



# An Assessment of Sustainable Highland Agricultural Systems in Thailand\*

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In recent years, growing national concern over environmental deterioration and diminishing natural resources, especially the prime forests of the country's northern watersheds, has attracted substantial investments of public resources. In the early days, direct protection of forests was the major means of environmental conservation. Gradually, other policies have been adopted. Among the various options, indirect protection through the introduction of permanent highland agriculture, as well as the reduction of deforestation caused by shifting cultivation (slash and burn), are considered sound alternatives. More governmental agencies, previously not involved in community-development activities have become active in highland development projects to combat the narcotics trade and other national ills. Moreover, highland development activities have received external budgetary support from foreign governments and international organizations.

As the Thai economy develops, it is inevitable that external assistance will come to an end. The study summarizes the success stories of existing highland development projects and defines a common development framework for further highland development. The following research steps were pursued:

- determining the intensity of resource use and identifying practices related to sustainability;
- estimating the cost and returns of each production system, including the cost of subsidies;
- identifying internal and external pressures that may threaten an agricultural system's sustainability;
- recommending an environmentally and economically sound model for highland community development.

## RESEARCH METHOD

Twelve villages from five development projects (UN-Sam Mun, TG-HDP, TA-HASD, Care, and the Royal Project) were selected for detailed study, to highlight aspects of past development efforts that have significantly contributed toward providing highland farmers with a basic livelihood, while minimizing damage to the environment. To compare the differences between villages with development projects and those without, two long-established, traditional villages, La Oop and Tissa in Mae Hong Son province—both of which have had no external technical assistance—were also selected for study.

Formal surveys, using two sets of questionnaires were conducted in the 12 villages. The first questionnaire dealt with analyzing the investment in highland agricultural and social development through various assistance projects. The second aimed to evaluate both the farmers' and communities' agricultural production and conservation practices, with particular emphasis on their effects on the productivity of land use systems and their impact on the environment. A total of 85 farmers were interviewed.

Detailed agro-ecosystem studies were conducted in seven villages.

The research sites are as shown in [Table 1](#).

## FINDINGS

### Overview

The traditional practice of rotational shifting agriculture is one of the highlands' most sustainable forms of land use. This technology, however, requires a lot of land. Some 30-40 rai per head (4.8-6.5 hectares) is needed for subsistence production of upland rice, i.e., 3-4 rai per head (one-half to two-thirds of one hectare) under cultivation in a given year, allowing the remaining land to lie "fallow" (to improve soil fertility and keep down weeds) for seven to nine years before it is used again. In recent years, however, the rotation cycle has been much reduced—to as little as two to five years in some areas. This has had the inevitable result of a sharp decline in productivity and hence income, as well as degradation of forests, soil, and the environment.

In Northern Thailand, the remaining area facing these problems with traditional rotational shifting agriculture is in the adjoining three provinces: Mae Hong Son, Chiang Mai and Tak. This area of over 10 million rai (1.6 million ha) has some 1,200 hilltribe communities with a population of about 230,000—almost one-quarter of the total national hilltribe population.

Throughout the highlands there is a clear trend toward permanent settlement over the last 30 years and ethnic differences are now less important in determining highland land use. Former opium-growing pioneer shifting cultivators, such as the Hmong, Lahu and Lisu, have settled down permanently, bought paddy land and now grow wetland rice. Despite their traditional reputation for emphasizing subsistence production, many Karen villages have adopted cash cropping in a major way.

With road and market access, agricultural intensification has proved the most effective way to increase income, while decreasing pressure on the land. High returns on cash crops compared to other agricultural activities will, however, eventually lead to production expansion and population increase by in-migration.

### **Production and Resource Use in Highland Agriculture**

**Land Use.** Land use has intensified in most cases. Cropping frequency has increased, with shortening fallow periods. Rather than just cropping the land once a year, many villages have adopted double (two successive crops a year) and triple (three crops a year) cropping. Intensive inter-cropping of maize with legumes, and fruit trees with vegetables is also common. Many cropping systems appear to be sustainable, in the sense that their productivity has been maintained for 10 years or more. These systems include rice-cabbage rotation, maize/rice/bean inter-cropping, and intensive production of vegetables and fruits.

With land use intensification (increased productivity per unit of land), combined with forest protection enforced by the Royal Forestry Department (RFD) and the emergence of awareness among highland farmers of the importance of forest conservation in watersheds, forest regeneration is evident in many of the villages studied.

**Water.** Water for irrigation is an essential ingredient to sustaining intensive highland agriculture. Water use has increased substantially. The use of low-cost sprinkler irrigation systems, which are fed by gravitation and are less costly than the more water conserving drip irrigation, have become common throughout the highlands.

The increase in water consumption in watershed areas will have a direct impact on downstream users. From 1980 to 1989, water use in Northern Thailand tripled, thus drastically decreasing the water available for export to the Central Region. Further growth in local water demand is inevitable. Water conservation will become an unavoidable necessity. In the highlands, the system of delivering water to farms via polyethylene pipes is efficient. Excessive losses through evaporation in the field, however, is a serious drawback to sprinkler irrigation. In response to dry season water scarcity, self regulation, e.g., with control valves, has been initiated in some villages. In general, however, water conservation at the farm level is still rare in the highlands. Information on water use efficiency is also virtually non-existent.

**Labor.** The move toward commercial agricultural production in the highlands has also led to a significant increase in labor demand per unit area. Thus, the high economic performance of certain cropping systems may attract even more in-migration of hilltribe labor from Myanmar. In this study, it was found that a

number of villages use Burmese laborers on a production-sharing (50:50) basis.

**Agricultural Chemicals.** Fertilizers and pesticides have become essential production inputs in the highlands. Hilltribe farmers who have adopted intensive cash cropping are highly open to using agricultural chemicals. Farmers are well aware that fertilizers applied to cash crops benefit the subsistence upland rice which is planted after crop harvesting. The direct use of fertilizers and pesticides in subsistence production is, however, still rare. Virtually all the farmers interviewed recognize the dangers of pesticides and knew some farmers in their own villages who have been ill after working with pesticides. Consequently, wages for spraying are 50 percent higher than the normal agricultural wage. No incidence of death directly linked to pesticide toxicity was, however, reported and definitive data on the evidence of pesticide pollution of water and soils are non-existent.

It should be noted that Hmong farmers at Pah Poo Chom village use Bacillus sprays on cabbages to control insects. A rudimentary form of Integrated Pest Management (IPM), which requires knowledge of the seasonal behavior of insect populations—for example, counting insects in the field before spraying—was practiced. Further decreases in the cost of Bacillus preparations and improved extension of IPM could effectively decrease the detrimental effects of pest control on both human health and the environment.

**Soil and Water Conservation.** All the methods and practices introduced by the various departments and projects to slow runoff and minimize soil erosion incur additional costs to farmers, i.e., labor costs, as well as the opportunity lost in using land to house various biological or physical structures. The positive on-site effects of conservation, in the form of increased land productivity, were neither recognized by farmers nor evident in the fields visited throughout the five provinces. Thus, farmers have no incentive to adopt soil and water conservation practices on their own behalf. Adoption of such practices has taken place largely through external stimulation—to please officials (in the hope of gaining citizenship or land rights, or to qualify for various benefits), or in response to cash incentives. The so-called "soil and water conservation technology" is, therefore, currently not self-sustaining. The most important incentive is land use security, not financial hand outs.

In terms of the off-site effects of soil erosion, the current methods of soil and water conservation measures lack unity. Individual farmers often leave gaps in the slopes of an entire hillside leading to water channeling, which, in turn, worsens soil erosion and increases the possibility of landslides.

### **Income from Different Cropping Systems**

Incomes from different highland cropping systems are shown in [Table 2](#).

Rice, Thailand's traditional subsistence crop, has the lowest rate of return. The traditional method of rice production requires years of fallow to restore soil fertility and control weeds. Even today, while government extension efforts, commercial production ventures and development projects have brought information and technology on new crops to the highlands, very little information is available to effectively improve upland rice production, given local constraints and the limitations of highland farming systems. The Upland Rice Ecosystem Project has been declared one of the four major research programs of IRRI (International Rice Research Institute) at Los Bangnos, The Philippines, since the 1980s. The Rice Research Institute of Thailand is now a member of the Upland Rice Consortium, whose members include India, Indonesia, and the Philippines, as well as IRRI. The institute is seeking ways to improve upland rice production through research. It will be many years, however, before the results of these research activities can be translated into productivity increases in the field.

The highest returns come from fruit trees. Growing fruit trees could become one of the main strategies in increasing farmers' income. Before this leads to the drawing up of a national policy that encourages covering whole mountains with fruit orchards, a word of caution should be noted. The production system for fruit orchards affords little flexibility, requires high investment costs and entails high risks. The problem of alternate bearing is well known for longans and lychees in the lowlands. Productivity may drop to zero in a bad year—the real cause is still little understood, even in highly advanced production areas, such as

California. Market development is often essential, as is now being done for certain villages by the Royal Project. The most significant implication on the highlands' environment is that large-scale development of orchards may spread throughout the region. Landscape of monoculture fruit trees or, if mixed, at the most two or three species, with ground coverage of grasses and herbs would have a much stronger and more negative effect upon highland biodiversity than the traditional production systems of upland rice and upland crops.

The high economic returns from fruit and vegetables would also lead to the expansion of highland agriculture by hilltribe farmers themselves, and by encouraging some lowland farmers to move to the highlands. This has happened in Mae Wang Sub District (fruit), Inthanon (cabbages), Mae Fah Luang Sub District (fruit), Chiang Rai (ginger and soy-bean), Om Koi (tomatoes), and Chiang Dao-Mae Taeng (taro, potatoes). Unless strict control is imposed on commercial production, there is a strong possibility that attempts to save the forest may in the end actually lead to further forest destruction through increased market forces and income opportunities.

To many people, including many field workers in various projects, fruit trees and tree crops may seem to provide services similar to natural forests. A further note of caution is in order. Rubber trees, because of their shallow roots, could not prevent the massive 1989 landslide at Khiriwong in Nakhon Sri Thammarat province. Furthermore, replacing deciduous trees (those shedding their leaves in the dry season, and which are native to many parts of the highlands) with evergreens, whether of fruit or timber species, will lead to major increases in dry season water consumption.

### **Support from the Government**

The Thai government has spent considerable resources both in helping to better the lives of highland people and in environmental conservation. Some of the assistance, both financial and technical, has come from foreign governments and organizations ([Table 3](#)). Highlights of some of these projects are as follows:

TA-HASD (Thai-Australia Highland Agricultural and Social Development Project) was implemented by the Hilltribe Welfare Division, with assistance from the Australian International Development Assistance Bureau (AIDAB)—an assistance organization of the Australian government. The highlight of this project was its program on the development of small watersheds as management units. The project provided assistance to farmers in land use management emphasizing slopes as the major criteria for land suitability. The project focused on the productivity of cropping systems as well as on soil and water conservation. Through Village Watershed Revolving Fund programs, management of improved resource bases, e.g., development of irrigation and paddy land, watershed management and conservation on a communal basis, has been initiated in some villages.

UN-Sam Mun (United Nations-Sam Mun Highland Development Project) was implemented by the RFD, with support from the UN. The project's strength is its initiatives in encouraging communal organization that facilitates interaction between highland communities sharing the same watershed and fostering collaboration to deal with potential conflicts on resource use.

The Royal Project has long been the only major publicly-supported source of agricultural technology for the highlands. The project introduces new crops, which often must include early support on marketing as well as production inputs. The Royal Project has mainly focused on temperate crops of fruit, vegetables and flowers. Fruit and vegetables proven to have commercial potential have spread to other villages outside the project area.

TG-HDP (Thai-German Highland Development Project), initially emphasized cash crops to replace opium, and then concentrated on initiating soil and water conservation (SWC) practices among farmers. The emphasis on SWC was such that cash incentives were given to farmers, extension workers and villages for the adoption of SWC. In 1990, a more comprehensive strategy was adopted by TG-HDP to include the development of Sustainable Farming Systems (SFS) and Community-based Land Use Planning and Local Watershed Management (CLM). Direct incentives have now been withdrawn. TG-HDP emphasizes

strengthening the role of local government offices dealing with agricultural extension, research, and hilltribe public welfare, and other related areas, in development activities.

Care International is a non-governmental organization (NGO). Its development projects in Mae Chaem and Mae Hong Son emphasize strengthening communal organization, assisting in establishing links with governmental bodies to improve existing farming systems on a sustainable basis, and increasing hilltribe access to public services.

All these projects have received financial assistance from foreign governments and international organizations. But in most cases contributions from the Thai government have also been substantial. The projects vary a great deal in the level of support provided to each village, household, and per capita. The Royal Project, which gives direct support in production and marketing efforts, spends relatively more. After deducting the costs of the technical assistance of expatriate advisers, the budget for the TA-HASD project is in line with the Thai government's spending on similar projects.

### **Roles of Communal Organizations**

Agricultural development in the highlands is constrained by scarcity of suitable land, but productivity and hence income could be increased by commercialization and the use of improved technology. It is important, however, that commercialization of highland agriculture does not lead to environmental degradation. In addition, highland communities are widely dispersed, which makes it difficult to monitor the impact of their actions on the environment.

Indigenous organizations, on the other hand, have long served in the communal management of natural resources, i.e., land-use management, control of forest fires and irrigation development. The strengthening of this communal organization offers an opportunity for local communities to take an active part in the management and conservation of natural resources.

A powerful tool to strengthen communal organization for resource management could be the Village Revolving Fund. At the moment, numerous funds have been initiated by various projects in some villages, including the Mosquito Net Fund, Latrine Fund, Pig Fund, Weaving Fund, Rice Bank, and Medicine Bank. Village Revolving Funds are generally operated by farmers, with varying degrees of efficiency and autonomy. The management of a Village Revolving Fund is a radical concept for most highland communities, although most are familiar with the concept of sharing. Too many funds in one village only leads to confusion and inefficiency. Too much supervision by government officials tends to create dependence and inhibits learning. A single Village Revolving Fund that is tied to communal resource management, along the line of the TA-HASD Watershed Development Demonstration Program, may be an effective way to foster local participation in natural resource management and conservation.

### **External Pressures**

***Competition from China, Laos and Myanmar:*** The high prices paid for temperate crops within Thailand and improved transportation between Northern Thailand and Myanmar, Laos and China will inevitably lead to increasing competition from farmers north of the Thai border. These countries have the biophysical advantages of lower temperatures because of higher latitudes as well as altitudes over Thailand. The cost of production of temperate fruit, vegetables and flowers, as well as field crops, such as red kidney beans, wheat and barley, are all much higher in Thailand (see [Table 4](#) for Kunming prices, Yunnan Province, China). In the face of such competition, the long-term prospect for temperate crops in the highlands is in grave doubt. Research will hopefully come up with alternatives, e.g., sub-tropical crops, such as lychees, longans, and mangoes.

***Intensification of Conflicts Arising from Competition for Resources:*** The high economic returns of highland agriculture has resulted in the expansion of production. This will lead to increased competition for the two most crucial resources, land and water. Conflicts regarding the use of land and forests and competition for water between neighboring villages, between highlands and lowlands, and between

agricultural and urban areas, will intensify.

**Government Policy on Land Use in the Highlands:** Forest protection and conservation is generally the main thrust of the Thai government's land use policy in the highlands. The policy direction involving the communities now living and cultivating land in the area of Watershed Class 1, however, is still unclear. Under what conditions will the highland communities be allowed, if at all, to live in the area? Relocation and regrouping policies have not been, nor are they ever likely to be, effectively implemented. With the size of the population involved, there is simply not enough suitable land anywhere for the people to be relocated to. The idea that people should be able to live in harmony with the forest, thereby meeting local livelihood and national conservation needs, has taken root and is relatively widely upheld among policy makers. This has already led to various development projects identifying procedures for resource allocation and conservation in the highlands. Lessons learned and information gathered may now lead to modifications and improvements in highland land use policy that is in line with the recent changes. However, there is no legal basis supporting sustainable permanent agriculture in the highlands.

### **Future Direction and Recommendations**

Where road access is good, the tendency is for highland communities to rapidly move toward commercialization. Urbanization is taking place at a rapid pace in such highland areas as Mae Fah Luang, Mae Wang and Pang Ma Pah. The potential for this development to have adverse effects on watersheds and the environment is obvious.

The rate of population increase in the highlands is very high. Even with increased productivity, maintaining an ecological balance will be difficult if the rapid growth in population cannot be contained.

The following action is essential for sustainable land use management in the highlands, and would help achieve a balance between providing a decent livelihood for the indigenous population and protecting national watersheds and forests:

- population control by accelerating family planning programs increasing of employment options and opportunities through greater support for basic education and providing scholarships to enhance voluntary migration to the lowlands;
- promoting research and development (R&D) on sustainable highland agriculture with an integrated perspective;
- promoting highland agricultural development strategies
- establishing a legal basis for land use rights for highland communities.

At present, agricultural research and extension work in the highlands is conducted on a piecemeal basis. Soil and water conservation research and technology are the responsibility of the Department of Land Development (DLD). Separate institutes of the Department of Agriculture carry out research on horticultural crops (fruit, flowers, vegetables) and field crops (rice, wheat, maize, soybean). Extending soil and water conservation technology and crop improvement methods to farmers are conducted independently. In addition, little attention is paid to water conservation. Most R&D soil and water conservation currently concentrates on erosion control. Almost no research is being done on water use efficiency and conservation.

The present bureaucratic division within the Ministry of Agriculture and Cooperatives does not lend itself to the solving of such complex problems. Joint projects with effective collaboration between the DLD and the Department of Agricultural Extension should be promoted to carry out research that would lead to the development of technology for improving agricultural productivity that also emphasizes natural resources conservation.

To avoid losing out in the competition from Yunnan (China), Laos and Myanmar, research on new alternatives should also focus on subtropical crops, e.g., mangoes, lychees, and longan.

The promotion of semi-commercial production in the highlands would be a prime development strategy. A fully commercialized system requires substantial investments in transport and marketing infrastructure, which are not likely to be available for all highland communities. The most important cropping system is rice, plus commercial crops. Diversity in production (i.e., with fruit, vegetables and field crops) suited to each environment should be encouraged. It is also important to allow farmers to support their livelihood through harvesting minor products in their communities or headwater forests for which conservation measures have been organized and monitored by the village organization.

Although many highland villages have been registered with the Ministry of Interior, the land occupied by these communities is mostly within conservation forests. This lack of land security has been a major impediment to investment in conservation practices, both at the farm and government levels. It is, therefore, necessary to announce a clearcut policy and to legislate the Highland Communities Act.

Rights for highland communities should be restricted to the use of land for residential and sustainable agriculture. Ownership should not be allowed and land use rights should be made conditional on land use, and conservation practice agreements.

Land use rights should be issued to communities, not to individuals, and should be revoked if conservation requirements are not met. The following procedures should be carried out:

- The RFD, Hilltribe Welfare Division, Village Committee and the Communal Network of Watershed Sharing Communities should together draw up definitive village boundaries;
- Land use planning should be implemented at the village level by the DLD, Hilltribe Welfare Division, and the Village Committee, in conjunction with neighboring villages;
- Provisions should be made for a Village Watershed Revolving Fund, incorporating all of the present numerous small funds. Assistance should be extended on the condition that watershed conservation practices are adopted, with the Hilltribe Welfare Division as the monitoring body. The Village Watershed Revolving Fund should encourage active and effective involvement by communities in resource conservation on a sustainable basis;
- Preparation should be made for the integration of highland communities into the national administrative structure.

Highland communities have only recently begun to be included in the national administrative structure of the Department of Local Administration (DOLA), Ministry of Interior, and its levels of administration through its provincial, district, Tambon and village level offices. The task of coordinating highland development has been entrusted to the Hilltribe Welfare Division. Over the long term, highland villages should be integrated into DOLA's structure just like other villages in Thailand. When the various projects are terminated and if the highland villages are still not ready to be incorporated into the DOLA structure, then they should be placed temporarily under the responsibility of the Hilltribe Welfare Division. The budgetary processes of the various departments and ministries involved should be closely coordinated. The criteria for bringing villages into the normal administrative system are as follows:

- the criteria currently used for registered villages;
- a village boundary has been defined and acknowledged by RFD;
- a land use plan has been implemented;
- more than half of the village's agricultural households are engaged in sustainable agricultural and conservation practices;
- the Watershed Revolving Fund can be successfully managed by a village organization;
- village organizations are involved in managing natural resources, protecting the environment and preventing forest fires.

It is the opinion of the research team that the nature of the tasks and skills required to identify and solve the problems of highland communities are different from other development tasks of the Ministry of Labour and Welfare, and will increasingly be drawn into issues related to urbanization. The proper authority for the Hilltribe Welfare Division would be the Ministry of Interior. This would allow smooth coordination with DOLA

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