Evaluation Of Farmers' Adoption Of Sustainable Land Management Techniques In Huey Thong Village

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EVALUATION OF FARMERS' ADOPTION OF SUSTAINABLE LAND MANAGEMENT TECHNIQUES IN HUEY THONG VILLAGE

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By

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"Give a man a fish, and he will eat for a day...
teach a man to fish, and he will eat for a lifetime."

Authorship

The authors of this report would like to state that all work contained herein represents the combined opinions, interpretations, and arguments of the entire project team. Regardless of who was the original author of each section, each member of the project team concurs that through the continual processes of correction and revision, the completed report is wholly representative of the equal contributions of all to the final product.

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1 - ABSTRACT

This project evaluated the progress of a project by the International Board for Soil Research and Management (IBSRAM) and the Department of Agricultural Extension (DOAE) of Thailand to encourage land management practices in Loei province. The project team interviewed the farmers of Huey Thong village and made recommendations to IBSRAM about how to improve the adoption of land management techniques by the farmers.

II - Executive Summary

In the province of Loei, situated in the hills near the border of Laos where Northern and Northeastern Thailand meet, there are a number of communities whose livelihood is based almost entirely on the farming of sloping lands. Unfortunately, the villagers there are approaching a dangerous stalemate—the ever-increasing population of Thailand has pressed almost all arable land into agricultural service, and the constant degradation of these lands due to poor farming methods has caused a continual decline in crop yields. Although the farmers are not in a suitable economic position to adopt progressive land conservation techniques, failing to address soil erosion and nutrient depletion as problems will continue to reduce the yields and thus the income of the farmers.

For these reasons, the International Board for Soil Research and Management (IBSRAM) and the Department of Agricultural Extension (DOAE) of Thailand began a project in 1995 to encourage the adoption of land management techniques that are economically viable for the farmers. Through a site selection process, the village of Huey Thong in the Dan Sai district of Loei was chosen as a model location for the IBSRAM and DOAE project. The project has continued until the present day, promoting sustainable land management through the participatory training of farmers.

It was the task of the WPI project team to investigate the progress of the Huey Thong project. The project team traveled to Loei to collect information on the adoption of land management techniques in the village, and analyzed and interpreted the results of this fieldwork to reach a number of conclusions about the problems in the village, the use of the alley cropping technique, and the nature of communication between the villagers. The ultimate goal of this project was to provide IBSRAM with recommendations about how to improve their efforts in Huey Thong.

Background Research

The first step toward reaching the project goal was to perform the necessary background research. Obtaining relevant background information was a continually adaptive process, as the goal underwent a number of significant transformations during the course of the project. During the preparatory work and the early project work (November 1999 through the first two weeks of January 2000), the focus of the project was not to work in Huey Thong, but rather, to examine the use of

rainfall simulation as a research tool in the region of Korat, located in Northeastern Thailand. Thus, extensive initial research included topics such as rice farming methods, soil erosion, experimental rainfall simulation, and the slotting technique for increased soil infiltration.

However, during the development of the early stages of research and methodology, this initial direction for the project proved to be unsatisfactory. The focus of the project was altered, and the team began to investigate the creation of a complete socioeconomic profile of the Mae Yom watershed, a research site for the Management of Soil Erosion Consortium (MSEC). For the third week through the end of January 2000, this revised project goal demanded exploration into a variety of new subjects, including MSEC policies and research models, watershed classification, socioeconomic analysis, and the region of Phrae in Northern Thailand. This second stage of research eventually led to further refinement of the project goal; for a number of reasons, the Mae Yom project was also found not to be a suitable focus for the WPI team.

By the beginning of February 2000, the project goals had undergone their last major transformation, and last stage of research was begun. The subjects investigated were participatory research methods, the DOAE of Thailand, and Huey Thong and the province of Loei. The fraction of total background research that was relevant to the final project objectives was included in this report. Although the demands of the project were continually and drastically changing, even the investigation of topics that later proved to be obsolete was useful for a more complete understanding of the vast subject of sustainable land management.

Methodology and Fieldwork

Once sufficient background research had been completed, the project team was able to formulate an effective methodology to satisfy the goal and objectives of the project. Due to the continual re-structuring of the project definition, the methodology for the fieldwork in Huey Thong was not established until directly before the project team traveled to Loei. Given the time constraints of the project, after an investigation into previous work in Loei and the specifications of the participatory research method, the chosen methodology was to utilize a qualitative focus group interview, and then perform ten qualitative in-depth interviews (five with farmers who had been trained by the DOAE, and five who had not). All of these interviews were performed using partici-

patory research techniques, and according to the information gained from background research into communication skills and Thai culture.

The actual field research took place from 7 February to 10 February 2000. During this time, the focus group interview was performed with the villagers of Huey Thong, when the farmers were asked to prioritize the major problems facing the village. Also, the project team completed the ten personal interviews, investigating four areas of interest: general information about the farmers; characteristics of their farms and crops grown; farmers' attitudes on land management and their past, current, and future practices; and family methods of decision making and communication within the village. In addition, the project team was able during the fieldwork to visit a number of the farms to see the land management practices currently in use, and observed the social, economic, and bio-physical characteristics of the village of Huey Thong.

Results, Analysis, and Conclusions

The final stage of the project was to examine the results of the fieldwork. The results of the focus group and the personal interviews were organized and then analyzed using qualitative methods, which drew on the experimental observations of the project team. Once analyzed, the findings of the fieldwork were interpreted to yield a number of conclusions about the current state of the Huey Thong project and the rate of adoption of soil erosion management techniques by the villagers.

The primary conclusion of this project was that there is a low rate of adoption of land management methods (specifically alley cropping) in Huey Thong. This lack of adoption was attributed to a low prioritization of land degradation as a problem, the lack of short-term benefits when using alley cropping, and communication barriers within the village. In order to address these issues, the project team formulated a number of recommendations. First, in the future, IBSRAM could attempt to relate soil erosion concepts to the farmers more in terms of its short-term economic effects. Furthermore, IBSRAM could continue to provide incentives such as seeds for the use of alley cropping, although these incentives may be better delivered in a format such as long-term rewards. These incentives will be required until science and technology are able to reduce the added labor and cost necessary to implement alley cropping. A final recommendation is that IBSRAM

could continue to look to indigenous techniques as a model for appropriate social and economic criteria for a new technique. By following these recommendations, the project team believes that IBSRAM will be able to improve the success of the Huey Thong project in encouraging the practice of sustainable land management by the villagers.

III - Introduction

Every nation of the world possesses a consciousness that is formed from an aggregate of the common values and shared aspirations of its people; this cultural amalgam is part of what fosters a national identity. In an economically developed, post-industrial society such as the United States, this consciousness is characterized by a doctrine of convenience, comfort, and material wealth. As would be true of any affluent nation, the focus of daily life is not determining *how* to survive—it is determining how to survive *better*, and more comfortably. However, there are other nations whose people possess a far different outlook; one such nation is Thailand.

Several hundred kilometers north of Bangkok, near the border of Laos, is the province of Loei. Scattered in countless villages across the wind-swept hills and valleys, the Thai farmers who inhabit this region support themselves and their families almost entirely through agriculture. Their kind of agriculture, however, is quite different from the large-scale, industrialized farming of the West. Utilizing methods that are strikingly similar to those of their ancestors, agriculture for the people of Loei is strictly a means for *survival*—a day-to-day struggle to coax sustenance (and perhaps a scant profit) from the land.

If the world were unchanged since the time of their ancestors, these farmers would be able to spend their lives unthreatened—continuing through traditional agricultural practices their natural state of symbiosis with the land. Unfortunately, the world has changed, and Thailand with it. One transformation is that the ever-increasing population of the nation has encroached upon virtually all of the available farmland. Thus, even the most infertile soils are now burdened by excessive farming—and both the land and those who depend on it have begun to suffer.

Short-term Survival Versus Long-term Sustainability

If scarcity of arable land and soil infertility were the only problems that the farmers of Loei should have to face, they would hardly rank as critical concerns. In recent years, science and technology have made astounding progress in the field of agronomy, and researchers continue to find new ways to conserve available farmland while increasing crop yields. Furthermore, these advances have crystallized around a concept known as *sustainability*, which ensures that by assessing

and adapting the farming methods of today, mankind can better conserve the farmlands of tomorrow. Regrettably, the situation in Loei is not so simple. Socioeconomic factors are inevitably entangled with the problems of agriculture, and together they have twisted sustainability and survival—two concepts that should be synonymous—against one another. For the farmers, a life-threatening conflict of interest has evolved. On one hand is the physical need and social desire to retain the low-cost subsistence farming methods they have been practicing for years, despite the fact that these methods aggravate the farmlands' chronic problems of soil erosion and nutrient depletion. On the other hand is sustainable farming, which through the conservation (and even improvement) of the farmlands will allow the farmers to survive well into the future. Unfortunately, most of the available land management techniques require more capital and added labor than the farmers can afford, and thus the farmers are faced with a considerable dilemma—they can favor their own survival either in the short-term or in the long-term, but not both.

What Is Being Done to Help

One advantage that the farmers of Loei province have is that they are not alone in their struggle to find a viable compromise between saving their deteriorating farmland and fulfilling their basic economic needs. There are many organizations that work throughout Thailand and the rest of Southeast Asia to encourage the alleviation of agricultural poverty through land management practices that are economically feasible. One such organization is the International Board for Soil Research and Management (IBSRAM), which has been striving since 1983 to find sustainable farming solutions that are effective as well as economically and socially viable.

In November 1995, IBSRAM launched a pilot program in a combined effort with the Department of Agricultural Extension (DOAE) of Thailand. After extensive site research and countless interviews, IBSRAM and the DOAE selected a location—the village of Huey Thong, in the Dan Sai district of Loei—to begin the integration and testing of land management techniques within an agricultural community. During the years since, over 30 farmers from Huey Thong have been trained in the use of modern land management techniques and encouraged to use them on their farms. Carried by the efforts of IBSRAM personnel and the extentionists of the DOAE, the goal of the Huey Thong Project is to determine how to best promote the adoption of land management

techniques by the farmers, especially through the communication and cooperation within the agricultural community as a whole.

The Scope of This Project

Since the Huey Thong Project began, officials from both IBSRAM and the DOAE have returned to the site frequently, to monitor the progress of the project and to provide support for the farmers as problems arose. However, IBSRAM, responsible for several different multinational networks that reach from Africa to the Pacific, has not had the opportunity to revisit the project site since 1998. Because the constant observation and re-evaluation of the research method is crucial to the success of the project, it was imperative to assess the current situation of land management in Huey Thong as soon as possible. Furthermore, as it is often difficult for any agency to critically investigate one of its own endeavors without bias, and since there is often much to be gained from another perspective, IBSRAM stood to benefit from an evaluation of the state of the project by an outside party. For both of these reasons, the WPI project team was sent to Loei.

The primary objective of the project team was to travel to the village of Huey Thong, and through various interviews, collect information about the social, economic, and agricultural problems facing the villagers. In addition, the project team investigated the quality of communication and cooperation between the villagers, as well as the status of land management on the farms. From this data, the team developed an assessment of the progress and effectiveness of the Huey Thong Project, and from this evaluation, made recommendations to IBSRAM about how it and the DOAE could best improve the extent to which the farmers are adopting sustainable land management techniques.

IV - Literature Review

This section contains relevant background information for the development and implementation of the project. Topics investigated include a variety of organizations that work to promote sustainable land management, as well as general research on Thailand, the province of Loei, and village of Huey Thong. Also included are a summary of all previous work done in Huey Thong and any topics, such as interviewing, which were necessary background for the project methodology.

1 Organizations

Within the last few decades, there have been many significant transformations in the way that the scientific community approaches the quest for solutions to global issues such as poverty or hunger. Perhaps the most important change in research paradigms has been the shift to thinking in terms of sustainable behavior. Simply defined, *sustainability* is the measure of how effective any human practice is in both the short-term and long-term sense. A sustainable practice must be able to meet current needs, while still protecting resources for future use. Sustainability has become a major focus for the scientific and technological endeavors of the current day, and as a result, many organizations have been formed whose primary concern is to examine issues of sustainable behavior.

The use of land is one of the most critical areas in which to assert sustainable practices. More specifically, in the realm of agriculture there has been considerable effort to encourage the sustainable use of land for farming, also known as *sustainable land management* (SLM). However, before exploring the various organizations that are working to promote SLM, it is important to first examine SLM itself—its definition, the criteria for a useful approach to it, and the obstacles that face the adoption of these approaches.

1.1 Sustainable Land Management

In terms of agriculture, the basic concept of sustainable land management is quite clear: it is the responsibility of every farmer to use the land in such a way, that if their farming practices were to be extended over a long period of time, there would be no damage done to the land. The

importance of SLM arises from the fact that humans are not divorced from the life cycles of the environment—humanity is part of them, and farming is a lucid example of this dependence. According to Paul B. Thompson [1995], "Farming is the activity that locates the human species most surely in the planetary ecosystem of the earth. It is on farming that we depend for food, and in farming that what we take from the earth is returned to it."

One of the major problems with SLM is that it is often expensive, and at times, even unprofitable. However, this lack of profitability exists only in the short-term sense, as the high long-term costs of unsustainable land use will inevitably catch up to profits, once land becomes excessively degraded. Resource-poor farmers are commonly both the victims and the cause of unsustainable land management. For this reason, more attention must be given to the roots of these farmers' problems. It is wholly possible for more food to be grown from existing farmland, if the intensified growth is based on sustainable practices. SLM is achieved when these resource-poor farmers can find proposed solutions that correlate with their social, cultural, and economic requirements [IBSRAM, 1999].

1.1.1 The Five Pillars of Sustainable Land Management

The International Board for Soil Research and Management (IBSRAM) names five "pillars", which they consider to be the key concepts that embody the spirit of SLM. According to IBSRAM, a successful SLM program will combine new and existing technologies with policies and the activities of the land users, in order to provide a marriage between socioeconomic and environmental concerns. This union should adhere to the following five principles [Bechstedt, 1997].

Productivity

In order for an SLM program to be widely adopted, it must maintain or enhance the current level of productivity for the specific land-use service. This is a major concern, especially as populations continue to increase, and food production in many regions is at critical levels.

Security

Another concern is the issue of worker safety, especially in countries with few safety regulations. To help encourage safe land use practices, an SLM program should reduce the level of production risks.

Protection

Arguably the most important of the five pillars, an SLM program must uphold its commitment to the environment. Namely, it must protect the potential of the land's resources, as well as guard against degradation of the soil and water quality over time.

Viability

A large portion of the world's land users are faced with the very serious dilemma of having to choose between earning a sustainable income and using the land responsibly. Consequently, in order to be functional, an SLM program must be economically viable for the land users.

Acceptability

In many regions, agriculture is intimately linked with important cultural practices. An SLM program should function within the confines of the social and cultural norms of the land users' community.

1.1.2 Obstacles to Sustainable Land Management

The guidelines of sustainable land use may certainly seem demanding, but it is necessary to consider all of the socioeconomic and biophysical criteria at hand for a program to be successful. While the quest for SLM is an ongoing struggle for researchers, a proposed program must fit within the socioeconomic restrictions of the environment in which it will be applied—if a procedure is unprofitable or otherwise inappropriate, it will be difficult to encourage land users to adopt new land management techniques. In this way, the goal of the SLM program can be undermined economically, even though the scientific theory is sound. Good land management is therefore very site- and situation-specific, and most countries continually struggle with how to reach farmers effectively.

Another unfortunate obstacle is that SLM programs are facing a serious time restriction. Soil degradation is currently reaching alarming proportions; it threatens the option for food self-sufficiency in some countries, and globally reduces farm income on borderline agricultural lands. There are many agricultural communities where, with each passing year, vast areas of land are irreparably damaged by poor land management practices.

1.1.3 Forums for Sustainable Land Management

Since the 1970s, forums such as the Stockholm Conference on the Human Environment in 1972 and the Global Governance in 1995 have developed many new environmental strategies [El-Swaify, 1985]. These forums allowed nations to prepare new environmental laws, policies, and strategies, including those directed at the control of land degradation. Although there has been some considerable progress made, many more countries need to introduce legislation aimed specifically at combating this environmental problem.

1.1.4 The Current Response to Sustainable Land Management

Research organizations have had a slow start at responding to the challenge of SLM. One reason is the deplorable state of existing data and knowledge; research results and data are fragmented, stored in many locations, and defined with different and conflicting concepts and units. However, improvements in the worldwide communication network are helping the globalization of research. With new ways of sharing information, such as electronic libraries, the Internet, or virtual help desks, researchers have a greater wealth of knowledge at their disposal than ever before.

As research shifts from a local to a global perspective, the cooperation of various regional, national, and international organizations helps to improve the progress toward worldwide SLM. On the regions level, universities, *nongovernment organizations* (NGO's) and *advanced research institutes* (ARI's) continue to address the problems specific to their respective locations. However, these organizations are cooperating more and more with the *national agricultural research and extension systems* (NARES), as well as with *international agricultural research centers* (IARC's) and other international organizations. NARES, while roughly synonymous with countries, concern only those parts

that deal with the research and extension of agricultural techniques. This coordination of efforts across many levels has been a valuable new direction for SLM [Maglinao, 1998].

1.2 GOVERNMENT ORGANIZATIONS FOR LAND MANAGEMENT

For many countries facing issues of SLM, the most direct and effectual level to perform research and disseminate land management technologies is at the national level, through the departments of their respective NARES. The nation of Thailand has a number of government agencies that deal with problems of sustainable land use; three of the most important are the Department of Land Development, the Royal Forestry Department, and the Department of Agricultural Extension.

1.2.1 Department of Land Development

The Department of Land Development (LDD) works to ensure the sustainable growth of land use within the country's borders. It is one of several government agencies created to address the many sustainability issues currently facing Thailand. One of the primary responsibilities of the LDD is to conduct the necessary soil surveys for proper land classification, so that the expansion of farmland use can be well managed. Furthermore, the LDD works with a number of other organizations to conduct experiments in soil and water conservation and in soil improvement. To this end, the LDD is responsible for analyzing soil, water, plant, and fertilizer samples as necessary.

Other responsibilities of the LDD include distribution, in its many forms. In addition to actual supplies such as soil cover and seeds, the LDD is responsible in general for distributing land development technologies, and providing support for these technologies. The LDD accomplishes this task through distribution to national extension agencies, as well as to the farmers themselves [Bechstedt, 1997].

1.2.2 Royal Forestry Department

The Royal Forestry Department (RFD) is a government agency that is committed to managing land use within the nation of Thailand according to the principles of SLM. The department was established in 1896, when the forests of Thailand were ample enough to accommodate an increasing interest in logging for both private and commercial purposes [Suraswadi, 2000]. How-

ever, the 20th century has witnessed a gross reduction in the area of these forestlands; approximately 85% of Thailand's forests have been destroyed in the last 40 years [Picard, 1999]. Consequently, the RFD has transitioned from primarily regulating the logging industry, to focusing on the conservation of the remaining areas of Thailand's national forests.

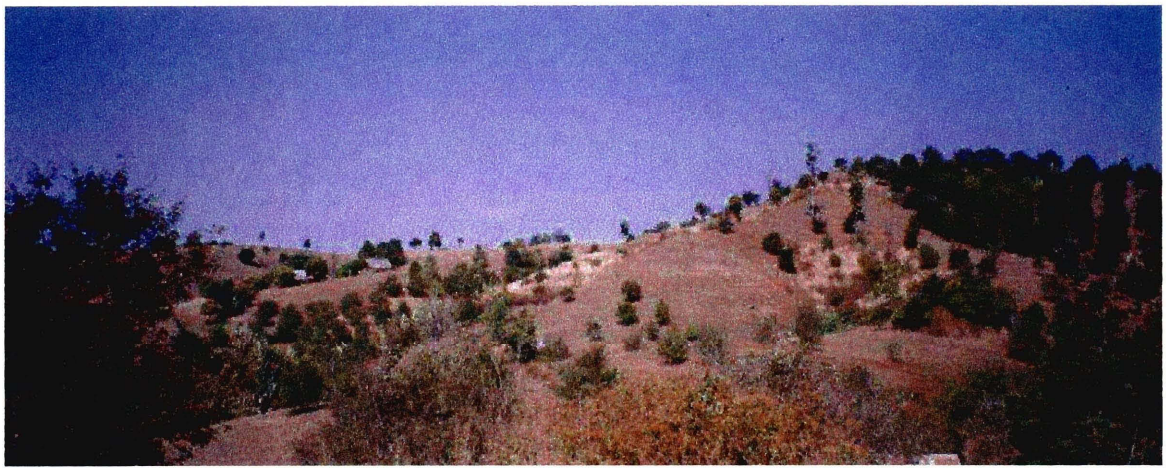

Figure 1: Deforestation in Northern Thailand

In an effort to guard these forests against any further permanent destruction, the current policies of the RFD mandate that 40% of the total geographical area of Thailand must remain as forestland (not agricultural land). This sum is divided such that 25% can be managed as production forest for timber, while the remaining 15% is to be maintained as protected forest areas for the purposes of recreation and environmental conservation [Suraswadi, 2000]. Forest conservation remains difficult despite this effort. In many areas of the country, economically challenged farmers are driven to illegally penetrate RFD protected lands; this problem continues to mount as existing farmland becomes too degraded to yield sufficient harvests.

1.2.3 Department of Agricultural Extension

The Department of Agricultural Extension (DOAE) of Thailand was founded in 1968 to establish extension systems for the farmers of Thailand. Agricultural extension is a system of education that reaches beyond classrooms or schools to the individual farmer, and is available to every member of the family on a farm. It is a "two-way method of taking proven practices to farmers, and

at the same time, sorting out the farmers' problems, and bringing them back to researchers for solutions. In turn, the solutions developed are returned to the farmer" [Chandrapatya, 1998].

There are approximately 800 districts (synonymous with counties) in Thailand, and an extension office exists for every district, each consisting of about ten extension officials, called *extentionists*. The extentionists are experts in a variety of fields, ranging from cropping systems (what and how to plant in specific areas), and home economics (household modernization and healthcare), to farmers' organizations. Close to ten villages are overseen by each official, who visits each village every other week [Rittikamron, 2000].

1.3 International Board for Soil Research and Management

While the departments of various NARES can be quite successful on a national level, they are limited in efficiency by the extent to which they can access resources on a global level. It is for this reason that international organizations become important; they are at a much greater advantage to coordinate the efforts of the NARES with the research information of ARI's and IARC's, as well as other resources, such as the support provided by donors. One such international organization is IBSRAM—the International Board for Soil Research and Management.

IBSRAM is an organization that works in an assortment of developing nations to encourage the research and application of sustainable land management technologies [Maglinao, 1998]. Founded in 1983 in Townsville, Australia, it began operation in 1985 with its headquarters in Bangkok, Thailand. Today, headed by Director General Dr. Eric T. Craswell, IBSRAM continues to be a major proponent of SLM, working with agencies in 24 countries [UIA, 1999].

1.3.1 IBSRAM's Mission

The purpose of IBSRAM, as defined by the organization's mission statement, is:

...to contribute to poverty alleviation and food security in developing regions through research and related activities that promote sustainable land management and a healthy environment [IBSRAM, 1999].

The phrase "poverty alleviation" refers to improved income and livelihood, as well as the empowerment of certain disadvantaged groups within the region, such as women. The phrase "food security" refers to a sufficient amount of food resources, both at the national and at the household level. Overall, IBSRAM aims to encourage food production and other forms of land use, so that populations may achieve adequate nourishment, income, and an improved standard of living. In doing so, IBSRAM requires the conservation of natural resources and of the quality of the environment for use by future generations [Maglinao, 1998].

1.3.2 Financing and Expenses

Support for the operation costs of IBSRAM is obtained through grants from many other organizations, such as the governments of Thailand, France, and Taiwan, as well as more than 20 international agencies, including the Asian Development Bank, the International Society of Soil Science, and the European Commission. This funding is used for research and programming costs, and to employ IBSRAM's paid staff of 25 people, who work primarily to bridge the gap between adaptive and strategic research [UIA, 1999]. To achieve this end, they must struggle to combine laboratory research with field studies, searching for ways to make the results of these efforts valid for each specific social and economic scenario of the variety of regions in need.

1.3.3 The Impact of IBSRAM

As an international board, IBSRAM has the potential to impact organizations on many different levels. While its most direct clients are the NARES, IBSRAM is able to affect countless research institutions and other academic communities through its widespread publications. The ultimate beneficiaries of the work of IBSRAM continue to be the farmers of the developing lands in which it functions.

Impact on the National Agricultural Research and Extension Systems

In its collaboration with various NARES, IBSRAM has made a substantial amount of progress in increasing the awareness toward SLM issues, in addition to promoting and conducting collaborative research of land management in both developing and industrialized countries

[IBSRAM, 1999]. In fact, IBSRAM has influenced a great deal of restructuring of both resource priorities and funding allocation in many of the associated NARES. IBSRAM has seen the integration of SLM into an increasing number of national policies and guidelines, besides continuing to participate in research with organizations within the NARES [Maglinao, 1998].

Impact on the Global Research Community

Through publications, newsletters, international conferences, and global databases, IBSRAM is able to affect research on a global scale [IBSRAM, 1999]. IBSRAM has been a pioneer in the campaign for SLM; their publications have led to the adoption of many of their research paradigms by other institutions. These adopted standards include the *Framework for the Evaluation of Sustainable Land Management* (FESLM), *soil, water, and nutrient management* (SWNM) programs, and the *participatory* and *network* approaches to soil research. Globally, IBSRAM has also managed to increase donor awareness and bolster support for SLM through its research [Maglinao, 1998].

Impact on the Farmers

On the local level, IBSRAM has been successful in raising the level of awareness among the farming community of SLM issues. Moreover, IBSRAM has been able to increase the initiative of these farmers to adopt and sustain new technologies to combat land management problems [Maglinao, 1998].

Overall, IBSRAM has led the way in tackling the relatively new crisis of land sustainability. This mentality has carried IBSRAM into a position of critical importance—the organization lists its comparative advantages (the advantages it holds over other international boards and environmental agencies) for the years 2000-2002 as "an extensive network of partners, a large volume and high quality of sustainable land management data, and the flexibility of an organization that learns quickly" [IBSRAM, 1999].

1.3.4 Obstacles Facing IBSRAM

One of the most severe obstacles facing IBSRAM is the challenge to find solutions that fit within the social, economic, and cultural restrictions of the region in which land management is a

problem. What makes this issue even more difficult to overcome are the cultural, linguistic, and disciplinary barriers that inhibit communication on all levels. Although IBSRAM has worked hard at aiming its approach toward reducing these barriers, a significant rift still exists between the researchers, policymakers, and farmers.

This unfortunate division has often led to a lack of permanent adoption of SLM technologies by the farmers in certain regions. For instance, a farmer may adopt a method as part of a study—he or she may even seem to be very supportive of the new technology—but the lasting effects of the change disappear with the researchers, as the farmer frequently returns to previous methods once the experiment ends.

So far, the most efficient way to combat these obstacles has been through a greater refinement of research and extension methods. IBSRAM is constantly occupied by the re-assessment of its goals and methods; one of the most important outcomes of this effort has been the creation of several SLM *networks*. Under the guidance of IBSRAM, these networks serve to better coordinate the efforts of the many involved SLM organizations and institutions on several different levels.

1.4 INTERNATIONAL NETWORKS

In a progressive approach to coordinating resources on a global level, IBSRAM has facilitated the creation of various SLM networks. Linking organizations on the international and the national level as well as integrating other nongovernment and independent research organizations, these networks enhance the sharing of information and capabilities between all parties.

1.4.1 Network Organization

An international network is organized to achieve the maximum flow of information across all levels. The chart in Figure 2 illustrates the organization of a typical network.

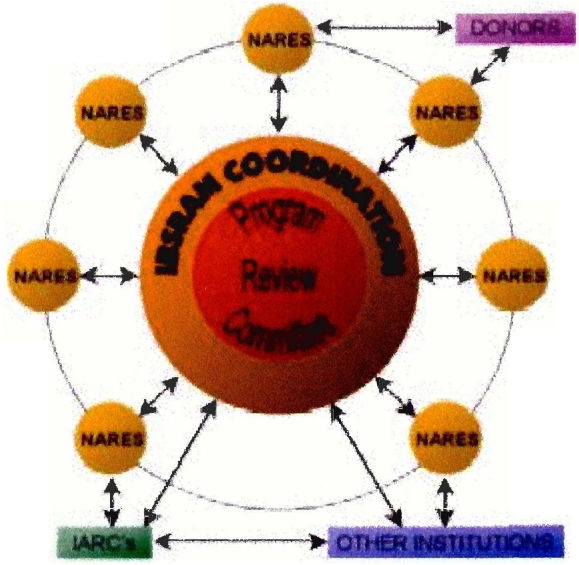

Figure 2: Management of international network

IBSRAM acts as the hub of the network, coordinating activities through the Program Review Committee. The NARES are connected through the reciprocal flow of resources between themselves and IBSRAM, while peripheral organizations such as IARC's, donors, and other institutions maintain interaction with the NARES, IBSRAM, and each other [Sajjapongse, 2000]. In this manner, cooperation between all the organizations of the network allows them to manage their mutual resources as efficiently as possible.

1.4.2 The Network Research Model

When performing research in a region, scientists working within a network follow a five-step process. First is the validation of existing knowledge, which is then re-validated to ensure accuracy. These steps are followed by on-farm research, after which occurs further research and training. The final step is training and extension.

Validation

Before a site can be chosen to perform the research, scientists must test any assumptions that have led them to select any specific location for an experiment. Thus, during the validation step, researchers work to determine if a proposed site is truly appropriate for the experiment. This

process is a crucial first step; if done correctly it can prevent unforeseen difficulties later in the research.

Re-validation

In all scientific endeavors, it is important to re-validate any results. Especially when dealing with a long-term project that requires substantial investments in both time and financing, re-validation is necessary to confirm that the validation step was performed correctly. Once the latest research has been found to support previous findings, a site can be finally selected for the project.

On-farm Research

After the arduous tasks of validation and re-validation have been completed, the actual research of the project can begin at the selected site. It is during this step that the objectives that form the background and foundation of the project are achieved, as the researchers test any methods they plan to use in training and extension. For scientists to be successful with this step, they must draw on a number of resources, including methods that are already known by the farmers. A wide variety of techniques are examined—those that are not viable are abandoned, and those that show promise are re-evaluated for further advantages and disadvantages.

On-farm Research and Training

Once the research step has yielded promising results, the process of training can begin. At this fourth stage, researchers continue to work at the site, testing methods as well as beginning the process of training. This step in the network research model is currently where the Huey Thong project under IBSRAM and the DOAE is working. In addition to continued investigation into suitable techniques, the focus of research also shifts toward how these techniques will be passed on to the farmer. This new facet of the research allows the scientists to begin exploring the best ways to encourage the adoption of the discovered land management techniques.

Training and Extension

The final step in the process occurs when a technique has been shown to be socially, economically, and biophysically suitable for a region and its farmers, and the researchers have determined successful ways to train the farmers. The study of adoption and the consideration of new techniques does not stop with this stage—research and assessment continue, as the process of extension begins to spread the land management technology throughout the region, through the efforts of various extension organizations and their workers [Sajjapongse, 2000].

1.4.3 *ASIALAND* Sloping Lands Network

One of the IBSRAM networks currently operating is the *ASIALAND* Sloping Lands Network, which works to alleviate the problems of land degradation in Southeast Asia due to soil erosion in hilly and mountainous regions. As a cooperative research network, it follows the model of organization displayed in Figure 2. Thus, the *ASIALAND* Sloping Lands Network is an effort coordinated by IBSRAM that draws on the resources provided by the other involved organizations.

Due to the crises of land management in many sloping-land regions of Thailand, its government is one of the several NARES that participates in the network's research partnership. Through national departments such as the LDD, RFD, and DOAE, along with other organizations such as ARI's or IARC's, IBSRAM is able to coordinate a number of different research projects to assist the nation of Thailand in pursuing greater use of sustainable land practices in its ailing agricultural areas.

2 THAILAND

Thailand is affectionately referred to as "The Land of Smiles". As the leading exporter of rice, it is one of the world's foremost agricultural powers. The cultural and religious history of Thailand is intertwined with all aspects of its present-day agricultural life.

2.1 RELIGION

Religion deeply affects the lives of the farmers in Thailand. Ninety-five percent of the population is Theravada Buddhist, and *wats* (temples) are present in many Thai villages. All young men are expected to become monks for at least one rainy season, during which they study Buddhist principles. A man who has never been a monk is regarded as a *khon dip*, literally an "unripe person".

Buddhism underlines the Thai virtue known as *nam-chai*, "water of the heart", a concept encompassing the compassion, kindness, and warmth archetypical of Thai actions. Tact, compromise, tolerance, and social harmony are regarded high above privacy or individual needs. This need for social harmony is shown in the expression of the sentiment known as *kreng-jai*, which is interpreted as an extreme reluctance to impose on anyone, give direct criticism, or be confrontational [The World Factbook, 1999].

2.2 CUSTOMS

Thailand is a country rich with meaningful customs dating back to the 12th and 13th centuries. These cultural conventions are ingrained in all aspects of life, but are less rigid in Bangkok and other urbanized areas. In rural areas such as Loei, these customs are just as significant today as they were hundreds of years ago.

2.2.1 Greeting

The traditional and most common greeting is the *wai*, shown in Figure 3. The person presses his or her palms together, as if in prayer, and positions them with fingertips at varying heights from the chin to well above the forehead. A different level of respect is denoted by each of these heights. A higher *wai* is reserved for the elderly and monks, and the person also lowers their eyes and bows slightly. The *wai* is a gesture of courtesy, and when done correctly demonstrates your level of education and class. It can mean "hello", "thank-you", "goodbye", or "I'm sorry."

Figure 3: Performing a wai

2.2.2 Body Language

The head is considered the highest part of the body in Buddhist culture. One should refrain from touching or passing an object over the head of a Thai person. Also, the bottoms of the feet are the least sacred part of the body and should never be pointed at anyone. For the same reason, one should never step over anyone or use his or her feet to move an object. When sitting on the floor, women generally sit with their feet tucked to one side and behind them, and men sit cross-legged. Men may also sit with their legs tucked to the side to show special respect.

2.2.3 Visiting

It is customary to remove one's shoes when entering a house. Thai tradition says a spirit resides in the doorsill of a home, so visitors avoid stepping on the doorsill [Yee et al., 1993]. These customs also hold true when visiting a *wat*, where the shoes are removed to show respect.

2.3 LIFESTYLE

The farming lifestyle is centered on the family. To understand Thai family life is to understand the core of a farmer's life and livelihood.

2.3.1 Thai family life

The rural family, in its typical village setting of 100 to 150 households, consists of many generations living under one roof. A home is usually a simple wooden house raised on posts. Sometimes Thai farmers own water buffalo as a form of insurance—if financial conditions prove too hard, the family can sell the animal for extra money. Livestock usually live below the house, and the family often lives in a single room. The father is regarded as the leader of the house, but the mother also plays a significant, if not equal, role. Traditionally, the home is also inherited by the family's youngest daughter, and she and her husband will care for her parents in their old age.

2.3.2 Age hierarchy

A prominent feature of the Thai concept of family is age hierarchy. Grandparents have an honored place in the household because of their acquired wisdom. Respect for elders is taught very early; this applies not only to parents or grandparents, but to siblings of different ages, as well. This delineation of roles applies to the world outside the family and permeates every aspect of a Thai's life [Yee et al., 1993].

2.4 AGRICULTURE IN THAILAND

Agriculture has traditionally been the backbone of the country's economy, but progress toward industrialization and manufacturing has cut the contribution of agriculture to Thailand's Gross Developmental Product to about 28%. The Ministry of Science, Technology, and Energy (MOSTE) is responsible for the development of the country's agriculture. One of its five technological policies is the "Implementation for Agricultural Development". This includes new agricultural technology, engineering, biotechnology, and genetic engineering [TAT, 1999].

Figure 4: Rice field in Thailand

One major effort in agricultural development undertaken by MOSTE, in the villages of the northeast province of Chumporn, is aimed at developing agricultural products in sandy soil. They have experimented with various types of crops, and overcome several difficulties regarding the adoption of techniques by successfully teaching other villages how to use the same methods on their own farms [LDD, 1999].

3 THE PROVINCE OF LOEI

A province in Thailand is comparable in relative size and organization to a state in the United States. The province of Loei is situated in the mountains 90 km (56 mi) south of Laos, 520 km (323 mi) north of Bangkok (see Figure 5). Loei's 14 districts fall in between the North and Northeast regions of Thailand, and share the culture and dialects of both. Its proximity to Laos has lead to Lao influences in many aspects of life, from religious ceremonies to food. It is home to approximately 630,000 people, with a population density of only 55 citizens per square kilometer—making Loei one of the least crowded areas of Thailand. The climate varies a great deal in comparison to the rest of the country; temperatures can range from 0° to 35° C [The World Factbook, 1999].

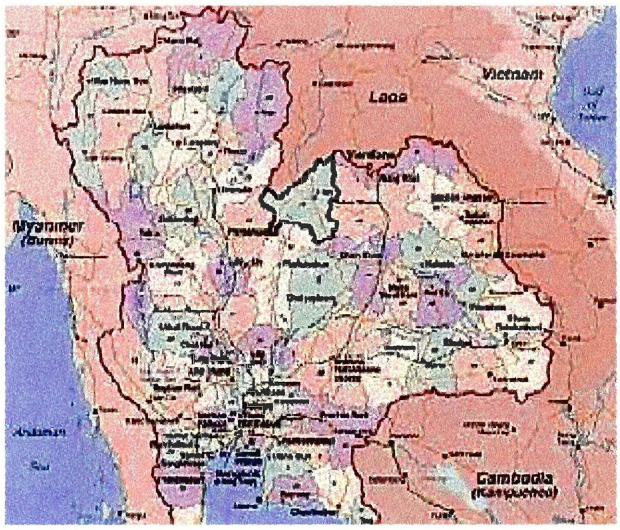

Figure 5: The province of Loei

3.1 THE DISTRICT OF DAN SAI

The Dan Sai district covers 1003 sq km in southern Loei and contains ten sub-districts. Classified as 80% deciduous forest and 20% plains, this mountainous region encompasses the population of 96 villages. In the true Thai tradition, the main occupation of the residents of Dan Sai is *subsistence farming* (farming for survival rather than profit), although only one third of the land area is used for agriculture. The remaining land is classified as natural reserve forest by the Royal Forestry Department.

3.1.1 Climate

Heavy rainfall from May to October, cool and dry weather from November to January, and hot and dry weather from February to April comprise the seasons of Dan Sai. Atypical of Thailand, Dan Sai sometimes experiences drought during the months of June and July. The temperature can fall to as low as 0° C during the cold season, but averages 16° to 17° C during the day.

3.1.2 Agriculture

The average amount of land owned by a subsistence farmer is 5 to 8 rai (see Appendix D). The majority of the land (83%) is used for the harvesting of field crops such as corn (for livestock), upland rice (also known as sticky rice), Job's tear, sweet potato, ginger, peanuts, and vege-

tables. Lowland rice (also known as paddy rice) is grown for household consumption on any land that is not sloped. Seven percent of this field cropland contains fruit tree orchards.

Alternative Income

Since farmers in only four of the ten sub-districts can plant year-round, the residents of the remaining districts must look to an additional source of income to survive. Livestock and fisheries are used to earn extra money by as many farmers as can spare the land. Many households must send family members into urbanized areas to work.

Problems Encountered by Farmers

The farmers face many agricultural problems specific to areas that are similar to Loei. The lack of rain and water during the dry season causes low production of crops and may lead to hard economic circumstances. Soil erosion is the number one contributor to land degradation in this area, and it causes low soil fertility when the nutrient-rich topsoil is washed away. Plant disease and insects are also of a problem, but are not considered serious. As the soil degrades more and more each year, the farmers find themselves needing to invest increasing amounts of money in fertilizers, labor, seed, etc. The Bank of Agriculture of Thailand lends money at low interest rates to farmers facing such problems [Rittikamron, 2000].

3.2 THE VILLAGE OF HUEY THONG

The Thai phrase *huey thong* is translated to mean "golden spring". The village of Huey Thong was established in 1949 by an original 30 households. Today, 160 families live and farm on this mountainous land.

3.2.1 Land Allotment

The village land was classified as natural reserve forest in 1984 by the RFD, which means that it is illegal for any person to farm on or develop this area. Since the citizens of Huey Thong lived in the area prior to the classification, the RFD has allocated a certain area of government property for cultivation. The residential areas and all agricultural land are located within what is legally

considered national forest reserve land, and therefore, by granting these land titles, the RFD gave the farmers permission to crop the forests. This decision is today considered by the forest officials to be a mistake.

A total of approximately 10,000 rai are owned by the 160 households of Huey Thong. One half of this land is classified as *sanctuary land*, and cultivation by any person is strictly prohibited. The other half owned by the villagers is the natural reserve forest that the farmers have been allowed to farm under the jurisdiction of the RFD. Of this remaining area (about 5,000 rai), 4,600 rai are used for field crops, 120 rai contain fruit tree orchards, 100 rai have paddy fields, and 8 rai are used for fishponds.

3.2.2 Difficulties Faced by Farmers

In 1997, a forest fire swept through Huey Thong and the neighboring villages, and over 80% of the villagers' crops were completely destroyed. This tragedy is one example of the major agricultural obstacles that these farmers have to overcome. As the village increases in population, and more and more land becomes unusable as a result of soil erosion, improper farming techniques, etc., these farmers must struggle to find land on which to plant their crops. They are forced to cultivate mountainous and forested areas with very steep and challenging slopes. This deforestation and the removal of natural vegetation are considerable contributors to the severe soil erosion, which, in turn, leads to low soil fertility of the land. Consequently, the villagers are forced to move to steeper land and continue to struggle with the obstacles of resource-poor farming in a vicious, debilitating cycle [Rittikamron, 2000].

4 SOIL EROSION

Erosion, in its most basic definition, is the process of wearing away the earth. More specifically, *soil erosion* is defined as the *detachment, transport,* and *deposition* of soil particles. It occurs when soil fragments are carried from place to place by forces such as wind and water, resulting in a constant migration of soil.

4.1 A Powerful Natural Force

Erosion is an extremely powerful force, one which operates slowly and constantly to change the face of the planet in extraordinary ways [Hudson, 1981]. Working as quietly as a gentle breeze, acting with as much circumstance as a single raindrop, erosion has the power to grind mountains to dust, cut rivers into solid rock, and turn forests into deserts.

4.1.1 Geological Erosion

While its effects may seem destructive at times, the process of erosion is actually a vital natural phenomenon. Scientists refer to erosion in its natural, uninhibited form as *geological erosion* [Hudson, 1981]. While this kind of erosion is perpetual and unstoppable, more importantly, it has the more important trait of being a vital necessity to sustain life on earth. Geological erosion is responsible for large deposits of valuable agricultural soil all over the world, because it is a central element in the formation of soil from rock and in the establishment of rivers and other natural waterways [Foth, 1984]. Ultimately, erosion is one of the factors that makes the growth of flora on this planet possible [Schwab et al., 1971].

4.1.2 Accelerated Erosion

Like so many other aspects of nature, the process of erosion only becomes a severe problem when it is complicated by the interfering hand of civilization. Thus, scientists distinguish erosion enhanced by the actions of mankind as *accelerated erosion* [Hudson, 1981]. Strip mining, massive agricultural operations, and urban development are all contributors to accelerated erosion [Schwab et al., 1971].

4.2 Agents of Soil Erosion

An active natural force, known as an *agent*, works as the catalyst to any erosive process. Many different types of eroding agents exist; all act in varying amounts to produce a combined effect over a given region.

4.2.1 Wind

One contributor to soil erosion is an element that is always around us—the air, which is constantly in motion. This moving air has the ability to carry particles from place to place, either by suspension, by skipping or bouncing them along the ground, or by rolling or sliding (referred to as *surface creep*) [Schwab et al., 1971]. As these moving particles pass over other geological surfaces, they can act (over the course of a long period of time) like sandpaper, decomposing rock into soil [Hudson, 1981].

4.2.2 Water

While wind is indeed a factor, especially in certain arid regions, it is actually water that is probably the single most destructive agent of erosion [Schwab et al., 1971]. The constant effort of precipitation most directly facilitates the process of erosion. Water can cause erosion initially by the direct impact of water against a surface, such as the force of falling raindrops, ocean waves, or water-falls. A great deal of erosion also occurs from the suspension of particles in flowing water as it makes its way to a standing reservoir (such as a puddle, pond, inland lake, or ocean) [Foth, 1984].

Figure 6: Advanced soil erosion by water

4.2.3 Other Agents

One must remember that erosion, as a natural process, acts over a span of time far greater than that of a human life. Thus, even the most insignificant of effects can, over time, stand to have a substantial erosive impact.

Temperature Changes

Even the simple changing of the seasons offers an opportunity for erosion. In the accelerated perspective of geological time, the drastic changes in temperature from day to night and from summer to winter cause a continual expanding and contracting of earth that can easily break rocks into soil. The added effect of water, which can expand when freezing while other surfaces are contracting, leads to an acceleration of this process [Hudson, 1981].

Biological Factors

The presence of living organisms can affect erosion. A certain amount of the actual destruction of rock is due directly to biological factors—for instance, mosses, lichens and tree roots can wedge into crevices in stone and break it apart. The trampling and breaking up of the ground by animals, such as livestock, can serve to make soil more easily erodible by wind or water [Hudson, 1981].

4.3 Types of Soil Erosion Caused by Water

The force of water (mainly in the form of precipitation) ranks overwhelmingly as the major cause of both geological and accelerated erosion. The erosion of a soil surface by water can be divided into four types of increasing severity: *raindrop erosion*, *sheet erosion, rill erosion,* and *gully erosion.*

4.3.1 Raindrop Erosion

Soil erosion begins the moment a lone drop of rain strikes the earth. *Raindrop erosion* is the erosion that occurs as soil particles are detached by the impact of falling water on the soil surface. While the force of a drop of rain may seem quite insignificant, from the perspective of a grain of soil,

it is actually like a small explosion. Rain can strike a surface at up to 30 miles per hour, catapulting soil particles into the air up to two feet vertically and five feet laterally [Schwab et al., 1971]. Raindrop erosion is the type of soil erosion that affects countries experiencing long rainy seasons, such as those in Southeast Asia.

4.3.2 Sheet Erosion

The next level of water erosion occurs when water begins to traverse the soil surface, in search of lower elevation to which it can drain. *Sheet erosion* takes place when water "sheets" over a smooth soil surface. However, as Foth notes, this makes sheet erosion an impractical classification; a smooth soil surface rarely exists in nature [1984]. Consequently, small depressions in the soil surface cause any runoff instead to drain in concentrated streams, known as *rills* [Schwab et al., 1971]. This type of soil erosion also afflicts the land of Southeast Asia during the monsoon seasons.

4.3.3 Rill Erosion

What appears as uniform soil removal by sheet erosion is more often accomplished by individual rills [Foth, 1984]. *Rill erosion* is the erosion that occurs as water drains through small channels and streamlets. While rills may range in size, they are usually not permanent. Most rills, if not removed naturally, can be erased by standard tillage operations [Schwab et al., 1971]. Despite the fact that rilling is a natural and unavoidable occurrence during precipitation, one must keep in mind that if not contained, rill growth can become a severe problem.

4.3.4 Gully Erosion

If left unchecked, a large rill has the potential to grow in size as erosion continues. At some point, a crossover occurs such that a channel no longer qualifies as a rill—it is a *gully*. The last stage of soil erosion, *gully erosion*, is the most severe; it presents "the impression of land neglect and soil destruction" [Foth, 1984]. Larger gullies create damage that cannot be repaired by standard farm equipment. Once land has reached this stage of dilapidation, extreme measures are required in order to restore it to a useable state.

4.4 The Relationship Between Erosion and Farmers

As the world is becoming more populated and the demand for food more intense, humans are causing the acceleration of soil erosion in devastating steps. Farmers are often the biggest victims of this, as the erosion sweeps away the most fertile soils from their fields, making it difficult at times to yield enough food to even feed their families. The farmers that are most affected by soil erosion tend to be those in Southeast Asia and Africa. The drastically changing seasons—monsoon rains and prolonged droughts—combine with predominately poor societies to encourage inferior farming techniques that in turn increase soil erosion. Soil erosion caused by farmers has even led to such events as land slides [Sajjapongse, 2000].

In the past 30 years, organizations have been formed worldwide to concentrate on the problems of accelerated erosion and the difficulties that arise when combating them. Numerous area-specific techniques for tackling soil erosion have been created, and have been successful in some regions. Unfortunately, researchers are only now discovering that socioeconomic issues are the main cause for the lack of adoption of these techniques. Many organizations, such as IBSRAM, are now concentrating on the socioeconomics of the communities they wish to help before researching methods of alleviation of soil erosion [Enters, 2000].

4.4.1 How Farmers Cause Accelerated Erosion

As populations in poorer countries grow, more farmers are being forced into the hilly and mountainous lands that have not been used for agricultural purposes in the past. Although they may not be suitable for these new lands, the farmers tend to bring their indigenous farming techniques with them. Farming with knowledge that was passed on from generation to generation, the inhabitants of these lands either cannot or will not embrace ideas and techniques that have benefited industrialized farming in other parts of the world. These are usually the farmers who unknowingly contribute to soil erosion, unaware or unable to stop the harm it will eventually cause them.

Deforestation

Massive deforestation, one of the biggest contributors to soil erosion, is the first enterprise undertaken by a group of farmers when they settle in a new location. With the removal of the

natural vegetation, soil is more exposed to the wind and rain. Farmers often use the *slash and burn* technique to rid their land of native plants—the farmers first cut down the large plants, and then set the entire field on fire. The ash that is left behind fertilizes the soil, but unfortunately after a year the soil actually becomes less fertile than it was before the fire. Ultimately, the effects of slash and burn serve to accelerate soil erosion and nutrient depletion, resulting in extensive land degradation.

Vertical Tillage

When preparing their land for planting, farmers often till their fields to produce rows that run up and down the grade of the slope, known as vertical tillage. The primary reason why this plowing method is practiced is because it allows the use of a tractor on even the steepest arable land. An undesirable effect of this technique, though, is that it succeeds in carving out pathways for the water to flow away from the fields more easily, taking the precious topsoil with it.

Use of Tractors

One modern agricultural tool that has spread to even the most rural farms is the tractor, whether it is found in the more affordable hand-held or conventional riding form. Besides the damage done by vertical tillage, an additional disadvantage for using tractors on sloping land is that they loosen the soil. On a normal field, this would make the soil more fertile by aerating it, but on a slope, it just makes it easier for the soil to be eroded.

Lack of Knowledge

Lack of knowledge epitomizes why farmers worsen the problem of soil erosion. Farmers often are not aware of the existence of soil erosion—they just witness the nutrient depletion of the soil in terms of a decreasing yield in crops. Since the survival of these farmers and their families depends solely on the crops they grow, farmers may not try find out what is wrong with a certain place; they can simply move to another. They end up leaving behind deteriorating farmlands, and then go on to do the same thing to another area.

4.5 TECHNIQUES TO ALLEVIATE SOIL EROSION

Different land types, farming practices, and weather patterns can cause soil erosion to affect the land in various types of ways. Certain farming methods have been developed to combat a variety of kinds of soil erosion. The procedures are specific to the type of soil erosion, the particular weather patterns that certain regions experience, and even the type of community that adopts it.

4.5.1 Conservation Tillage

Conservation tillage is the process of breaking up, granulating, and turning over the soil, as seen in Figure 7. It decreases the rate of soil erosion temporarily by making the soil rougher and more textured. Together with crop residues, this method can resist water and wind erosion. However, with time, the soil becomes smooth and erosion increases again [WEPP, 1999].

Figure 7: Conservation tillage

4.5.2 Crop Residue Management

Crop residue management, as seen in Figure 8, is one of the best ways to control rill erosion. It is the use of stems, leaves, and stalks of previously harvested crops to protect the soil surface from raindrop impact and detachment, as well as to help reduce soil surface sealing and maintain water infiltration [WEPP, 1999]. Crop residues act as flow barriers in rill channels, slowing the water flow and reducing the amount of soil eroded.

Figure 8: Crop residue management

4.5.3 Vegetated Waterways

The method of *vegetated waterways*, shown in Figure 9, is the planting of grass or other vegetation along waterways in between plots of crops. By collecting and concentrating overland flow, the waterways absorb the destructive energy that causes channel erosion and gully formation. The grass linings should be perennials adapted to the geographical region and soil. Maintenance requires that the linings are cut periodically, fertilized as needed, and not subjected to prolonged traffic by either livestock or vehicles [WEPP, 1999].

Figure 9: Vegetated waterway

4.5.4 Mulching

As an alternative to crop residue management, farmers can use *mulching* instead of excess crops to slow erosion. Mulch acts as a canopy for the soil, protecting it from water evaporation and

absorbing the force of rainfall; it also helps to control weeds and fertilize the soil. Material for mulching can be made from fallen trees and branches, and may help to control forest fires.

4.5.5 Contour Cultivation

The use of *contour cultivation* requires planting crops and performing tillage along the contours of a slope. These contour ridges slow or stop the downhill flow of water. Also, water is held between these ridges, which reduces soil erosion and increases soil moisture.

4.5.6 Terracing

Terracing is a combination of contouring and land shaping in which soil ridges are designed to intercept runoff water and channel it to a specific outlet. It is most effective when used against surface runoff, because it decreases the length and slope of the hillside. It is used mostly on hills with steep inclines, as shown in Figure 10 [WEPP, 1999].

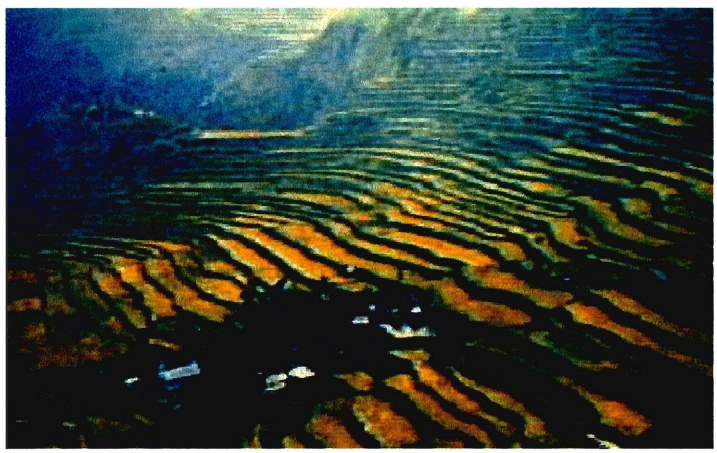

Figure 10: Terracing

4.5.7 Strip Cropping

A very effective and cost efficient technique, *strip cropping* is a combination of contour cultivation and crop rotation, in which alternate strips of row crops and soil conserving crops are grown on the same slope, perpendicular to the wind or water flow [WEPP, 1999]. Figure 11 displays an example of strip cropping—the dense soil-conserving crops slow surface runoff and slow the process of erosion.

Figure 11: Strip cropping

4.5.8 Alley Cropping

A variation of strip cropping, *alley cropping* has been recently developed specifically for use on sloped lands. The majority of the protection against soil erosion comes from the use of *hedge-rows* (strips of dense plant growth). Farmers plant alternating rows of hedgerow crops and alley crops horizontally along the contours of the hill on their fields, as shown in Figure 12. The dense hedgerow plants prevent water from flowing down the slopes of the fields, while at the same time catching topsoil that would otherwise wash away. The plants that make up the hedgerows are often plants that do not yield anything that can be sold, such as *vetiver grass*, *leucaena*, and *pigeon pea*. The crops grown in the alleys are chosen by the individual farmer, and are usually sold for profit. Bushy legumes are suitable for hedgerows and are sometimes chosen for the additional benefit of increased soil fertility.

Figure 12: Alley cropping along a slope

Alley cropping has been successful in many countries, such as Thailand. At least a month of preparation is needed in order to cultivate successful hedgerows. Since farmers generally grow their cash crops during the rainy season, the fields must be prepared during the preceding cool season.

Alley cropping has been proven a "profitable soil conservation technology, as evidenced by the high incremental values of net present values and benefit-cost ratios" [Sajjapongse, 2000]. It adheres to the five pillars of the Framework for the Evaluation of Sustainable Land Management (FESLM) as stated by IBSRAM to be: productivity, security, protection, viability, and acceptability (see Section 1.1.1).

The Use of Fruit Trees

Farmers often do not wish to wait the four or five years required to see the benefits in their soil that result from the use of alley cropping. Many complain that the hedgerows in alley cropping occupy as much as half of their farmable land, decreasing the productivity of the farm. In order to make alley cropping more appealing to farmers, researchers have suggested planting fruit trees within the hedgerows (see Figure 13). Trees such as banana or mango not only provide food, but are also a cash crop. In addition, some farmers have begun using pineapple plants as the hedgerows, because they provide benefits similar to those of fruit trees [Sajjapongse, 2000].

Figure 13: Alley cropping with fruit trees

Benefits

The primary benefit and purpose of alley cropping is the amelioration of soil erosion. After adopting this technique, farmers have discovered other benefits. For example, using alley cropping on a slope eventually decreases its incline. Natural terracing results, which also facilitates the reduction of soil erosion. Unfortunately, this micro-terracing can take up to ten years to become evident, which can be longer than many farmers are willing to wait.

Figure 14: Natural micro-terraces resulting from alley cropping

Soil erosion is blamed for removing the fertile soils of the slopes of hills and mountains, but the location where that soil is taken is often overlooked. The valleys in between hills or moun-

tains can be used by farmers to grow lowland rice during the rainy season. However, the soil that is swept down from degraded slopes during the rainy season can bury the rice plants, ruining the crops. Farmers who use alley cropping on their sloped fields have found that they can grow rice on their lowland fields where previously impossible (see Figure 15), thus making better use of their land.

Figure 15: Lowland rice grown in a valley, due to protection from alley cropping

4.6 Obstacles to the Adoption of Techniques

In the past, almost all land management research has been conducted in the same manner. Researchers from over the world gathered to study the topography of an area in order to ascertain the most appropriate land management technique for that location. The researchers would then proceed to transfer the technology to the farmers of that area, leaving when they felt that the technique was completely understood. Often, upon follow-up of that area, researchers would discover that the farmers had discontinued using the land management technique. They began to research the reasons for this abandonment, and found that they were primarily social and economic.

4.6.1 Economic Obstacles

Some of the greatest reasons for abandoning techniques tend to be economic. Even if farmers have been introduced to the simplest or most effective of techniques, unless they have the money to supply themselves with the tools necessary, the technique is not useful. This is often the case with fertilizer—farmers know that using fertilizer will help their crops flourish, but they do not

have the resources to purchase it. Another way that economics can affect a farmer's adoption of a technique is if it requires an initial investment with no short-term benefits; alley cropping is an example of this. Not only is additional labor required, but seeds are as well, and benefits are usually not evident for a few years.

4.6.2 Social Obstacles

There can be social or cultural reasons for a technology to not be readily adopted. One problem arises when extentionists only teach a technique to the male farmer of a family, disregarding that the farmer's wife also has an influence. In many Thai families, women take an active role in the process of decision-making, and when they do not understand the reason for using a certain farming technique, they may be more likely to veto its use. Often, this lack of support is because the wife or mother in a family is responsible for the management of finances and will not allow the use of a technology to continue if it is too expensive. Physical reasons can also be a factor; an example is that women sometimes find that the technique of alley cropping has made the farming more difficult for them because they are not tall enough to step over the hedgerows. Thus, if the women have not been properly educated in the purposes of a certain land management technology, they may be more critical of its disadvantages, and more prone to discontinue its use [Chandrapatya, 2000].

4.6.3 Lack of Interaction with Farmers at the Research Level

Ever since a more interactive approach to research has been introduced, it has been noted that if a farmers give their input for a technique at the research level, they are more likely to adopt that technique. Researchers can also forego the opportunity to learn valuable indigenous knowledge that only the farmers can provide, if they are not involved at an early stage [Maglinao, 1999].

5 HUEY THONG PILOT PROJECT CHRONOLOGY

The Huey Thong project, titled "Pilot Project for On-Farm, Farmer-Managed Trials for Managing Soil Erosion", was initiated in 1995 by Mr. Wattanamongkol, a specialist from the DOAE Provincial Office in Loei. Mr. Wattanamongkol and his team of researchers were trained in

transferring technologies by IBSRAM, in collaboration with the LDD and the DOAE, and funded by the government of Thailand through the Department of Technical and Economic Cooperation (DTEC) [IBSRAM, 1998]. The purpose of this project is to investigate the capability of on-farm, farmer-managed practices for adopting land management techniques. There were four main steps of the Huey Thong Pilot Project; site selection, training of the extentionists, obtaining a preliminary village profile, and the implementation of farmer-managed trials.

5.1 Site Selection

In November 1995, a team headed by the DOAE conducted surveys of villages in the mountainous regions of Northern and Northeastern Thailand, in order to find a representative site to be used in the pilot project. This team included specialists from the LDD, the DOAE, and IBSRAM, and had technical support from five Thai universities. Huey Thong village was selected as representative because soil erosion has caused serious land degradation in the sloping land surrounding the Phu Luang Mountain. In addition to the problem of soil erosion, soil fertility is very low there and these farmers use tractors to vertically till their slopes, which intensifies the land degradation [IBSRAM, 1998].

5.2 Training of the Extentionists

Since it is important to modify the land management technologies to fit the location-specific physical and social constraints, IBSRAM provided training for the researchers and officials on how to use *participatory* methods. Participatory methods require the involvement of the farmers in every aspect of research and extension. The training of the researchers was intended to act as a set of guidelines, not as strict instructions. The success of the participatory method depends on the attitudes and responsiveness of the individuals involved, on the quality of the learning environment, and on the context in which the techniques are applied [Bechstedt, 1997].

Before the extentionists were able to obtain a comprehensive profile of the village of Huey Thong, they were required to be trained in problem identification, site selection, and site characterization, using *agro-economic system analysis* and the methods of *participatory rural appraisal* and *rapid rural appraisal.*

5.2.1 Agro-economic System Analysis

Agro-economic system analysis (AEA) is the gathering of biophysical and demographical information of a farming area. Agro-economic data is often the center of attention in on-farm research because it is important for assessing the suitability of a technology for the local environment. Agro-economic information is not, however, the only important data, so it is imperative that techniques such as participatory rural appraisal and rapid rural appraisal are used to perform AEA. This way, socioeconomic data is taken into account to determine how feasible a technique is likely to be under a given circumstance [Werner, 1993].

5.2.2 Participatory Rural Appraisal

Participatory rural appraisal (PRA) is defined as an intensive, systematic yet semi-structured, mutual learning experience carried out in a community by a multidisciplinary team that includes the community members. The purpose of PRA is to gain an understanding of the complexities of a topic using methods that empower community members to express, share, enhance, analyze, monitor, and evaluate their knowledge [Bechstedt, 1997].

5.2.3 Rapid Rural Appaisal

Rapid rural appraisal (RRA) is an extractive survey method used for the collection of local data. RRA is defined as a "systematic, semi-structured activity conducted on-site by a multidisciplinary team with the aim of quickly and efficiently acquiring new information and hypotheses about rural life and rural resources" [Bechstedt, 1997]. It is guided by the same principles as PRA, in which the farmer remains the provider and the researcher the receiver and processor of information.

5.3 Obtaining Preliminary Village Profile

Prior to implementing the on-farm trials, the DOAE investigators wanted an accurate profile of the farmers in Huey Thong. The DOAE regional office possessed secondary data on the villagers concerning such things as farms, family sizes, crops, labor, land use, cultural events, and mobilization of resources. This secondary data was not appropriate for the researchers to analyze,

but it provided them with a strong foundation of information, and could later be used for validation purposes. The extentionists then performed AEA using PRA and RRA to obtain firsthand a detailed biophysical and socioeconomic profile, and to identify the problems, solutions, and opportunities of the farmers. The extentionists would be able to use this profile when analyzing the success of the pilot project [IBSRAM, 1998].

5.4 Implementation of Farmer-Managed Trials

With the newly acquired knowledge on Huey Thong and its inhabitants, the extensionists arranged a meeting with the villagers. The officials were now armed with enough information to ask appropriate questions and conduct the meeting in a way most effective for obtaining the desired data. They planned for the meeting to be held at night, when the majority of the farmers would not be working, in order to increase attendance. This meeting marked the beginning of the actual implementation of the on-farm, farmer managed trials of land management techniques.

Using economic and social status, the researchers separated the participants into three groups: one including Huey Thong's key informants (the official and unofficial leaders) who were also the wealthiest individuals, another with the moderately wealthy farmers, and the third with the poorest farmers. This format was designed to ensure that the villagers would feel comfortable and be encouraged to speak more freely. The next step of the project was to find farmers willing to be trained in land management techniques. Using these three groups, household surveys and an assessment of the villagers' problems were carried out with the purpose of discovering the best-suited volunteers for the trials [Rittikamron, 2000].

5.4.1 Household Surveys

From each of the three groups, nine farmers were randomly selected. During the next month, the extentionists visited each of the 27 households, and spent an entire day extensively interviewing the farmer and his or her family. Information was obtained regarding four main aspects of the research (the economic, physiological, biological, and social characteristics).

Since the DOAE interviewed only 27 out of the 160 total households, in order to ensure that the information obtained from these few households could be applied to Huey Thong, the extension workers arranged for another meeting. During this discussion, they presented the analyzed

tension workers arranged for another meeting. During this discussion, they presented the analyzed data from the family interviews to the entire village. This meeting was held during the day, due to the difficulty in presenting visual data at night. Despite this, almost the entire village attended, including the older generations of farmers. The analyzed data was discussed and validated by the village.

5.4.2 Assessment of Villagers' Problems

After revalidating the data with the villagers, the extentionists discussed with them the village's problems. The farmers initiated everything—the researchers did not ask leading questions or try to bias the farmers in any way. It was determined that soil erosion was the most serious problem facing the village. At this point, thirty of the villagers confirmed that soil erosion was a problem on their farms. Ten of this group stated that they would like to try and alleviate this problem; these ten were chosen as the volunteers for the project [Rittikamron, 2000].

5.4.3 Chiang Mai Farmer Training Conference

In 1996, the first group of farmers from Huey Thong traveled to Chiang Mai to learn about land management techniques. IBSRAM funded the conference so that the farmers were paid for all five days away from their farms, including the two days that were spent in travel. The farmers were trained to compute the slope of their land, make contour lines using special tools, and to use land management techniques such as alley cropping.

The DOAE and IBSRAM organized the conference to include on-site and off-site training. The first day was spent in classrooms, where theories were taught to the farmers. They brought these theories to the field the next day, when they first visited a research site, and then a demonstration site. The research site showed the land management techniques with every variable controlled, while the demonstration site was an actual farm on which a farmer, not an official, had implemented the land management techniques. On the last day, the extension officers assessed the conference by getting input from the farmers on their questions and comments in regards to the technologies they had been taught. Each volunteer was asked to give a presentation on his or her plans for implement-

ing the technologies. Alley cropping was chosen as the best method for reducing soil erosion by the farmers of Huey Thong.

Figure 16: Demonstration site for farmer training

5.4.4 On-farm Implementation of Land Management Techniques

After the first conference, the ten farmers who attended went back to Huey Thong and implemented alley cropping on their farms. They helped each other to make contour lines, decided on cash crops to be grown in the alleys, and planted hedgerows using a mixture of pigeon pea and leucaena. Corn, upland rice, and red bean were chosen as the optimum cash crops. After growing hedgerows for a few years, it was found that pigeon pea is easily grown anywhere, but only survives for about three years, and that the soil of Huey Thong is too acidic for the leucaena. Another hardship was faced in 1997 when a huge forest fire demolished 80% of the farms in Huey Thong, including the majority of the farmland containing alley cropping.

The conference in Chiang Mai has been held annually since 1996, and a total of 30 farmers have been trained. Currently, the farmers, IBSRAM, and the LDD are trying to find the most suitable crop for the hedgerows.

6 BACKGROUND FOR METHODOLOGY

Investigation into subjects such as participatory research techniques, various types of interviews, and the communication skills necessary to properly conduct these interviews was researched as background for the methodology of the WPI project.

6.1 PARTICIPATORY TECHNOLOGY DEVELOPMENT

Participatory technology development (PTD) is a mode of introducing land management techniques in which the farmers and researchers are both active participants in the design, implementation, monitoring, and evaluation of these techniques. It helps farmers to further develop and validate potential options for SLM methods by having them integrate the technologies of their choice into the farming systems. To clarify terms, PTD is the use of participatory methods to introduce technologies to farmers, while PRA is the use of participatory methods to create a detailed profile of a village and its farming activities. PTD was developed in the 1970's, when the *transfer of technology* (TOT) approach began to fail. In TOT, all key research decisions were made by the researchers or officials, and then resulting technologies were transferred to the farmers. Resource-poor farmers would not accept new technologies or adopt them in their lands because the TOT approach did not take into account the complex socioeconomic issues surrounding land management. For example, a technology such as vegetated waterways might have proven to greatly reduce soil erosion, but was not adopted by farmers because it was simply not profitable to them on the short-term basis [Bechstedt, 1997].

Figure 17: Farmers and extentionists working together in Huey Thong village

6.1.1 Principles of Participatory Technology Development

The implementation of PTD is governed by principles that guide the direction of land development. These principles were developed by IBSRAM to aid in the acceptance and appropriate use of PTD by NARES and other IBSRAM members. The main ideas behind the use of PTD fall into three broad categories: focus of farmers' perceptions, involvement of farmers, and holistic and interdisciplinary approach.

Focus on Farmers' Perceptions

One principle of PTD is the emphasis on early analysis of resources, including physical resources such as seed or fertilizer, and economic resources such as labor and profit. In order to learn the truth about these resources, the farmers' attitudes, goals, and perceptions must be carefully scrutinized. For instance, if farmers believe that they will be subsidized if they are considered poor, they may exaggerate their debt.

Involvement of Farmers

Another principle is the involvement of the farmers in all aspects of research, and in selecting and testing an appropriate technology [Bechstedt, 1997]. The farmers are most knowledgeable about their land and needs, and the researchers are most knowledgeable about the available techniques; together they can arrive at an applicable and sustainable technique. Ultimately,

the farmer decides whether a technique is adopted or not and, therefore his or her opinions are the most important factors in choosing a technology.

Holistic and Interdisciplinary Approach

Every activity of a farm is intertwined with many other farming components and operations. Hence, proposed solutions must take into account all closely linked problems. A holistic approach implies the use of an interdisciplinary research team that can better see all aspects and implications of a technology [Bechstedt, 1997].

6.1.2 Goals of Participatory Technology Development

Three main goals of the participatory approach are: improved communication with the farmers, incorporation of indigenous technical knowledge with scientific technical knowledge, and improved linkage between resource-poor farmers and researchers.

Improved Communication

Successful research requires frank, straightforward opinions expressed by the farmers, which in turn require trust and confidence between the individuals involved. Trust can be achieved through better communication skills. IBSRAM trains its members in listening skills, body language, probing, and use of neutral questions in order to communicate respect, attentiveness, and impartiality [Bechstedt, 1997]. This approach invites the farmers to articulate their own opinions, rather than leaning toward what they think the researchers are hoping to hear. Cultural differences must be taken into careful consideration.

Incorporation of Indigenous Technical Knowledge

"Nobody has a better understanding of the different needs and opportunities the farm offers than the farmer himself. Nobody is better able to judge which kind of technology would be required and how to get it to work on the farm. New technologies are therefore more likely to succeed the earlier the specialized 'farming systems know-how' of farmers is utilized and combined with

the technical knowledge of researchers and extentionists" [Werner, 1993]. This "farming system know-how" is referred to as a *indigenous technical knowledge* (ITK).

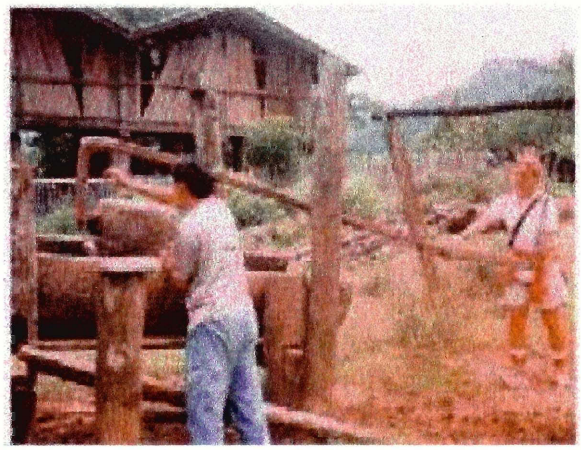

Figure 18: Indigenous technical knowledge

The knowledge systems of both researchers and farmers are important in the incorporation of new methods, and ITK can facilitate understanding and communication. ITK is especially pertinent to SLM because it is site-specific, dynamic, adaptive to local conditions, incorporates cultural norms and social roles, and is more relevant for small, resource-poor farmers [Bechstedt, 1997].

Improved Relationships

The need to improve relationships is urgent with respect to resource-poor farmers, because they face both environmental and technological restraints without the sufficient power to exert pressure on researchers or government to make them more responsive to their needs. The establishment of a true partnership between farmers' organizations and research institutes requires steps such as encouragement of strong, knowledgeable farmers' organizations, sensitizing researchers to their needs, and improving the representation of farmers. Table 1 shows key elements of conventional versus participatory farmer-researcher relationship [Bechstedt, 1997].

Table 1: Key elements of conventional and participatory farmer-researcher relationships

Conventional View *Of Farmer-Researcher Relationship*	*Participatory View* *of Farmer-Researcher Relationship*
Researcher is the expert—farmer is the layman.	Researcher and farmer are experts in their own knowledge and experience.
Researcher represents modern agriculture—farmer represents backward traditional agriculture.	Both types of knowledge merit respect.
Researcher deserves respect from the farmer; farmer shows respect.	Researcher and farmer mutually respect and esteem each other's work and way of life.
Researcher asks questions and the farmer gives replies or complies.	Researcher is motivated and able to answer, listen, and learn from the farmer, who therefore teaches as well as learns.
Researcher makes decisions and farmer complies with researcher's decisions.	Farmer, assisted by the researcher, will make and be responsible for decisions.
Researcher is expected to teach and convince the farmer that a technology is better than existing practice, while the farmer is supposed to learn from the received wisdom.	Researcher and farmer jointly examine if the technology actually addresses the needs and goals of the farmer in a sound, effective, and sustainable way.
Researcher controls strategic resources—farmer lacks control and is powerless.	New technology strengthens the farmer's control over resources and enhances empowerment.

6.1.3 Role of Extentionists

The role of the extentionists is bringing knowledge to the farmers, while at the same time providing inspiration and motivation to succeed in agriculture. The extension team bestows the farmers with *teet a-vut tang panya,* or a "wisdom weapon"—the concept of knowledge as a weapon to combat land degradation. This notion asserts that there is no better, more flexible, or more all-encompassing way to meet a farmer's needs and to address the complex problems of farming, than to develop the mind. Extentionists provide the "wisdom weapon" to encourage farmers to identify opportunities as well as problems, and to make decisions on these discoveries [Chandrapatya, 2000].

6.2 PERSONAL INTERVIEWING

Surveying is a powerful technique used in the social sciences to collect data such as opinions, attitudes, and behaviors of people. Personal interviews are a type of surveying in which participants are chosen specifically because of their availability, knowledge, interests, etc. instead of by random selection. An interview should be organized so that first the background of an interviewee is established. Then the details of relevant experiences are communicated, and finally the importance of these experiences, in relation to the problem under investigation, is conveyed [Isadore, 1998].

6.2.1 Styles of Personal Interviews

Personal interviews come in three broad styles and differ in the extent of standardization in the questions. To get the most straightforward and most representative data, it is important to choose the style that best fits the kind of results for which the researcher is looking.

Standardized Interviews

Standardized interviews utilize a structured script of questions to get simple and brief answers from the farmer. Bias is substantially decreased and results can be modeled for a large group, but this method is not appropriate when a flexible technique is needed or when a researcher wants to capture detailed data.

In-depth Qualitative Interviews

An in-depth qualitative interview is flexible and exploratory. The researcher adjusts follow-up questions depending on how the interviewee answers earlier questions [Doyle, 1999]. This allows for rich, detailed data and helps the researcher understands the experiences of participants. However, this method is not representative of a large or random sample and has a higher probability of the presence of biases. Open-ended questions best suit in-depth qualitative interviews.

Focus Group Interviews

Focus group interviews are flexible, guided group discussions that rely on group dynamics for data collection. This kind of interview provides researchers with large-scale comprehension of a situation in a shorter amount of time than other surveying techniques such as natural observation.

6.2.2 Challenges of Interviewing

When performing any type of interview, there are a number of difficulties that should be kept in mind in order to receive accurate results. First, a single survey does not prove a correlation; therefore, other means must be applied in order to corroborate results. An interviewer might use data directly from previous surveys, or build from them to enhance the credibility of his or her results. A second problem is the existence of biases in any form. Interviewers may bias a survey by how they word a question, the order of the questions, the manner in which they ask the question, or inaccurate representation of results. The interviewee may also create bias by answering to make him- or herself look better—for example, they may answer according to their preconceived notions of the interviewers' expectations [Doyle, 1999].

Minimizing Biases

In order to minimize biases, the researchers should focus on listening to the interviewee and not lead answers in any specific direction. They should interrupt as little as possible and take into account cultural and/or social miscommunication.

Tape recording or transcribing the interview verbatim is the best way to minimize bias [Doyle, 1999]. This guarantees that original data is kept intact, data collection and analysis is kept

separate, and the researcher can concentrate on the interview process. The goal of analysis is to identify and extract the most important, meaningful, and interesting parts of the interview for data analysis purposes. There exists a delicate balance between extracting and interpreting pertinent information without simply fulfilling the preconceived notions of a researcher.

Choosing participants

A limited number of people can be chosen to participate in an interview. It is most important to pick a range of candidates who can present the widest possible range of opinions and experiences. This way the interviewers will not be accused of only using participants whose thoughts conform to researchers' expectations.

Ethical Considerations

In choosing participants, it is crucial that researchers take ethical considerations into account. Ethically, interviewers are required to obtain informed consent of the subjects. This means that researchers are very honest about the purpose, origins, and the procedures of the study, and the uses of the interview data. Confidentiality must be kept and any negative effects of an interview must be carefully considered [Doyle, 1999].

6.3 COMMUNICATION SKILLS

A researcher needs more than technical knowledge of land management to effectively involve farmers in the development of their farming techniques. The interviewer must be extremely aware of his or her speech and actions to facilitate the most honest and unguarded responses from the farmers. When using proper communication skills, dialogue with the farmer will lead to improved communication and honest opinions. These skills are especially important in open-ended interviews where researchers want to discover the attitudes and perceptions of the farmers.

6.3.1 Factors Determining the Relationship

When talking to researchers, farmers are often aware that the researcher is considered to be of higher social status, has a higher education, may represent the government, and may even be

from a different ethnic group or speak a different language. As a result, farmers are guided by their expectations of the researcher, are sometimes suspicious of official motives, tend to defer to what they believe is the view of the researcher, and/or try to be as polite as possible. The interviewer must be conscious of these factors in order to get frank opinions from the farmers.

6.3.2 Listening Skills

The interviewer must be attentive and receptive to anything that the farmer says, even if it is contrary to scientific technical knowledge. This will show respect for the farmers and their opinions, increasing their confidence and openness. In return, the farmers will feel more comfortable and secure in the interviewers' sincerity and motives.

6.3.3 Body Language

A researcher's stance, body position, facial expressions, and hand gestures can give off significant signals to the farmers. Open postures, attentive faces, or an action as simple as a smile will convey respect and attentiveness. In cross-cultural situations, social norms and taboos concerning body language must be studied by the interviewers in preparation.

6.3.4 Probing

Probing is a technique that combines good listening skills with open-ended questions. The researcher will clarify the opinions and reconfirm statements of the farmers by rephrasing or repeating sentences in the form of neutral and open questions.

6.3.5 Open Questions Versus Leading Questions

One of the biggest dangers in interviewing is the use of *leading* questions. A leading question is one that gives only the options of yes or no as answers, a question that articulates the researchers' opinions, or a question that might pressure the farmer to answer in a specific manner. An example of a leading question is, "Do you use the technique of terracing to combat the problem of soil erosion?" It is leading in many ways: this question assumes that the farmer knows about soil ero-

sion and thinks it is a problem, it suggests that farmers should be using techniques they may have never heard of, and is accusatory in general.

Open and neutral or balanced questioning is the technique that eliminates the use of leading questions and thereby increases the farmer's confidence in and validity of his or her answers. To eliminate all direction of the answers by the researchers, the interviewers must restrain and be conscious of their own opinions about the issues at hand. The following are examples of open questions: "Can you tell me more about this?" "What makes you see it this way?" "How do you think other farmers would feel about this?" The use of questions such as these allow the interviewee to provide answers and information without being inhibited by the researcher's expectations [Bechstedt, 1997].

V - METHODOLOGY

The goal of this project was to assess the attitudes and perceptions of the farmers of the Huey Thong village concerning land management techniques and the extent of their adoption. The data acquisition was accomplished through a focus group and ten in-depth, personal interviews. The focus group interview was conducted using the participatory research model, and the personal interviews were carried out in a semi-structured, open-ended manner. The information was translated by Dr. Suraphol Chandrapatya and Khun Jutima (Took) Anumatrachakit of IBSRAM, and then recorded by the WPI project team in the form of notes. The in-depth interviews were analyzed qualitatively and compared with the information obtained from the focus group interview.

1 THE HUEY THONG PILOT PROJECT

The purpose of the Huey Thong pilot project, under the DOAE and IBSRAM, was to investigate the capability of on-site, farmer-managed practices for adopting land management techniques. This experiment involves four primary stages of a farmer's acceptance of a new technique: knowledge, persuasion, decision, and implementation [Chandrapatya, 1998]. The complete process is modeled in Figure 19. The final stage, implementation, is the step that the WPI project team investigated.

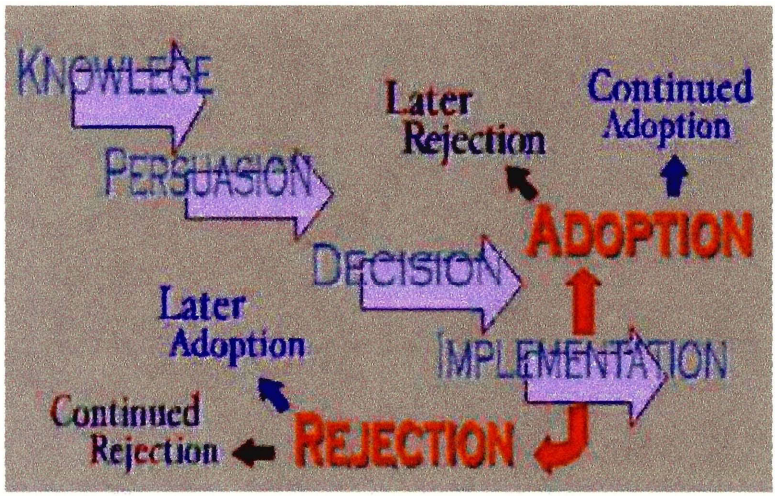

Figure 19: Model of stages of a farmer's adoption of a technique

1.1 KNOWLEDGE

The knowledge stage occurs when the farmer is exposed to the technique's existence and gains an understanding of how it functions. In the pilot project, this stage was accomplished either when the farmer attended a conference in Chiang Mai, or when he or she was introduced to the technique by a knowledgeable extension worker or farmer.

1.2 PERSUASION

When the farmer develops a favorable (or unfavorable) opinion of the technique, persuasion has occurred. The farmers of Huey Thong formed opinions of the land management techniques during a Chiang Mai conference, and expressed these opinions in the presentations each person gave on the last day of the conference.

1.3 DECISION

The decision phase occurs when the farmer engages in an activity that leads to a choice to either adopt or reject the technique. The Huey Thong villagers tended to come to a decision after discussing technologies with neighbors, family members, and/or their spouses.

1.4 IMPLEMENTATION

The implementation of a technique occurs when the farmer actually adopts or rejects the technology for his or her farm. Implementation can continue up until the land management technique is considered obsolete. If the farmers have adopted the technology, they can choose to later reject it or continue using it while on the other hand, farmers who have originally rejected a technique may choose to adopt it later [Chandrapatya, 1998]. The WPI project team visited Huey Thong and interviewed farmers to assess the success of this last stage of implementation.

2 FIELD VISIT PREPARATION

The most important experience during the WPI project was the actual fieldwork, thus the visit had to be carefully thought out and planned. Four key steps were followed to prepare for the field trip to Huey Thong: clarification of the goal, selection of main topics, preparation of subtopics, selection of data collection techniques, and preliminary steps for the visit.

2.1 CLARIFICATION OF GOAL AND OBJECTIVES

The first step of preparation required the team to better refine the focus of the project, and to evaluate new objectives appropriate for achieving this new goal. To this end, the group continued to investigate previous work in Huey Thong, and discussed field visits and the participatory research model with Dr. Suraphol Chandrapatya, an expert on both subjects.

2.2 SELECTION OF MAIN TOPICS

Once the goal was refined, main topics were chosen for the project interviews that would encompass all approaches to assessing the implementation stage of farmer adoption. The selected topics were:

- Farmer background
- Agricultural experiences and problems
- Land management technique adoption
- Communication issues

2.3 PREPARATION OF SUBTOPICS AND KEY QUESTIONS

When an issue was too complex to be approached in one piece, it became necessary to break it down into manageable parts. However, it was still important to keep the overall purpose in mind. Subtopics and key questions were extracted from the list of main topics. The subtopics addressed in the interviews under the topic of "farmer background" were:

- Farmer age
- Family size
- Education level of farmer
- Sources of income for household
- Ownership of livestock
- Farm size
- Cash crops grown
- Decision making process for household

The subtopics under the topic "agricultural experiences and problems" were:

- Villagers' opinions of problems
- Prioritization of these problems
- Problems encountered specifically on farms
- Attitudes of the farmers about soil erosion

The subtopics under the topic "land management technique adoption" were:

- Opinions on land management techniques
- Extent of use of land management techniques
- Reasons for ending use of land management techniques
- Use of alley cropping

The subtopics addressed in the interviews under the topic of "social issues" were:

- Overall conditions of the village
- Role of women influencing the adoption of techniques
- Communication within the village

2.4 Techniques for Collecting Information

The last step in the preparation for the field visit was to select techniques of data collection that most effectively dealt with the prepared topics. It was decided that a focus group and in-depth personal interviews would be used. The focus group, using participatory methods, would best address the overall conditions of the village and its problems. The in-depth interviews would deal with the remaining subtopics, and discover individual knowledge, attitudes, and backgrounds, as well as uncover opinions that might not be expressed during the focus group interview. Different sequences of questions were discussed, and the final interviews used are listed in Appendix A.

2.5 Preliminary Steps of Visit

Before traveling to Loei, Dr. Suraphol established contact with the district DOAE authorities and with the headman of Huey Thong. The WPI team planned the field trip so that the community life was disrupted as little as possible. Arrangements for the transportation, lodging, and food for participants were made, along with determining the locations for the focus group and the in-depth personal interviews.

3 Interviews

Since open-ended, qualitative interviews were performed using the participatory method, it was not imperative to have an extensive set of questions to cover every issue. Instead, it was more important to have a few key questions to give direction to the interview, and to then use follow-up questions to clarify each answer [Chandrapatya, 2000]. Information gathering, analysis, and interpretation are continuous and constantly changing processes. Thus, there was a need for regularly reviewing and assessing data as it was presented, in order to plan the next follow-up question or the next phase of each interview.

3.1 Participatory Approach

When interviewing following participatory guidelines, researchers should not simply present knowledge to farmers. Instead, they should ask questions that permit the farmers to come up

with their own conclusions. Interviewers need to be careful not to lead farmers to respond in a manner that only reflects the interviewers' own expectations.

3.1.1 Participatory Methods Versus Traditional Surveying

Participatory methods of interviewing can be compared to traditional surveying methods; each technique is more suitable for different situations (see Table 2). In general, participatory methods are best for learning and understanding rural people's needs, opinions, expectations, and attitudes. Surveying is best for gathering representative, quantitative data and for statistical analysis [Bechstedt, 1997].

Table 2: Participatory research method versus traditional surveying

	Participatory Research	*Survey Research*
Duration:	Short	Long
Cost:	Low	Medium to high
Scope:	Wide	Limited
Depth:	Introductory	Exhaustive
Structure:	Flexible	Fixed
Participation:	High	Low
Major research tools:	Group discussion	Formal questionnaire
Preference:	People-related information	Factual information
Statistical analysis:	Little or none	Major part
Individual case:	Pertinent	Not pertinent
Organization:	Non-hierarchical	Hierarchical
Data:	Qualitative	Quantitative
Analysis:	On-the-spot or in the field	Office-based
Team:	Multidisciplinary	Enumerator

3.1.2 Limitations of the Participatory Approach

Teamwork, experience, and an interdisciplinary approach are critical to the success of participatory research. If these attributes are not available, participatory interviews of a village may be counterproductive or present unreliable data. Limitations may include difficulty in extracting exact information, lack of time to spend in a village, difficulty in finding a multidisciplinary team, lack of experience of team members, and lack of understanding of the process by any involved individual.

3.2 FOCUS GROUP INTERVIEW

The first interview of the fieldwork utilized a focus group of the farmers of Huey Thong. The group was interviewed to gain information about the social, economic, and biophysical characteristics of the village's agricultural community.

3.2.1 Objectives of Focus Group

The focus group with the farmers was held to accomplish three objectives. The first objective was to obtain a detailed prioritization of the problems in the village, according to the people of Huey Thong, which could not be done in personal interviews. The second was to gain preliminary understanding of the social, economic, and agricultural characteristics of the village, in order to gauge the appropriateness of the personal interview questions. Finally, the focus group interview was performed in order to provide an alternate source of validation. Rather than performing additional personal interviews to confirm the research, a focus group would provide supplementary information while simultaneously revalidating the personal interview data.

3.2.2 Focus Group Interview Process

The focus group interview was a five-part process. First was an introduction and initial discussion, followed by further discussion and a listing of problem statements within sub-groups. After the lists produced by the sub-groups were consolidated, this list was prioritized using a partici-

patory technique for ranking problems as a group. The focus group interview was concluded with some final discussion about land management on the farms.

Introduction and Initial Discussion

The first part of the focus group process began with an introduction of the WPI project team and the extension officers of the DOAE, and then a brief statement about the objectives and goals of the project. The introduction was followed by a group discussion about the current state of the village's agricultural lands and some preliminary investigation into which problems have recently presented the most difficulty for the community. The farmers were then questioned about the major changes that had occurred in the village agriculture over the last few years.

Discussion of Problem Statements in Sub-groups

The next task was to divide the focus group into sub-groups for more specific discussion on the problems of the village. Each of the sub-groups, composed of six to nine farmers, was facilitated by one of the DOAE extension officers and observed by a member of the WPI project team. According to participatory research standards, this size of sub-group is ideal for maximizing the sharing of ideas and communication between farmers. The sub-groups were separated, so that the members could become involved in greater discussion without interference from another group. Each was asked as a group to devise a list of the most serious problems facing the village of Huey Thong, which would later be combined with the lists of the other groups.

Consolidation of Problem Statements

In the third part of the focus group interview, a compilation of the agricultural concerns of the entire village was created out of the three separate sub-group lists. Dr. Suraphol managed this process, using the participatory research model. Any problem statements that were similarly recorded in all three lists were carefully re-worded to be as representative as possible, and placed on the master list. If a problem had only been raised by one or two of the groups, the rest of the farmers were asked to evaluate to what extent they felt it was a problem, as well. Often, different sub-groups were asked to clarify or otherwise explain some of the problem statements on their individual lists. When this process had been completed, the result was a list of problem statements agreed upon by

all of the farmers present, and thus was a representation of the collective concerns of the village as a whole.

Prioritization of Problem Statements

Once a compiled list had been created, the next part of the interview was to rank the problem statements according to how serious the farmers perceived them to be. To accomplish this, the project team used a participatory research technique proposed by Dr. Suraphol.

To rank the problems, the farmers were first given a number of stones, depending on how many problem statements were listed. It was explained to the farmers that they must put the same number of stones as there were problem statements next to the one that is most important. The farmers continued in this manner, putting one less stone next to each problem of successively lower importance than the first. Eventually, there was one stone remaining for the problem of least significance.

The benefits of using this process to rank the problems are many. First, as the farmers often have limited levels of education, the stones succeed in making the abstract process of prioritization much more tangible, and thus easier for the farmers and more likely to produce accurate results. Also, the use of the stones makes the intermediate ranking more precise, as the farmers can easily determine if problems statements of similar importance should be ranked higher or lower. Another benefit is that the participatory nature of the process allows greater cooperation between the farmers, and serves to encourage teamwork and a sense of community involvement in addressing the problems of the village. Finally, the technique used was flexible enough to accommodate a range of groups and problems. For instance, in the case of a division between the farmers about which of two problems is more important, either a vote can be taken, or the same number of stones can be allocated to each, signifying equal importance. This flexibility allows the researcher greater control while mediating the focus group.

Examination of Techniques and Concluding Discussion

Once the problem statements had been prioritized, the last step of the interview was to discuss the methods that the farmers use to deal with these concerns. The farmers were asked about

the techniques that they use for land management on their farms, and were also asked to give their opinions about why these methods seemed to be working or not. After this discussion was completed, the farmers were thanked for their time and their hospitality, and the focus group interview was concluded.

3.3 PERSONAL INTERVIEWS

The personal interviews were completed in a span of two and a half days, and consisted of preliminary farm visits and ten semi-structured interviews with farmers. The first full day of interviews was organized to include five farmers who had attended a Chiang Mai conference on land management, whereas the second day comprised of five interviews with farmers who had not attended a conference.

3.3.1 Objectives of Personal Interviews

The objectives of the personal interviews were to obtain individual opinions from the villagers about their farms, to compare the attitudes of farmers who had been trained with those who had not, and to gain understanding of their perspectives on village communication. The semi-structured, in-depth method of interviewing would allow for a better understanding of the farmers' techniques, attitudes, and experiences on an individual basis. Since the level of education of the farmers in Huey Thong was reasonably low [Rittikamron, 2000], the personal interview style was chosen as a method that could maximize the content of the responses of less educated farmers [Doyle, 1999].

3.3.2 Preliminary Visits

Immediately after the conclusion of the focus group interview, the farms of two of the most progressive farmers in the village were visited in order for the project team to see alley cropping and observe the farming lifestyle firsthand. Preliminary questions were asked of these progressive farmers to gain a better understanding of subsistence farming, to reconfirm the relevance of interview questions, and to make last-minute changes in the question wording.

3.3.3 Progression of Interviews

Each interview was held at a meeting site within Huey Thong, and both sets of farmers were asked the same interview questions. One member of the WPI team would ask a prepared topic question, which was then translated by Khun Took. After each prepared key question, several follow-up questions ensued, with the purpose of clarifying a farmer's response, delving further into their opinion, or gaining additional information about the topic. The farmer's replies were, in turn, also translated and recorded as notes by the project team.

All interviewed farmers remained at the meeting site until the completion of all interviews so that additional follow-up questions could be asked of each, if the need arose. Several extension officers from the DOAE were present to facilitate interpretation of technical or agricultural terms, and to aid the WPI project team with the use of the participatory approach.

Since the interviews could not be recorded verbatim, each WPI team member took notes individually so that the recorded interviews could later be compared and discussed in order to eliminate any bias occurring during note taking [Doyle, 1999]. Every interview question, including follow-up questions, was worded in an open-ended, balanced manner to avoid leading the farmers to conclusions not of their own thinking.

VI - RESULTS AND ANALYSIS

This section contains the results of the interviews and the subsequent analysis of those results. The findings were the principal source of information to evaluate the extent to which the farmers of the Huey Thong village have adopted land management techniques on their farms.

1 INTERVIEW RESULTS

The experimental information to support an assessment of the Huey Thong project was obtained from a focus group and ten personal interviews. In the focus group interview, the farmers made a prioritized list of the problems facing the village, and they were asked about any techniques they were currently using to deal with these problems. The personal interviews were with five farmers who have been trained in alley cropping and five farmers who have not, and were recorded in four sections: general information, farm characteristics, land management techniques, and communication and decision-making.

1.1 FOCUS GROUP: FARMERS OF HUEY THONG VILLAGE

The first phase of the field work in Loei province was the focus group interview with the farmers of Huey Thong. The session was held in the house of Khun Song Wangkeeree, the elected headman of the village. In addition to mediating the session, Dr. Suraphol Chandrapatya of IBSRAM acted as the translator, rephrasing the interview questions in Thai as they were asked. In the early stages of the interview, the number in attendance totaled 26 men and 2 women; as the day progressed, this number dwindled, with some of the farmers returning to the work of their farms. The interview itself began at 9:30 AM, and consisted of a five-part process: a general introduction and preliminary discussion; the formation of a list of problem statements within smaller focus groups; the fusion of these lists into an overall list of problem statements for the village; the ranking of this list in order of severity; and finally, a discussion of possible solution techniques and some concluding comments. The focus group was concluded by early afternoon.

1.1.1 Introduction and Initial Discussion

The first part of the focus group began with an introduction of the WPI project team and the extension officers of the DOAE, and then a brief statement about the objectives and goals of the WPI project. The introduction was followed by a group discussion about the current state of the village's agricultural lands and a preliminary investigation into which problems have recently presented the most difficulty for the community.

From the farmers' descriptions, the majority of their farmland area is sloping land, with a minor amount of flatlands in the small valleys between the hills. Each farmer grows a selection of crops specifically for household consumption, as well as cash crops to sell at the nearest market. For all of the farmers, the primary subsistence crop is upland rice; the entire group also plants Job's tear, both for subsistence and for profit. Other crops that the farmers mentioned were red bean, black bean, peanut, and a small amount of corn grown to feed livestock.

Next, the farmers were asked to generalize the major changes in the village agriculture over the last few years. The overall opinion was that farm production has dropped, exhibiting a steady and gradual decline over the past several harvests. When questioned about why they suspected this decrease had occurred, most farmers blamed low soil fertility. The farmers explained that most of them adhered to the *mono-cropping* system. This means that the farmers will grow a single main crop on a fraction of their land for four to five years and, when soil fertility starts to decrease, they move to a different section of their land [Chandrapatya, 2000]. Several years ago, the farmers had been planting corn, but due to the decreasing yields, as well as an increase in the price of seeds, they had switched to Job's tear. However, they had noticed that after the first year of planting Job's tear, they needed to add fertilizers to the land in order to maintain the previous production levels. This observation was their justification for claiming that the soil nutrient levels had dropped.

The farmers also mentioned that they had been increasing the number of fruit trees on their farms. Although they require a more substantial initial investment, the fruit trees demand less labor and seem to be hardier in withstanding the low-fertility soil. The types of trees grown included longan, lychee, mango, and papaya. Those farmers who had bought fruit trees were now beginning to see a return on their investments, as trees planted a few years ago were finally beginning

to bear fruit. At this point, the discussion was postponed, in order to continue with the second part of the interview—the small-group discussion.

1.1.2 Discussion of Problem Statements in Sub-groups

For the next part of the interview, the focus group was broken into three sub-groups and asked to compose a list of the problems facing the village. Each of the sub-groups was composed of six to nine farmers, and each was mediated by one of the DOAE extension officers and observed by a member of the WPI project team. After a period of approximately one hour, each group was able to produce a list of about a dozen items, which they considered the most serious problems threatening the village. During this time, it was observed that the farmers worked together and consulted one another much more than they did within the larger focus group; they also appeared to include the opinions of the few women farmers more than before—although often at the behest of the extension workers. The individual lists were not translated into English, and in the next part of the interview, the sub-group lists were used to compile a master list of problem statements for the village as a whole.

1.1.3 Consolidation of Problem Statements

The third part of the focus group interview required the farmers to consolidate the three separate lists of problem statements into a single list, a compilation of the agricultural concerns of the entire village, as shown in Figure 20. When this process had been completed, a total of 17 problems, which are listed in Table 3, had been deemed universal concerns among the villagers present.

Figure 20: Creating the combined list of problem statements in a focus group

Table 3: Combined list of problem statements

Problem Statement	Description
1. Not enough income	Farmers' level of income does not meet their consumption needs or those of their families.
2. Inadequate water supply	Especially during the dry season, the farms are in a continual state of drought.
3. Land degradation (low soil fertility)	Nutrient levels have steadily decreased in recent years, due partly to mono-cropping and soil erosion.
4. Lack of capital	Farmers lack funds to invest in tractors, fertilizer, and other agricultural input.
5. Decreasing crop yields	Total amount produced at each harvest has steadily decreased each year.
6. Low market price of products	Due to external economic factors, prices of farm goods have remained low.
7. Lack of knowledge	Particularly when changing to a new crop, farmers find they do not know enough about useful techniques.
8. Village is far from hospital	The nearest hospital is quite far away, and does not have enough volunteers to send to the village.
9. Do not form effective groups	Farmers sell their cash crops individually; they do not use a cooperative to enhance their bargaining power.
10. Do not have deeds for farmland	Many of the farmers cannot sell any of their land, lacking the necessary documents.
11. Village is far from market	Proximity of the market is an issue, since the farmers sell individually and must transport their goods there.
12. Soil erosion on farmland	Soil erosion has been augmented by the use of tractors for tilling along the grade of sloping farmlands.
13. Increase in cost of farm investment	Cost of total farm input has risen with an increase in price of seeds, fertilizers, and equipment.
14. Weed problems on farmland	Farmers have trouble with managing weeds, especially within the alleys of an alley-cropped slope.
15. Pest problems on farmland	Pesticides are expensive, and field-burning practices destroy natural predators.
16. Lack of village cohesiveness	Farmers feel that they suffer from poor cooperation and communication within the village community.
17. Fruit trees grow slowly	While a good long-term investment, fruit trees initially take a long time to generate a profit.

The complete list put forth by the farmers contained a wide array of problems, stemming from any one or a combination of social, economic, biological, and physical causes. Although the farmers suggested all of the items listed as presenting some level of difficulty to the community, the seventeen problems ranged greatly in severity. The next part of the interview was to have the group prioritize this combined list, according to the seriousness of each problem.

1.1.4 Prioritization of Problem Statements

The group was re-convened in the house of the village headman, and set to the task of prioritizing the combined list of problem statements by assigning a number of stones to each. There were 17 farmers present for this part of the interview. During the process, the farmers were observed to be interacting well, and most of them seemed to be contributing verbally to the work of appropriating the agreed upon number of stones to each problem. A picture of this part of the interview is shown in Figure 21. However, only a few of the farmers seemed to be taking the more active role of moving the stones, and their opinions appeared to be more influential than some of the others, who held back. The prioritized list that the farmers produced is shown in Table 4. The only items about which there were a division of opinion were problem statements (1) and (2). "Not enough income" was chosen as the most severe problem by only nine of the farmers present, while the remaining eight chose "lack of capital" to be first on the list. All agreed, however, that these two were the most urgent.

Figure 21: Prioritizing the problem statements in the focus group

Table 4: Combined and prioritized list of problem statements

1. Not enough income
2. Lack of capital
3. Do not have deeds for farmland
4. Decreasing crop yields
5. Increase in cost of farm investment
6. Inadequate water supply
7. Land degradation (low soil fertility)
8. Low market price of products
9. Soil erosion on farmland
10. Lack of knowledge
11. Weed problems on farmland
12. Pest problems on farmland
13. Fruit trees grow slowly
14. Village is far from market
15. Lack of village cohesiveness
16. Do not form effective groups
17. Village is far from hospital

The two problem statements which related most directly to sustainable land practices, "land degradation" and "soil erosion", were ranked seventh and ninth in priority, respectively. The fifth part of the focus group interview provided further insight into how the farmers were dealing with all of these problems.

1.1.5 Examination of Techniques and Concluding Discussion

The final part of the interview contained a series of questions about the techniques that the farmers use to manage land degradation in the village farmlands. At this point in the interview, there were 16 farmers present (14 men and 2 women). The discussion focused on what techniques they did or did not use, and their advantages and disadvantages. Dr. Suraphol translated all of the questions and the farmers' responses as they were related.

Question 1: Why do you think that soil quality is low?

The farmers agreed that the system of mono-cropping is particularly responsible for the land degradation, and they admitted in general to caring poorly for the land. A few of them added that tillage up and down the slope instead of across it (which is unfortunately dangerous to attempt with a tractor on the steep lands) adds to the soil erosion problems. When asked about other practices that could be responsible for agricultural problems, the farmers noted the burning of dead fields before they are plowed again. This practice is contributes to the pest control problem; while the fires do kill the pests, they also kill helpful natural insect predators.

Question 2: How do you solve these problems?

Some of the farmers said they choose to plow their fields along the contours of the slopes, but this is not popular since it must be done by hand. Many of them, especially those who had been to one of the conferences in Chiang Mai, perform alley cropping on some part of their land, using leucaena and pigeon pea for the hedgerow material. One of the farmers, Khun Bauw Sitasung, had recently planted hedgerows of pineapple, which if successful, would provide adequate soil erosion management along with a commercial profit. The only other technique that was mentioned was using hillside ditches, but this was said to be only effective for lower-grade slopes.

Question 3: Do these techniques work well?

The most common response was that alley cropping was difficult because they did not know of a suitable hedgerow material—one that was cheap and easy to plant, could withstand the Loei growing conditions, and produced a vendible product. Many of the farmers had tried hedgerows that were a combination of leucaena and pigeon pea plants. They said that the leucaena did not grow well because of the high soil acidity, and while the pigeon pea flourished and yielded an edible product, the plants died after a few years. Khun Bauw could not comment on the effectiveness of the pineapple hedgerows he had recently planted, as it was too early to judge whether they would be successful. Another possibility for hedgerow material, the farmers said, was lemongrass; however, the plants were only effective for about two years, and then eventually died from the lack of available water.

Question 4: If you do not use these techniques, why?

All of the farmers who did use land management techniques had been to one of the Chiang Mai conferences, except for two who had been trained by other farmers in the village. The remainder did not use any techniques to manage land degradation, and most had not been to one of the conferences. Some of them claimed to have tried alley cropping, but were discouraged by the fact that no truly suitable hedgerow materials were available.

Question 5: What are some of the advantages and disadvantages of these techniques?

A sizeable fraction of the focus group agreed that the alley cropping technique helped slow the rate of soil erosion on their farms. They also cited the ability of the pigeon pea to provide an edible crop as another advantage. Many of the farmers, though, felt that alley cropping did not provide worthwhile short-term benefits. They said that the plants did not grow well initially, and they had trouble keeping the hedgerows alive. In addition, since the alleys, as well as the crops between them, must be planted along the contours of the slope, the entire practice required much more labor than they could afford. Finally, many of the farmers said that the hedgerows were easily consumed by the fires that occasionally swept through the farmlands, rendering their hard work and investment useless.

Question 6: Do you talk to your neighbors about your ideas for your farm?

Some of the farmers stated that they never discussed farming practices with their neighbors. Others said that while they did try to talk with their neighbors about techniques that they were trying, often the farmer was not very receptive. One of the reasons offered for this was that many of the villagers are not eager to adopt any practice that does not conform to the traditional farming methods. A few villagers claimed that although they discussed ideas with their neighbors, they had trouble justifying why alley cropping was a more desirable practice. Nearly all of the farmers who had been to one of the conferences in Chiang Mai said that they had talked to their neighbors upon their return. When asked about communication within the home, 11 of the 14 male farmers present said they discussed their ideas about farming techniques with their wives.

Question 7: Do you plan to continue your current practices? Why or why not?

The majority of the farmers present claimed that they would continue with some form of land management practice. The most popular practice of those available seemed to be alley cropping; many of the farmers had been trained in the process and said they knew how to make contour lines. There were a few other individual reasons for continuing: one farmer said that he believed alley cropping would eventually improve his soil quality, and another said he would continue because it had been too short a time to tell if the technique was successful. A third farmer said that he would continue because he appreciates how beautiful the hedgerows are.

However, some of the farmers who said they would continue with land management went on to add that due to restrictions on the labor they could provide, they would only continue alley cropping on a limited scale. For most, this meant that they would maintain alleys in their orchards, since the various fruit trees are all high-investment crops that require little labor, but yield a good long-term reward. In response to the comments about labor, Khun Song said that the main reason Khun Bauw has been so successful on his farm is because he works hard to solve problems when they arise. Many of the other farmers agreed that, compared to Khun Bauw, they did not put as much effort into solving the problems of their farms as perhaps they should.

1.2 PERSONAL INTERVIEWS: DOAE-TRAINED FARMERS

The first five interviewees were selected because they have attended one of the Chiang Mai conferences. They have been trained in the use of alley cropping in order to reduce soil erosion on their farms.

1.2.1 Interview 1: Khun Bauw Sitasung

Khun Bauw was born in Dan Sai 53 years ago. He completed four years of elementary education before he started his life as a farmer. Khun Bauw lives with his wife, four daughters, and young nephew. His eldest son is currently attending university, the fee for which is the household's biggest expense (about 30,000 – 40,000 Baht per year).

Khun Bauw is the main decision maker of his household. He is helped on his farm by his wife and his children, who assist when they are on holiday from school. His main source of income is agriculture. Khun Bauw not only grows lychee, longan, papaya, and mango trees, red bean, and pineapple, but he also raises six water buffalo (he is the only person in Huey Thong who owns water buffalo), chickens, and fish. His fishpond and some of his land are shown in Figure 22. He sells fruit and fish to his neighbors and at the market, and has been resourceful enough to breed lychee trees, which he also sells. Khun Bauw's farm is about 100 rai.

Figure 22: Fish pond on Khun Bauw's farmland

Khun Bauw's biggest problems on his farm deal with the irrigation and fertilizing of his fields. He has minimal trouble with soil erosion, which was reduced even more when he started using alley cropping four years ago. Khun Bauw grows hedgerows of pineapple plants and leucaena, and uses peanuts and red bean as the field crops within the alleys. In the past two years, he has grown red bean in the alleys, which he plans to change this coming year. He also plans to plant banana trees within the hedgerows. Currently alley cropping is used on 20 rai of his farm.

Khun Bauw claims that alley cropping has helped him protect his fields from soil erosion. He believes that this farming technique is profitable, as his red bean crop has prospered. He noted that the hedgerows provided a healthy shadow for the alley crops. Also, he was able to use the red bean crop residues as a compost fertilizer.

In the past, Khun Bauw tried to combat soil erosion by using the hillside ditch technique, but alley cropping has been much more successful. A few of his neighbors, all of whom have attended a conference in Chiang Mai, use soil erosion techniques. Some of them know about the techniques that he uses, but do not have the money for the labor required to maintain hedgerows. Khun Bauw declared that he will continue using alley cropping because "it is the best".

The extension workers have named Khun Bauw "The Innovative" or "The Progressive" farmer. The other farmers admit to his being much more diligent than themselves. The other villagers said that when they have problems on their fields, they would go home and not bother to try and fix it, whereas Khun Bauw would not leave the fields until the problem was solved. It is because of this attitude that Khun Bauw went from being a relatively poor to comparably one of the richest farmers in Huey Thong. His determination and resourcefulness have led Khun Bauw to pursue such innovations as piping water to his farm from the mountains, which is how he created his own fishpond. In order to finance such an undertaking, Khun Bauw received a loan from the Thailand Bank of Agriculture, something that all farmers can do. When Khun Bauw borrows money, he uses all of it to improve his farmland, while other farmers use it for different purposes as well.

1.2.2 Interview 2: Khun Ket Prommawan

Khun Ket, shown in Figure 23 (along with the project team and Khun Took), is a native resident of Huey Thong. He is a forty-year-old farmer who lives with his wife, two sons, daughter,

and his father-in-law. Khun Ket has been farming since he finished school, which was after four years of education. His wife and he take care of the farm, as his children are in school. Khun Ket is the primary decision maker of his house. His biggest expense comes from paying for labor to help him on his farm, which usually amounts to about 10,000 Baht annually. His household's main source of income is agriculture, though Khun Ket also works as a carpenter when he is needed.

Figure 23: Interviewing Khun Ket (center)

Khun Ket's land spans approximately 80 rai, on which he grows upland as well as low-land rice, ginger, and Job's tear. He does not raise livestock. Khun Ket's biggest problems on his farm originate from forest fires and the generally low quality of soil. He also has had trouble with lack of money, the large distance between the village and the market, and the low prices for which his produce sells in the market. He has no irrigation system, and so depends on rain for the water his crops need.

Khun Ket is aware that soil erosion is a problem on his farm because he sees the rain washing his soil away. He attended the DOAE's and IBSRAM's conference, and used alley cropping for two years. In 1997, his hedgerows were destroyed in the forest fire that devastated 80% of Huey Thong, and since then he has not restored them. He plans to do so in the future, but presently does not have the money needed to hire the extra labor that would be required. Khun Ket found alley cropping to be helpful in protecting against soil erosion. His biggest problem with alley cropping was the weeds that were difficult to eliminate.

Khun Ket says that he shares his farming techniques and ideas with his neighbors. According to him, they were interested in his alley cropping when they saw it, but he is unsure whether they would actually apply it to their own farms. If Khun Ket starts to use alley cropping once again, he will use it in small sections on each plot of land that he owns, instead of concentrating it all on one field.

1.2.3 Interview 3: Khun Song Wangkeeree

Fifty-one-year-old Khun Song Wangkeeree has been the headman of Huey Thong for the past 24 years. He was elected into office, and will retain this position until he retires. Khun Song was born in Huey Thong where he was educated for four years, and currently lives with his wife, daughter, and two sons. His children help him on the farm when they are on vacation from school, but his wife generally only does the housework. Khun Song and his wife make decisions for the household together.

Khun Song's household's main source of income is agriculture. On their farm, they grow Job's tear, ginger, and upland rice, and they have recently started growing lychee and longan trees. Their farm covers 60 rai, and houses the family's chickens. The biggest problem that Khun Song has to deal with is that of not possessing the ownership deed to his land. As a result of this, he is unable to sell any of it. He is also unable to develop his land, as often these developments require permits.

Khun Song believes that soil erosion is a problem on his farm, because he observes the soil losing its fertility. After attending the conference in Chiang Mai, he used alley cropping. He stopped after the 1997 forest fire devastated his farm, and since then has not had the time to re-grow the hedges. Khun Song thinks that alley cropping is helpful, but it requires a lot of time to maintain. A problem that he dealt with in regards to his alley cropping was that he found it difficult to eliminate weeds that grew in the hedges. When he used alley cropping on his fields, Khun Song grew pigeon pea for the hedgerows. He asserts that he will use alley cropping again in the future if he has the time to tend the hedgerows, and if he can plant them closer to his house, where he has an available water source.

In terms of village cohesiveness, Khun Song claims to have shared his ideas on farming with other villagers last year, but not this year. Even though he is the headman of the village, he said that he does not share his ideas any more than an average villager.

1.2.4 Interview 4: Khun Sompong Sitasung

Khun Sompong Sitasung is thirteen years younger than his brother Khun Bauw, the "Innovative Farmer" (making him 40 years old). He was also educated for four years and he resides with his wife, son, and two daughters. His children are all enrolled in school, but help on the farm on the weekends. Khun Sompong's wife helps him to make household decisions. Food is the biggest expense for the family. Khun Sompong laughs about having been farming "since he was born".

On Khun Sompong's 120 rai farm, they grow corn, upland rice, pea, lowland rice, and Job's tear in the rotating plot method. The rice is generally for household consumption, while the corn and pea are sold for a profit. He finds that his biggest problems are financial; he needs to pay for both his children's education and for materials needed on the farm, as well as for food and necessities. If Khun Sompong had more financial resources, he would invest in seeds and fertilizer for his farm. At this time, he takes out loans from the bank to pay for these things.

Khun Sompong attended the first conference in Chiang Mai in 1996. He recognizes soil erosion to be a problem on his highly sloped lands in terms of how the eroded soil covers his lowland fields, burying his lowland rice plants. Since he introduced alley cropping to his highland fields two years ago, Khun Sompong has been able to use his paddy fields more effectively, because they were not smothered by soil eroded from the surrounding sloped fields. He will continue to use alley cropping, with pigeon pea as the hedgerow plant.

Khun Sompong's neighbors asked about his alley cropping when they saw its success, and he shared his techniques and ideas with them.

1.2.5 Interview 5: Khun Kongchean Soda

The next farmer interviewed was Khun Kongchean, shown in Figure 24 along with Khun Sompong. He is 32 years old, has lived in Huey Thong all his life, and has completed six years of education. Khun Kongchean lives with his wife and two sons. His children attend school,

and thus do not help on the farm, but his wife helps on the farm as well as with decision-making. The biggest expense his family has is that of food. Two years ago, Khun Kongchean started working in his own motorcycle repair shop, and uses these profits as secondary income.

Figure 24: Interviewing Khun Kongchean (left) and Khun Sompong (center)

On his 50 rai farm, Khun Kongchean grows Job's tear, upland rice, ginger, and lychee trees and raises chickens. His biggest problem in regards to his farm is the high price for making the necessary investments.

Khun Kongchean recognizes soil erosion as a problem, because he has noticed how in successive years the crops do not grow as well as previously. He uses alley cropping on a few rai, but the other fields do not include any farming techniques to combat soil erosion. He applied alley cropping on more of his farm for the two years before the 1997 forest fire, when he planted pigeon pea and longan trees as hedgerow crops. Khun Kongchean wishes to use alley cropping again because he saw good results, but he has not had the time to reinstate it on the majority of his fields. His biggest problem with alley cropping was the large amounts of weeds that grew in the alleys. He states that weeds grow faster with alley cropping than without.

Not only does Khun Kongchean need more time in order to start using alley cropping once again, but he needs better soil. He alleges that only the people who went to the Chiang Mai conference at some point have used alley cropping. Other villagers may think that alley cropping is a good idea, but they do not have the seeds they require to initiate the use of alley cropping in their

own fields. Khun Kongchean shares his ideas with other farmers because "everyone would like to have better soil".

1.3 PERSONAL INTERVIEWS: UNTRAINED FARMERS

The last five personal interviews were done with farmers who had not been to a training conference in Chiang Mai (see Figure 25). The purpose of these interviews was to concentrate on the farmers' perceptions of soil erosion on their land, their attitudes toward alley cropping, and the extent to which they communicate with the rest of the village. The primary focus of the interviews was to answer the questions of whether these farmers plan to adopt alley cropping and why.

Figure 25: Interviewing the untrained farmers

1.3.1 Interview 6: Khun Rittiporn Prommawan

Khun Rittiporn was born in the Huey Thong village, and after ten years of schooling, he moved to Bangkok at the age of 22. After living in Bangkok for five years, he moved back to the village in 1998 because of the economic crisis in Thailand, and has been farming ever since. He is 29 years old and lives with his wife, with whom he consults when making decisions, and a nine-month-old daughter. Secondary to agriculture, his family earns income by running a shop in the village. Khun Rittiporn and hired laborers work on the farm while his wife manages the shop. He asserted that the biggest expense of his house is the cost of investing in his crops and hiring labor.

His farm consists of 30 rai that he utilizes in the same rotating plot manner as his neighbors, growing the crops of ginger, Job's tear, and upland rice. He does not raise livestock. Plant disease, especially with ginger, and high market prices were the biggest problems listed by Khun Rittiporn. He claimed that soil fertility and soil erosion are problems as well, and he tries to improve the soil productivity by using fertilizer and rotating the plots of land that he plants on. If he had extra resources, he would grow longan and lychee trees because of their high profit margin.

Concerning the Chiang Mai conferences, Khun Rittiporn did not attend because he was living in Bangkok, but he knows farmers who have, and has thus heard about alley cropping. He stated that the farmers who attended the conference have not talked with him about it. Even though he agreed that soil erosion is a problem, Khun Rittiporn does not think that he will employ alley cropping in his fields because he feels that the results seen on the farms of his neighbors were not good enough. Because of damage from forest fires, he wants to see a better outcome before he tries alley cropping.

1.3.2 Interview 7: Khun Sakorn Prommawan

Khun Sakorn moved to Huey Thong 23 years ago from a village five kilometers away, to live with his wife in the village. He is 43 years old, and lives with his wife and three sons. He had four years of education, and has been farming since he was married. His wife helps on the farms with the planting and contributes to the decision-making. His sons also contribute to the labor when they are not in school. The schooling of his sons is the largest expense of the household, costing approximately 5,000 Baht per month. Agriculture is the main source of income, and Khun Sakorn works as the janitor at the school in Huey Thong for additional income.

Khun Sakorn grows mango, tamarind, lowland rice, and Job's tear on his 40 rai farm, with Job's tear as the main cash crop. Khun Sakorn raises chickens and tends a one rai fishpond, along with cultivating the fields. The fishpond is used year round for household consumption and is natural. If extra resources were available, Khun Sakorn would like to build a new fishpond to raise fish for profit. He feels there are no major problems with his farm. He states that his land is somewhat sloped, and his soil is good quality because it is not located in the highlands like some of his

neighbors'. However, he has noticed a decline in soil fertility of about 50% since he has been farming this land, and is compelled to use fertilizers. He is not aware of the definition of soil erosion.

Khun Sakorn had heard about the Chiang Mai conferences but did not attend, and has no comment about alley cropping. He says he does not share ideas or techniques with neighbors, and that the farmers who did go to Chiang Mai did not discuss what they learned with him.

1.3.3 Interview 8: Khun Paiboon Hansaipa

Khun Paiboon has lived in Huey Thong for eight years with his wife's family. Before this, he worked in a village 27 km away as a hired laborer. The 30-year-old farmer went to school for six years and currently lives with his wife, daughter, mother-in-law, and father-in-law. The main source of income for his house is agriculture; he and his father-in-law tend to the farm. Khun Paiboon states that the biggest expense of his house is food, and he occasionally works as a carpenter for additional income when he has time. The decisions of the household are made by his father-in-law.

On his 30 to 40 rai farm, Khun Paiboon cultivates Job's tear, red bean, and upland rice, with upland rice as his main cash crop. He also raises chickens and fish, which are for household consumption. He has been farming for the past eight years on the land he classifies as both sloped and flat. Khun Paiboon feels there are no major problems with his farm. If he had extra resources available, he would increase the size of his fishpond. He rates his soil as good, even though he sometimes has to use fertilizer. Over the past few years, the yield of his crops has reduced noticeably. Concerning soil erosion, he did not know the term but, when defined, stated that he thinks soil erosion is a problem because it washes the soil off of the slopes of upland rice and onto the lower fields.

Khun Paiboon has knowledge of the conferences in Chiang Mai and alley cropping, and he thinks it is a good initiative because of the results he has seen on his neighbors' farms who use alley cropping. He says that he and his neighbors share ideas and farming techniques and he would like to try implementing alley cropping on his own farm in the future.

1.3.4 Interview 9: Khun Saran Sopradit

Khun Saran is 42 years old and has been farming in Huey Thong since the age of 22, when he moved from a nearby village, after his marriage. As a child, he received four years of educa-

tion and now lives with his wife, one daughter, and two sons. Farming is the only source of income for the household. The biggest expenses for his family are food and education, and the decisions of the house are made by Khun Saran.

Khun Saran farms on the 50 rai of his land using the mono-cropping method popular in the village, and classifies all of his land to be mountainous. His main cash crop is corn sold to feed livestock. Upland rice, Job's tear, and black bean are also grown. He does not raise livestock, and plans to grow fruit trees in the near future. Khun Saran states the main problem he encounters on his farm is low soil fertility, for which he uses fertilizer, but he does not utilize any other land management techniques. He was unsure about the definition of soil erosion, but believes that it is not good for his farm.

Khun Saran has heard about the Chiang Mai conferences but has not had time to attend. He feels that alley cropping has had positive results for some farmers, and negative results for others, such as those whose crops were destroyed in the forest fire. He does not share farming techniques or ideas with his neighbors, only with family members. Khun Saran stated that he plans to plant fruit trees to try and alleviate his soil fertility problem.

1.3.5 Interview 10: Khun Bunnong Srithasang

Khun Bunnong has been farming nearly his entire life and moved to Huey Thong twelve years ago to live with his wife. He has had four years of education and presently lives with his wife and 11-year-old daughter. The entire family contributes to farming, which is the main source of income, but Khun Bunnong makes the decisions alone. For additional income, Khun Bunnong works as a laborer on other farms. The biggest expense of the house is food.

He owns 70 rai of land, on which ginger, lowland rice, upland rice, and Job's tear are grown using the mono-cropping method. He also grows lychee and longan trees. Ginger is the main cash crop, and chickens are raised on the farm for household consumption. The major problems Khun Bunnong encounters on his farm are low soil fertility and soil erosion due to the slope of the land. He states that he uses fertilizer, which helps a little with the soil fertility, but the soil has become increasingly worse because of soil erosion caused by the use of a tractor. The soil erosion is a

problem because it removes the soil from the sloped land, and he feels he does not know how to solve this problem.

Khun Bunnong knows of the Chiang Mai conferences and would attend one if given the chance—he feels they are beneficial because the farmers are provided with knowledge. He has talked with his neighbors about farming techniques and he thinks that alley cropping is good for those farmers for whom it has improved their farms, and bad for the farmers who do not take good care of their land. Khun Bunnong stated that he plans to try alley cropping in the future if he were provided with seeds, but his next development is to grow fruit trees.

2 Analysis of Interview Results

This section contains an analysis of the results from both the focus group and personal interviews. As most of the data is qualitative and the sample population was relatively small, whenever figures are applicable, they are given as the exact number of answers and not as a percentage.

2.1 Analysis of Focus Group Results

Although a key function of the focus group interview was to provide an alternate source of information to validate the results of the personal interviews, it was also useful for providing the prioritized list of the farmers' problem statements. For analysis, the final ranking of the problems was examined qualitatively for any trends in grouping, such as a collection of similar problem statements all ranked at a similar level.

All of the problem statements on the list can be classified as social, economic, or biophysical. Thus, the first step in analyzing the focus group results was to classify the responses. Table 5 shows the list of the problem statements, along with each item's classification.

Table 5: Classification of prioritized list of problem statements

Problem Statement	Classification	
1. Not enough income	Economic	Primarily Economic
2. Lack of capital	Economic	
3. Do not have deeds for farmland	Social	
4. Decreasing crop yields	Biophysical	
5. Increase in cost of farm investment	Economic	
6. Inadequate water supply	Biophysical	Primarily Biophysical
7. Land degradation (low soil fertility)	Biophysical	
8. Low market price of products	Economic	
9. Soil erosion on farmland	Biophysical	
10. Lack of knowledge	Social	
11. Weed problems on farmland	Biophysical	
12. Pest problems on farmland	Biophysical	
13. Fruit trees grow slowly	Biophysical	
14. Village is far from market	Social	Primarily Social
15. Lack of village cohesiveness	Social	
16. Do not form effective groups	Social	
17. Village is far from hospital	Social	

Once classified, it became evident that the problem statements were divided into three distinct groups, according to their classification as social, economic, or biophysical. List items (1) to (5) were considered high priority, list items (6) to (13) medium priority, and list items (14) to (17) low priority. Of the high priority problem statements, more than half (three out of five) were economic; of these three, two were the most highly ranked overall ("not enough income" and "lack of capital"). The middle grouping dealt almost entirely with the physical characteristics of the farmland, with six out of eight classified as biophysical problems. Lowest in rank were the social problems; all four of the low priority items concerned the village and the interactions of its people.

Thus, the overall tendency of the farmers, as shown by the focus group, was to rank economic problems as being most urgent, followed by land degradation issues and other natural problems. Of least concern were the social problems of the village.

2.2 Analysis of Personal Interview Results

Since the interview questions were designed to fit into a number of specific categories, the results of the individual interviews of the farmers were analyzed according to these sections. The four main areas of interest were: general information about the farmers and their families, characteristics of the farms and crops grown, land management techniques (specifically alley cropping), and the communication between the villagers as well as their methods of decision-making.

2.2.1 General Information

After obtaining the full name of each farmer, other general information that was acquired included their age, their level of education, the number of people currently in their household, and the number of years that they had lived in Huey Thong. Also asked was whether or not the farmers had another source of income (besides agriculture). The information on these topics is displayed in Table 6.

Table 6: General information of farmers interviewed

	Age	Years in Huey Thong	Years of Education	Family Size	Alternative Income
Khun Bauw	53	53	4	7	None
Khun Ket	40	40	4	6	Carpenter
Khun Song	51	51	4	5	None
Khun Sompong	40	40	4	5	None
Khun Kongchean	32	32	6	4	Motorcycle Repairs
Khun Rittiporn	29	24	10	3	Owns Shop
Khun Sakorn	43	23	4	5	Janitor
Khun Paiboon	30	8	6	5	Carpenter
Khun Saran	42	20	4	5	None
Khun Bunnong	33	12	4	3	Laborer
SUMMARY:	**Average 39.3**	**Average 30.3 years**	**Average 5 years**	**Average 4.8 people**	**6/10 have 2nd income**

The farmers were of a wide range of ages, with the youngest one interviewed being 29 years old and the oldest 53. The distribution of the other ages was spaced at fairly even intervals throughout this range. Between farmers who have lived in the village their whole lives and those who had moved to Huey Thong at some point, the division was even—five to five. All of the farmers had similar levels of education; seven of the ten interviewed had only four years of formal schooling, and another two had only six years. The highest level of education attained by any of the farmers was ten years.

The size of households ranged from three to seven people. The mode was five persons in the household, which was the case for half of the farmers. Only four of the farmers surveyed relied solely on agriculture for income; the other six mostly worked as laborers for extra support (two were carpenters, one a farmhand, a one a custodian for the public school one family owned a small shop, and one a motorcycle repair shop).

2.2.2 Farm Characteristics

The second area of interest was the characteristics of each farm. The primary data collected on this subject were the size of the farm, the crops currently grown (as well as which of these were the main cash crop or crops), and what livestock, if any, the farmer owns. This information is contained in Table 7.

Table 7: Farm characteristics of farmers interviewed

	Farm Size (in rai)	Crops	Livestock
Khun Bauw	~ 100	*Lychee, mango, longan*, red bean, peanut, pineapple	Water buffalo (6), chickens, fish
Khun Ket	~ 80	*Lowland rice*, upland rice, ginger, Job's tear	None
Khun Song	~ 60	*Job's tear*, ginger, upland rice, lychee, longan	Chickens
Khun Sompong	~ 120	*Corn, peas*, Job's tear, upland rice, low-land rice	None
Khun Kongchean	~ 50	*Job's tear*, upland rice, ginger, lychee	Chickens
Khun Rittiporn	~30	*Job's tear*, ginger, upland rice	None
Khun Sakorn	~ 40	*Job's tear*, tamarind, lowland rice, mango	Chickens, fish
Khun Paiboon	~ 35	*Upland rice*, Jobs tear, red bean	Chickens, fish
Khun Saran	~ 50	*Corn*, upland rice, Job's tear, black bean	None
Khun Bunnong	~ 70	*Ginger*, lowland rice, upland rice, Job's tear, lychee, longan	Chickens
SUMMARY:	**Average ~ 63.5 rai**	**Upland rice – 7/10** **Longan – 3/10** **Job's tear – 6/10** **Lychee – 3/10** **Lowland rice – 4/10** **Corn – 2/10** **Ginger – 3/10** **Red bean – 2/10**	**6/10 have livestock**

Crops in *italicized text* are the main cash crops for those farmers.

The farms ranged from a minimum of 20 rai to a maximum of 120 rai (all values were approximate). The arithmetic mean was 63.5 rai. The crops grown on each farm varied, although nearly every farmer grew some form of upland or lowland rice, as well as Job's tear; this fact is in agreement with the results obtained from the focus group interview. Other crops grown, which were also mentioned in the focus group, include ginger, corn, red bean, black bean, and fruit trees such as lychee and longan.

A majority of the farmers (seven out of ten) own some form of livestock, which in all cases was chicken, water buffalo, or fish (by way of a fish pond on their property). For the majority of farmers interviewed, their livestock consisted only of chickens; only one farmer raised buffalo.

2.2.3 Land Management Techniques

The next major area of focus for the personal interviews was the farmers' use of land management practices, although from information gained in the focus group, the project team chose to focus almost exclusively on the alley cropping technique. The farmers were asked about their knowledge and understanding of soil erosion, and whether they view it is a problem on their farm. Then, the farmers were questioned about their use of alley cropping in the past, whether they use the techniques currently, and whether or not they plan to use it in the future. Other information gained from the personal interviews included general attitudes and opinions about land management and the alley cropping techniques. Some of the results are given in Table 8.

Table 8: Land management techniques of farmers interviewed

		Alley Cropping Technique		
	Soil Erosion Problem	Past Use	Current Use	Plan Future Use
Khun Bauw	Yes	Yes	Yes	Yes
Khun Ket	Yes	Yes	No	Yes
Khun Song	Yes	Yes	No	Yes
Khun Sompong	Yes	Yes	Yes	Yes
Khun Kongchean	Yes	Yes	Yes	Yes
Khun Rittiporn	Yes	No	No	No
Khun Sakorn	No	No	No	No
Khun Paiboon	Yes	No	No	Yes
Khun Saran	Yes	No	No	No
Khun Bunnong	Yes	No	No	Yes
SUMMARY:	**Yes – 9/10**	**Yes – 5/10**	**Yes – 3/10**	**Yes – 7/10**

An overwhelming majority of farmers—nine out of the ten surveyed—felt that soil erosion presented some level of difficulty for their farmland. This result is in accordance with the prioritized list created in the focus group, which placed land degradation as the seventh most urgent concern, and soil erosion as ninth. Half of the farmers had used alley cropping in the past for anywhere from two to four years; this result was expected as these farmers were the five interviewed on the first day, who had been to one of the conferences in Chiang Mai to learn about the technique. Of these five, only three were continuing to use alley cropping, although for all of them it was only on a limited scale, usually on plots containing fruit trees.

When asked about their intentions for the future, well over half of the farmers stated that they intended to use alley cropping again. The number of farmers in favor of the technique was seven; five of these were the five who had used it initially, and the other two were farmers who had not, and had not been to any of the conferences. All of the farmers who claimed that they did not intend to use alley cropping in the future had not previously utilized it, although two of the three did feel that soil erosion was a serious problem.

The data obtained concerning the use of alley cropping was then compared to the previous results on the general information of the farmers and the characteristics of their farms. One correlation found was between farm size and the farmers' attitudes about alley cropping. First, those farmers whose farms had an area larger than the arithmetic mean tended to exhibit greater acceptance of alley cropping: three of four had used the technique in the past, two of four are using it currently (which is a majority of the three total who are currently using it), and all of the four intend to use it in the future. When analyzed in reference to the farmers with below average-size farms, the attitudes toward alley cropping tended to be less accepting. Of the six smaller farms, two had used alley cropping in the past, only one uses it presently, and half intend to use it in the future. All of the farmers who said they would not use alley cropping in the future owned farms that were smaller than the average size.

Another interesting correlation was that all of the farmers who had used alley cropping in the past were also born in the village, and all of the farmers who had neither used alley cropping nor been to any of the DOAE conferences had moved to Huey Thong at some point. It is possible that this was a coincidence, especially because of the small sample population interviewed; when asked for

their opinion, the extension officers of the DOAE said that they did not believe there was any correlation between whether or not a farmer was born in the village, and how willing they would be to adopt alley cropping.

Other results analyzed were the age and education level of the farmer with respect to attitudes on alley cropping. Age was found to have no direct correlation according to the interviews; the farmers who favored the alley cropping technique, as well as those who did not, were spread across the range of ages without any discernable pattern. Education did not seem to be related according to the results, either—the majority of farmers who had four years of schooling were divided on the use of alley cropping in the past, present, and future. The data for the attitudes of farmers who had received more than four years of education was inconclusive as well; on average, they were slightly in favor of land management, although the one farmer with ten years of schooling claimed he had never practiced alley cropping, and did not intend to in the future.

2.2.4 Communication and Decision-making

The final area of analysis was the communication within the village, and how decisions were made in the household, especially with regards to the roles of the farmers' wives. The team investigated the extent to which the farmers communicated their concerns and shared their ideas with their neighbors and the other people in the village. Also, it was determined whether or not each farmer makes decisions alone, and whether he chooses to include his wife in the decision-making process. In all cases these two were complementary, except in one case where the farmer's father-in-law made all decisions, and therefore his wife was not involved even though the farmer did not make all the decisions himself. The results of this investigation are shown in Table 9.

Table 9: Communication and decision-making practices of farmers interviewed

	Discusses with neighbors	Make decisions alone	Make decisions with wife	Plan to use alley cropping in the future
Khun Bauw	Yes	Yes	No	Yes
Khun Ket	Yes	No	Yes	Yes
Khun Song	No	No	Yes	Yes
Khun Sompong	Yes	No	Yes	Yes
Khun Kongchean	Yes	No	Yes	Yes
Khun Rittiporn	Yes	No	Yes	No
Khun Sakorn	No	No	Yes	No
Khun Paiboon	Yes	No	No	Yes
Khun Saran	No	No	Yes	No
Khun Bunnong	Yes	Yes	No	Yes
SUMMARY:	**Yes – 7/10**	**Yes – 2/10**	**Yes – 7/10**	**Yes – 7/10**

Well over half of the farmers (seven out of ten) claimed that they spoke with their neighbors about land management. Furthermore, the same percentage of farmers claimed that they include their wife when they make decisions, though many of these farmers said in the interview that after consulting their wife, they make the final decision. According to the data, there was no correlation between communication and whether or not the farmers include their wife in decision-making.

There was, however, a relationship between a farmer's communication with his neighbors and whether or not he was willing to use alley cropping in the future. Of the seven farmers who said they talk with their neighbors about agriculture, six of them plan future use. Conversely, nearly all of the farmers who did not communicate with their neighbors (two out of three) did not plan future use of alley cropping.

3 DATA VALIDITY ISSUES

There were several issues to take into consideration when examining the validity of the data collected. The language barrier, lack of expertise on the part of the WPI project team, and the expectations of the farmers all may have influenced the validity of the responses to some extent, especially when qualitative data such as opinions and attitudes were analyzed.

3.1 LANGUAGE BARRIER

The language barrier provided many difficulties during the interviewing process. Misunderstandings in translation, the inability to notice insinuations, and misinterpretation of vocabulary all may have contributed to the slanting of the data. For example, the translator may not have been aware that certain interview questions were carefully worded to avoid leading the farmers, and unknowingly translated an open question as a leading one. A final problem presented with the language barrier was the fact that the project team was unable to record the farmers' responses verbatim, and instead took notes. In many surveys, note-taking can lead to biases from the interviewer; however, all three project members took separate sets of notes, which were later compared to eliminate this chance of prejudicing the results.

3.2 Lack of Expertise

A lack of knowledge on the part of the WPI project team about the subjects of interviewing, soil erosion, farming, extension systems, and Thai culture may have limited the extent to which correlations may be made on the results. However, the very nature of the project required an outside and less-knowledgeable viewpoint to assess the progress of the Huey Thong pilot study, and problems resulting from the lack of expertise were outweighed by the insight gained from the project team as an outside perspective. Furthermore, extensive research was performed by the project team in preparation for the fieldwork, to partially overcome the problem of limited expertise.

3.3 Preconceived Notions of the Farmers

Farmers tend to exaggerate amount of debt and underestimate income in front of extension workers, in order to possibly gain more assistance from the government [Chandrapatya, 2000]. This exaggeration may have also affected the prioritization of problem statements during the focus group, but this effect was minimized by several factors. The officials from the DOAE were familiar to the farmers, and rarely were directly involved with the interviewing process, so it is likely that the farmers were not occupied with impressing or influencing them. The fact that the actual interviews were completed by foreign students who have no stake in the outcome of the project also refutes the existence of exaggeration. Moreover, the focuses of each interview were not at all economic by nature, so a bias created by the embellishment of economic problems can be considered negligible.

VII - Conclusions

To achieve the ultimate goal of this project, the results of the fieldwork in Loei were interpreted according to the project team's experimental observations and understanding of the background information. This interpretation of the project findings has yielded a number of conclusions about the success thus far of the project by IBSRAM and the DOAE to encourage sustainable land management in the village of Huey Thong.

One of the most direct conclusions that can be drawn from the findings of this project is that there is not a very high rate of adoption of sustainable land management techniques by the villagers of Huey Thong. Only three of the ten farmers interviewed are currently using alley cropping. This figure represent a low acceptance rate among trained and untrained farmers alike, as the goal of the Huey Thong project is to encourage land management both through extension training and communication within the village. The project team has reached several conclusions regarding the causes of limited adoption, and formulated some recommendations to help alleviate this problem.

Importance of Land Management to Farmers

The findings of this project indicate a number of possible causes for the poor rate of adoption of the alley cropping technique. One possible reason is the relatively low level of importance that the farmers place on the problems of land degradation. During the focus group interview, the farmers classified soil erosion on their farms as only an intermediate priority, ranking below most of the economic concerns listed. In conjunction with the results of the personal interviews, the prioritization appeared to be linked to the immediacy of the farmers' economic problems, as compared to the long-term effects of soil erosion damage. Due in part to the difficulties of Thailand's economy in recent years, the financial problems of the farmers and their families are considered to be much more important than the slow but steady effects of soil erosion. It is important to note, however, that the tendency of the farmers to postpone land management issues is not indicative of their ability of the farmers to engage in long-term planning; many of the farmers interviewed listed the education of their children (a worthwhile long-term investment) as a major expense. Rather, the problem is that the day-to-day choices of the families of Huey Thong are shaped in large part by fiscal

limitations, and thus lack of income is a very tangible concern to the villagers. Soil erosion and nutrient depletion, in comparison, are rather intangible; the progress of land degradation is measured in years, and it is often difficult to recognize the effects of poor farming techniques before they have developed beyond feasible repair.

Economic Viability of Alley Cropping

The precedence of economic concerns over the problems of soil erosion and nutrient depletion are related to another possible cause for the low rate of adoption—namely, that alley cropping does not provide enough short-term benefits. Of the five farmers who were trained in the use of alley cropping in Chiang Mai, two had given up the practice after the 1997 fire had burned their hedgerows. Two of the other three, though continuing to use the technique, had restricted its scope to only a few rai. While a number of farmers agreed that alley cropping is useful in its purpose to reduce soil erosion on sloping farmland, the advantages were few when compared to the many disadvantages of the technique. The shortcomings of alley cropping that they cited included the amount of labor necessary to construct the hedgerows (which must be done during the busiest time of planting season), and the lack of economic benefits such as a product that could be sold or consumed. Furthermore, there is not a suitable material with which to construct the hedgerows: leucaena does not grow well due to the soil acidity in Loei, pigeon pea (which does produce an edible product) thrives only for a few years, lemongrass is not suitable for the lack of water, and most other materials are too expensive. The farmers and the extentionists are currently searching for a suitable hedgerow crop.

Although a majority of the farmers expressed an interest in practicing alley cropping in the future, it is the belief of the project team that this finding is not truly representative of the farmers' future intentions. This discrepancy is supported by the experimental observations and background research of the project team, which hold that the farmers interviewed may have been inaccurately optimistic, or may have answered according to their perception of the expectations of the interviewer. Overall, the farmers were supportive of land management practices, but the truth of the agricultural situation in Huey Thong is that when satisfying economic needs is pitted against land conservation, the economics usually take precedence.

Communication Issues

Another major factor that was found to affect the adoption of land management techniques was the level of communication between the farmers. In general, the farmers who claimed to discuss their ideas with their neighbors were more supportive of alley cropping, as shown by their willingness to use it in the future. Likewise, those farmers who said they did not converse with their neighbors about farming were less supportive. Any limitations to communication within the village are of critical concern to the Huey Thong project, as the successful spread of land management hinges upon the interaction between trained and untrained farmers.

Consequently, one of the major reasons for the limited adoption of alley cropping may be a lack of communication within the village. This conclusion is concurrent with the findings of the focus group interview, in which the farmers claimed that they do not communicate enough, and listed a lack of cooperative effort and a lack of village cohesiveness as problems they are facing. Although in the personal interviews the majority of farmers stated that they do share ideas with the other villagers, the extent of this communication is questionable. The interactions between progressive farmers may be quite high, but this has a limited effect on the spread of land management unless they talk to the other farmers, as well. The fact that there were only two farmers in the village who had tried alley cropping without first going to one of the conferences in Chiang Mai (discovered in the focus group) is evidence that the transfer of knowledge between trained and untrained farmers has not taken place.

There are a number of factors responsible for restricted communication between the farmers. One issue is that the programs of the DOAE and other organizations often provide the farmers with free or subsidized materials, and thus the farmers may be concerned that if they share their knowledge of these programs, the net result of increased participation will be a reduction in their individual benefits. In addition, there is a certain degree of social inhibition to share and spread farming ideas. For instance, during the personal interviews, the village headman admitted that he does not personally encourage land management amongst the villagers. The social norms of the village are such that decisions concerning the traditional act of subsistence farming are left primarily up to individual farmers, and accordingly, the farmers are not accustomed to promote their ideas to one another too strongly.

Recommendations

Based on the conclusions, the project team has developed recommendations for IBSRAM to address some of the obstacles to the success of the Huey Thong project. First, one of the primary ways adoption could be assisted is by refining the way soil erosion concepts are presented to the farmers. Since the farmers prioritize economic concerns above the problems of land degradation, the most effective way to present soil erosion would be in terms of its economic effects. Furthermore, even though the effects of soil erosion are most severe in the long-term, the farmers would better identify with them if they could be illustrated as a short-term problem. The recommendation of the project team is that, in training the farmers to practice sustainable land management, the problems of soil erosion should be related in concrete terms of their immediate economic consequences. One way to accomplish this would be to show to the farmers what amount of soil is actually lost from their land in the course of one week, and relate this quantity to the amount of profit they will lose due to the decrease in yields from nutrient depletion.

Unfortunately, until a better hedgerow material is found, the adoption of alley cropping will always be hindered by its short-term disadvantages. Thus, another recommendation is that until the added labor and initial cost of alley cropping can be reduced, IBSRAM should continue to provide incentives to the farmers to use the technique. Although these incentives can be provided in a form such as seeds, extentionists must be careful to offer them in a way such that farmers do not feel that their personal benefits would be threatened by telling other villagers, as this can lead to inhibited communication in the community. The incentives could also be provided on more of a reward basis; some sort of compensation could be granted to farmers for using the alley cropping technique for a predetermined length of time (such as a few years). These rewards would help to ensure that the techniques were continued by the trained farmers for a longer period of time on a reasonable area of land, and would allow some of the visible long-term effects to accumulate so that they could be shown to other farmers in the village.

The final recommendation of this project team is for IBSRAM to continue to look to indigenous technical knowledge for guidance in the development of new land management techniques. Although researchers have a great deal of power to develop new and better methods to deal with soil erosion, these methods will always be limited in their im-

plementation by economic and social factors. Indigenous technologies, on the other hand, have survived for generations because they are particularly well suited for the capabilities and resources of the farmers. The villagers of Huey Thong continue to use techniques such as mono-cropping to manage the limitations of their environment, and while such a technique is not very successful at inhibiting land degradation, it is an excellent model of the social and economic parameters of an appropriate technique. In order to address better the issues of adoption, researchers need to continue to study the characteristics of indigenous knowledge.

Appendix A - Personal Interview Questions

Farmer Background

What is your name?

How old are you?

How long have you lived in this village?

What is your level of education?

How many people live in your house? Who are they?

How many of them take part in farming?

What is the major source of income for the household?

What is the biggest expense?

Are there any other sources of income?

Agricultural Experience and Problems

How long have you been farming?

What are your main cash crops?

Do you have livestock? What are they used for?

How would you classify the land you farm on?

What are the problems you deal with, and what is your biggest concern?

Do you think soil erosion is a problem for you? Why or why not?

Land Management Technique Adoption

Do you use land management techniques? Which ones and why?

For how long have these been used?

Do you think they are profitable or not? If no, why?

What are the techniques' advantages, disadvantages, benefits, and problems?

What have you learned from your land management techniques?

What do you think is the most important reason to use land management techniques?

Have these land management techniques met your expectations?

Do you think you will use it in the future? Why or why not?

Communication Issues

How are decisions made in your house?

Who contributes to decision-making, and how?

What is the role of your spouse?

Are your neighbors using land management techniques?

Are they aware that you do or do not use land management techniques?

Do you share farming techniques and ideas with them?

Appendix B - Glossary of Terms

absorption: The process of a soil taking in external liquids, gases, or solutes.

accelerated erosion: Erosion that is either caused specifically or enhanced in effect by the practices of mankind.

agent: Any entity or force in nature that is responsible for causing erosion, such as wind or flowing water.

alley cropping: A method of land management where rows (alleys) of crops are alternated with dense hedgerows.

Baht: The basic currency unit of Thailand; equal to approximately 0.027 United States Dollars in January–February 2000 (see Appendix D).

cash crop: A crop that is grown primarily to be sold for profit, instead of being eaten by the farmer.

conservation tillage: Breaking up, granulating, and turning over the soil to make it more rough, as protection against erosion.

contour cultivation: Plowing and planting perpendicular to the grade of a slope (along the contours), rather than up and down the grade.

crop residue management: Use of parts of previous harvests to cover bare soil after planting new crops, to reduce the effects of erosion.

deciduous: Having leaves that fall off at the end of a certain growing period or season.

deposition: The stage of erosion that occurs when soil particles are dropped by the transporting agent.

detachment: The dislodging of soil particles by force; usually caused by an agent such as water or wind.

erodibility: A measure of how prone to the process of erosion a given soil is.

erosion: The detachment, transport, and eventual deposition of particles of earth by eroding agents.

erosivity: A measure of the ability of rain to cause erosion, due to its physical characteristics (such as size or velocity).

extentionists:	Trained personnel who work to encourage the spread of land management techniques, especially through the education and training of farmers.
genetic engineering:	The manipulation of plant or animal genes for the purpose of improving the organism.
geological erosion:	Erosion that occurs naturally (without human interference), caused by an agent such as wind or water.
gully erosion:	The stage of water erosion where large trenches (gullies) have formed in the land; soil erosion occurs as water flows along these channels.
hectare:	A measurement of land area equal to 100 square kilometers (see Appendix D).
hedgerow:	A dense row of crops, the roots of which protect the soil and reduce runoff.
infiltration:	The process by which external liquids, gases, or solutes permeate the soil.
Khun:	A Thai title, translated to mean "Mr.", "Mrs.", or "Ms.".
land tenure:	Ownership of the land.
leading question:	An interview question that limits the response of, presupposes certain knowledge or opinions of, or transmits a particular expectation to the interviewee; can lead to biased results.
leucaena:	A plant commonly used as hedgerow material.
lowland rice:	Also known as "paddy rice"; rice that must be grown on a level surface and flooded for a certain period of its development.
mono-cropping:	A form of indigenous technical knowledge (ITK); farmers grow a single main crop for a number of years on part of their land, and rotate to a different part when nutrients become depleted.
mulching:	Similar to crop residue management, except material (mulch) other than previous crop wastes are used.
pigeon pea:	A plant commonly used as hedgerow material; only lives for a few years and bears an edible product.
probing:	The technique of asking questions that direct the flow of conversation unobtrusively by rephrasing or repeating dialogue.

rai: A measurement of land area used in Thailand, equal to 1600 square meters (see Appendix D).

raindrop erosion: The stage of water erosion where falling rain (raindrop splash) is responsible for the detachment of particles.

rill erosion: The stage of water erosion where small channels (rills) begin to form and wash away soil down a slope.

runoff: The portion of precipitation that drains to a body of water by way of surface flow.

sanctuary land: Land that has been restricted from use for farming or other commercial land practices by the Royal Forestry Department (RFD) of Thailand.

saturation: The maximum level of absorption that can be achieved by a given soil.

sheet erosion: The stage of water erosion directly after raindrop splash occurs, when soil is washed down a slope in sheets; usually degrades immediately to rill erosion.

slash and burn: A technique for clearing land, in which all flora is cut down and then burned to create ash for cultivation.

strip cropping: A combination of crop rotation and contour cropping in which strips of crops are grown perpendicular to water flow.

subsistence farming: Farming that is done primarily for survival, not for profit.

surface creep: The rolling or bouncing of soil particles along a surface by wind.

terracing: Use of soil ridges along a hillside to reduce the slope and length of the hill, as protection against erosion.

transport: The movement of soil particles from place to place; usually caused by an agent such as water or wind.

upland rice: Also called "sticky rice"; can be grown on sloped hills.

vegetated waterway: Planting grass along a waterway between crop plots in order to hold the soil in place.

vetiver grass: A plant that is commonly used in strip cropping and other land management practices to limit runoff.

***wai*:** Thai gesture used as a greeting or to show respect.

wat:	A Buddhist temple.
watershed:	A bounded area of land that ultimately drains to a single common body of water (either flowing or stationary).

Appendix C - Glossary of Acronyms

AEA:	*Agro-economic system analysis*
ARI:	*Advanced research institute*
DOAE:	Department of Agricultural Extension
DTEC:	Department for Technical and Economic Cooperation
FESLM:	Framework for the Evaluation of Sustainable Land Management
IARC:	*International agricultural research center*
IBSRAM:	International Board for Soil Research and Management
ITK:	*Indigenous technical knowledge*
LDD:	Department of Land Development (of Thailand)
MOSTE:	Ministry of Science, Technology, and Energy
MSEC:	Management of Soil Erosion Consortium
NARES:	*National agricultural research and extension systems*
NGO:	*Nongovernment organization*
PRA:	*Participatory rural appraisal*
PTD:	*Participatory technology development*
RFD:	Royal Forestry Department (of Thailand)
RRA:	*Rapid rural appraisal*
SLM:	*Sustainable land management*
SWNM:	*Soil, water, and nutrient management*
TOT:	*Transfer of technology*

Appendix D - Unit Conversions

Distance Measurements

1 centimeter (cm) = 0.01 meters (m) = 0.39 inches (in)
1 in = 2.54 cm = 0.025 m

1 kilometer (km) = 1,000 m = 0.62 miles (mi)
1 mi = 1.609 km = 1,609 m

Area Measurements

RAI	ACRES	SQUARE METERS	HECTARES	RAI	ACRES	SQUARE METERS	HECTARES
1	0.395	1,600	16	60	23.7	96,000	960
5	1.98	8,000	80	70	27.7	112,000	1,120
10	3.95	16,000	160	80	31.6	128,000	1,280
15	5.93	24,000	240	90	35.6	144,000	1,440
20	7.91	32,000	320	100	39.5	160,000	1,600
30	11.9	48,000	480	150	59.3	240,000	2,400
40	15.8	64,000	640	200	79.1	320,000	3,200
50	19.8	80,000	800	300	118.6	480,000	4,800

Temperature Measurements

°C	-20	-10	0	5	10	15	20	25	30	40	50	60	70	80	90	100
°F	-4	14	32	41	50	59	68	77	86	104	122	140	158	176	194	212

Currency

In January–February 2000: 1 United States Dollar = 37 Thai Baht
(approximate values) 1 Thai Baht = 0.027 United States Dollar

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