological niche and farmer selection of rice varieties in the Chiang Mai Valley, Thailand. In *An Introduction to Human Ecology Research on Agricultural Systems in Southeast Asia*, A.T. Rambo and P.E. Sajise, Eds. College, Laguna. University of the Philippines at Los Baños. 303-311.

Romm, J. 1981. Environment and development in Southeast Asia: Trends, themes and issues. In *A Colloquium on Southeast Asian Studies*, T.S. Bahrin, C. Jeshurun, and A.T. Rambo, Eds. Institute of Southeast Asian Studies. Singapore. 195-218.

Sajise, P.E. and Rambo, A.T., Eds. *Agroecosystem Research in Rural Resource Management and Development: Selected Papers Presented at the Second SUAN-EAPI Regional Symposium on Agroecosystem Research, Baguio City, Philippines, 18-22 March 1985.* College, Laguna, Philippines. Program on Environmental Science and Management. University of the Philippines at Los Baños. (In press).

Soemarwoto, O. and Asdak, C. Some cautionary notes on energy planning. In O. Soemarwoto and A.T. Rambo (see below). (In press).

Soemarwoto, O. and Rambo, A.T., Eds. *Impact of Development on Human Activity Systems in Southeast Asia: Proceedings of the First SUAN/EAPI Regional Research Symposium Held at the Institute of Ecology, Padjadjaran University, Bandung, Indonesia, August 8-11, 1983.* Institute of Ecology. Padjadjaran University. Bandung, Indonesia. (In press).

Soemarwoto, O. and Soemarwoto, I. 1984. The Javanese rural ecosystem. In *An Introduction to Human Ecology Research on Agricultural Systems in Southeast Asia*, A.T. Rambo and P.E. Sajise, Eds. College, Laguna. University of the Philippines at Los Baños. 254-287.

Subhadhira, S. The rural job creation program and labor migration in relation to agroecosystems of northeast Thailand. In O. Soemarwoto and A.T. Rambo (see above). (In press).

-10-