16 Northern Thailand

Changing Smallholder Land Use Patterns

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The Alternatives to Slash and Burn (ASB) research program in northern Thailand seeks to understand land use change in the mountainous mainland Southeast Asia (MMSEA) ecoregion and to develop technologies and policies that can improve land use management and human welfare in the region. The MMSEA includes the large region of hill and mountain terrain that joins the Himalayan mountains in southwestern China and extends through northern portions of Myanmar, Thailand, and Laos, to Vietnam in the east (figure 16.1). Several major river systems flow through or have headwaters in this region, also long known for its diverse ethnic composition and complex mosaic patterns of traditional land use that include shifting cultivation. Because this region also includes most of what remains of mainland Southeast Asia's rapidly dwindling forest resources, it is the focus of increasing environmental concern related to the use and management of surface water and biodiversity and to global climate change.

Improving natural resource management, reducing rural poverty, and understanding the important role of socioeconomic context in which resource use decisions are made are key ASB objectives. More specifically, given strong and growing concern over watersheds and river systems that support major lowland populations, their rice bowl production areas, and urban and industrial centers, ASB chose watersheds as its unit of observation in establishing

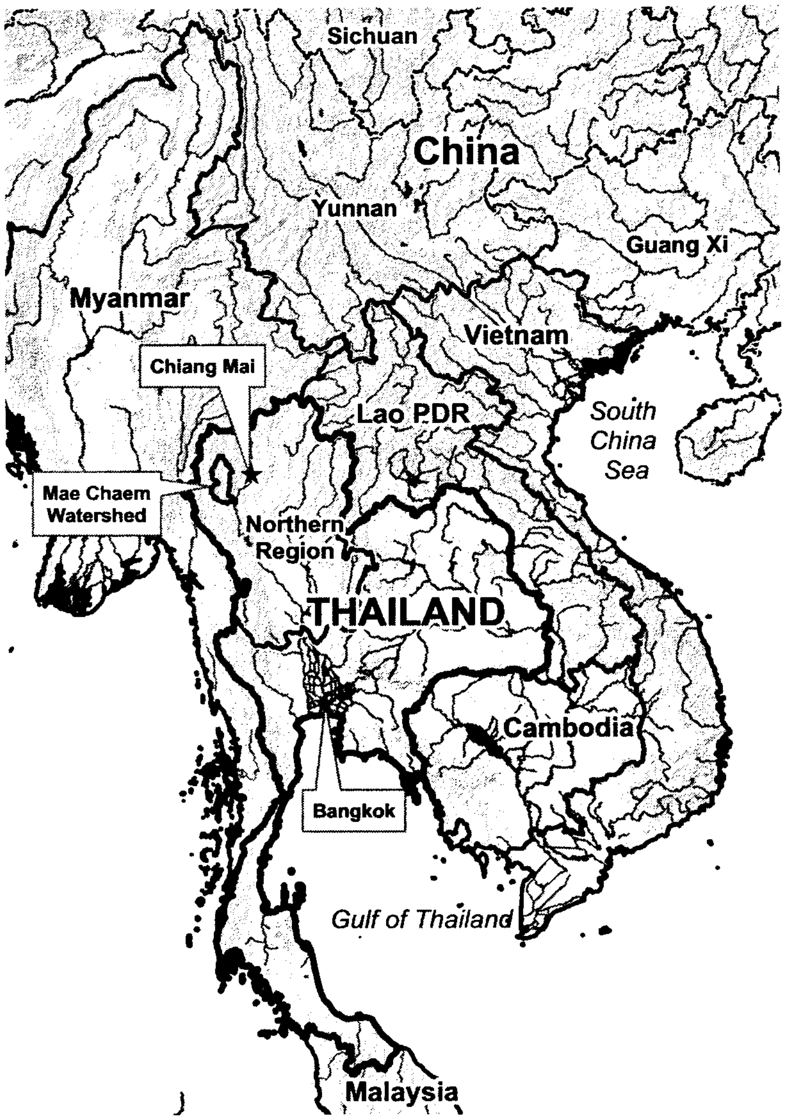

Figure 16.1 Mountainous mainland Southeast Asia and the ASB Thailand benchmark site.

an analytical framework. Moreover, special focus is given to land use in upper tributaries, where many poor minority communities have benefited least from the rapid economic development that has characterized Thailand and the region. We also seek to incorporate into our analysis relevant lessons from the Asian economic crisis and constitutional and governance issues emerging in Thai society and the wider region.

This chapter focuses on changes in patterns of land use in mountainous landscapes of northern Thailand, with particular attention to changing land uses of mountain minority communities and the effects of these changes on environmental services emerging from watersheds. The next two sections describe changes in land use in the study area, discuss some of the factors influencing land use change, and identify some of the environmental consequences of these changes. Then we examine selected project-specific responses to factors influencing changes in forest and land use, describe promising technological and institutional innovations, and provide details of ASB's research, capacity strengthening, and outreach agendas in Thailand.

CHANGING LAND USE PATTERNS IN MOUNTAIN WATERSHEDS

The ASB Thailand research strategy began with a review of policy concerns and issues associated with changing patterns of land use in northern Thailand, with emphasis on upper watershed areas (Thomas 1996). We also reviewed the literature and ongoing research to identify strategic knowledge gaps and to guide the selection of an appropriate benchmark site and program development. Based on these reviews, the 4000-km^2 Mae Chaem watershed was selected as the primary ASB benchmark site. The ASB's secondary focus in Thailand has been on one ridge of the Mae Taeng watershed where the Sam Mun Highland Development Project was conducted over the period 1987 to 1994.

Because most land in upper watershed areas is officially classified as reserved or protected forest, our first task was to identify types of forest resource user groups and examine their uses of forested land for timber and other purposes and then to assess the effects of user practices on watershed degradation.

DEFORESTATION

Thailand entered its era of rapid economic growth in 1960 with the launching of its first national 5-year economic and social development plan. Although much economic development has been achieved, one cost has been the loss of more than half of Thailand's natural forest resources, resulting in growing concern about loss of biodiversity and contributions to global climate change. Table 16.1 summarizes changes in proportions of land under forest, agriculture, and other uses over the period 1960 to 1998, for the nation as a whole and for northern Thailand.

Table 16.1 Changes in Percentage Land Cover in Thailand and Northern Thailand, 1960–1998

Land Cover		Proportion of Total Area (%)				
		1960	1970	1980	1990	1998
Forest cover	National	54.0	46.0	32.0	27.3	25.3
	Northern Thailand	68.8	67.3	53.9	46.4	43.1
Farm land	National	20.0	29.0	37.1	41.2	41.5
	Northern Thailand	11.0	17.0	24.5	28.0	27.5
Other nonforest	National	26.0	25.0	30.9	31.5	33.2
	Northern Thailand	20.2	15.7	21.6	25.6	29.4

Sources: Adapted from Charuppat (1998) (Royal Forest Department), Center for Agricultural Statistics (1994), and Center for Agricultural Information (1998).

Although dramatic decreases in forest cover began later in northern Thailand than in much of the rest of the country, major losses occurred at both levels in the 1970s. Rates of loss appear to have begun to decline recently, but percentage losses in forest cover are still above the national average. Moreover, although most remaining forest is in the north, losses there are already greater than in other areas of the MMSEA. There are three principal proximate causes of deforestation in northern Thailand: conversion of forests to agriculture, logging, and traditional farming practiced in forested areas.

- **Conversion of Forests to Agriculture.** Conversion of forest after 1960 throughout Thailand was associated primarily with expansion of land for agriculture, as seen in table 16.1, both to feed the growing population and to produce export crops to provide foreign exchange for the rapidly growing economy. Conversion to agriculture was facilitated by heavy logging and, in the late 1970s, by policies promoting agricultural expansion. Policies to address political and national security issues further encouraged forest clearing (Pragtong and Thomas 1990). As agriculture began to expand into increasingly marginal sites, overall population growth rates began to decline, the economy underwent structural adjustments that favored the industrial and service sectors, and urban and suburban growth began to accelerate. Forest conversion then became increasingly associated with cities, industry, housing, resorts, and, more recently, land speculation (Thomas 1996, 1997).
- **Logging of Natural Forest.** Logging helped fuel economic growth initially, but the combination of huge concession areas overlapping with protected forest areas and local communities, high official and unofficial harvest rates, low replanting rates, settlement and cultivation of logged areas, and slow expansion of plantation forests made such contributions to economic growth unsustainable (Pragtong and Thomas 1990). Although logging concessions were stopped in 1989, illegal logging is still a problem in reserved forest and protected areas. Forest department policy now emphasizes forest conservation rather than timber production and the strict enforcement of established rules.
- **Traditional Agriculture within the Forest.** In the mountains of northern Thailand, various ethnic minorities have long lived as farmers in the forest (Kunstadter et al. 1978). A web of interrelated issues is associated with their land use practices, including opium production, shifting cultivation, rural poverty, and the impact of land use practices on protected forest areas and on the environmental services these forests provide (Rerkasem and Rerkasem 1994; TDRI 1994; Thomas 1996; Kaosa-ard 2000). The 1997 distribution of mountain ethnic minority populations living in the midlands and highlands (above 600 m a.s.l.) is presented in table 16.2 for the nation as a whole, the northern region, Chiang Mai province, and the ASB benchmark site (Mae Chaem). Although national proportions of mountain ethnic minorities are quite low, they often make up more than half of the population in northern upper watershed areas.

The grouping of communities into highland, midland, and lowland categories corresponds to the altitude zones in which they have been most prevalent and the

Table 16.2 Distribution of Mountain Ethnic Populations, by Ethnic Group and Geographic Area, 1997

Groups	Nation	Northern Thailand	Chiang Mai	Mae Chaem
With Highland Agricultural Traditions				
H'mong	126,300	119,768	19,011	4,814
Lahu	85,845	84,262	32,583	—
Akha	56,616	56,157	5,486	—
Yao	48,357	42,561	353	—
Lisu	33,365	31,040	13,201	431
Subtotal	350,483	333,788	70,634	5,245
With Midland Agricultural Traditions				
Karen	353,574	310,909	111,667	29,197
Htin	38,823	40,302	—	—
Lua	17,637	16,225	5,473	1,451
Khamu	13,674	10,567	21	—
Mlabri	125	125	—	—
Subtotal	423,833	378,128	117,161	30,648
Mountain minorities[a]	774,316	711,916	187,795	35,893
Proportion of total	100%	92%	24%	5%
Total population	60,816,227	12,091,337	1,573,757	67,912
Mountain minorities	1%	6%	12%	53%

[a]Mountain minorities are defined as members of the ethnic groups listed in this table.
Source: Adapted from Hilltribe Welfare Division (1998).

types of agroecosystem management practices they have traditionally used (Preechapanya 2001). (Highland peak areas, a strategically important but small altitude zone not densely inhabited by humans, are excluded from the analysis presented here.) Although such groupings are based on traditional distinctions widely applicable across the MMSEA ecoregion, altitude zones are approximate, geographic domains of ethnic groups' overlap, and conditions change and traditions adapt over time. Table 16.3 presents estimates for the ASB benchmark site of the distribution of ethnic groups across altitude zones (top portion of table 16.3; rows sum to 100 percent) and ethnic distributions within each zone (bottom portion of table 16.3, columns sum to 100 percent) as of 1997. Note that 27 percent of highland tradition populations (H'mong and Lisu) are now located in midland and lowland zones, whereas 42 percent of midland tradition populations (Karen and Lua) are located in the highland zone (usually near its lower boundary), where they outnumber traditional highland groups by a factor of four.

From an environmental viewpoint, the most important distinction between traditional groups is their agroecosystem management (Thomas 1996). Attention usually has focused on shifting cultivation, or swidden components of their systems: Highland groups are associated with pioneer swidden agriculture, midland groups with

Table 16.3 Distribution of Ethnic Groups in the ASB site, by Altitude Zone, 1997

	Population	Distribution of Ethnic Groups Across Zones (%)		
		Highlands	Midlands	Lowlands
H'mong and Lisu	6,192	73	12	15
Karen and Lua	42,900	42	47	11
Thai	18,820	—	3	97
Total	67,912	33	32	35
	Population	**Ethnic Composition of Altitude Zones (%)**		
		Highlands	**Midlands**	**Lowlands**
H'mong and Lisu	6,192	20	3	4
Karen and Lua	42,900	80	94	19
Thai	18,820	—	3	77
Total	67,912			

Source: Unpublished International Center for Research in Agroforestry and Ministry of Interior data.

established swidden agriculture, and lowland groups with northern Thai swidden agriculture (Sheng 1979). There has never been a basis for official recognition of forest fallow fields as a component of agricultural land holdings, and clearing of fields in a shifting cultivation system is officially viewed as forest destruction. Critics of these official views claim that when a new field is cleared—especially under established or rotational swidden agriculture—an old field is returned to fallow, resulting in no net deforestation. Although remote sensing can provide estimates of the proportion of an area that is cleared of forest at a given time, little is known about the impact on forest ecosystems of changing swidden agriculture practices.

Watershed Degradation

Many believe that groups practicing agriculture of different types in different altitude zones are damaging the watersheds they cultivate (Rerkasem and Rerkasem 1994; TDRI 1994; Thomas 1996; Tangtham 1999; Kaosa-ard 2000). Two primary concerns are reductions in the quantity and quality of watershed services and increased conflict over watershed services. Although these concerns are most urgent in northern Thailand, they are relevant throughout MMSEA, including portions of the Hong (Red), Mekong, Salween, Irawaddy, Yangtze, and Xi Jiang (Pearl) river systems (Kaosa-ard et al. 1995; CMU 1996; Revenga et al. 1998; Tangtham 1999).

Reductions in the Quality and Quantity of Watershed Services

The mountains of northern Thailand are the headlands of the Chao Phraya river system, which nourishes Thailand's key rice (*Oryza sativa* L.) production areas in the central plains and the vast urban–industrial complex around Bangkok. Concern about deterioration of watershed services began in the 1960s when a group from the Kasetsart University Faculty of Forestry began research at three small highland subcatchments at Doi Pui. Findings through 1980 from a detailed set of studies suggest that the effects of swidden agriculture on stream flow, soil erosion, and water pollution were negative but modest, especially when compared with the effects on the same environmental parameters of more intensive forms of agriculture and the road construction and other activities associated with the human settlements that accompanied agricultural intensification (Chunkao et al. 1974, 1981; Lapudomlert et al. 1974; Prachoom et al. 1974; Aksornkoae et al. 1977; Chunkao 1983). Several follow-up studies have been undertaken (e.g., Royal Forest Department 1993; Vincent et al. 1995; Kaosa-ard 2000), but there is still insufficient socioeconomic and environmental information for comprehensive land use planning (Kaosa-ard 1996; Tangtham 1999). In particular, almost nothing is known about the effects of changes in product mix or production technology in mountain mosaic land use patterns on the quantity or quality of watershed services on-site or downstream or of the effects of such changes on the human welfare; both are key research questions for ASB.

Conflict Between Resource User Groups

Growing environmental awareness combined with increasing demands for water by agriculture, cities, and industry are focusing attention on land use in upper watersheds (Hirsch 1997). Increasing competition for water resources among a growing range of stakeholders, combined with shortages of key data and limited access to existing knowledge, are fueling debate, conflict, and confrontation (Kaosa-ard 2000). Various schools of thought are developing, some of which appear to reject most scientific analysis, whereas others seem unable to integrate local knowledge regarding watershed management practices, water rights, and water use into policy debates. In order for water scarcity to prompt innovation, conservation, and efficiency, established and agreed-upon criteria for measuring and valuing resource stocks and flows are needed (Kaosa-ard 1996). Valuation and other measures should be developed using both traditional and contemporary tools and concepts. Organizations and institutions to manage disputes at various levels also must be strengthened. Meanwhile, because action programs must proceed with less-than-ideal knowledge, tools, and institutions, mechanisms must be developed to systematically distill lessons learned from ongoing successes and failures into future action programs.

DETERMINANTS, EFFECTS, AND SPATIAL PATTERNS OF LAND USE

Three sets of factors contribute to land use and land cover change in northern Thailand: incentives and pressures for land use change, responses to these incentives and pressures by traditional mountain land use systems, and the spatial distribution of these responses.

Incentives and Pressures for Land Use Change

Six interrelated factors influence incentives and pressures for land use change.

Demographic Change

High population growth rates of mountain ethnic minority communities combined with migration to these areas from neighboring countries have increased the pressure of population on land (Rerkasem and Rerkasem 1994). In recent decades Thailand has been a safe haven and an economic magnet for many people in neighboring countries. Because many ethnic minority communities in the midlands and highlands are still being integrated into the formal Thai administration system, they are included only in recent demographic data. Table 16.2 presents estimates from the Hilltribe Welfare Division (1998) of mountain minority populations living above 600 m a.s.l. in 1997 at the benchmark, provincial, regional, and national levels. Although the mountain minority population represents only about 1 percent of the national population, almost all (92 percent) mountain minority members live in the northern region, and in the Mae Chaem site ethnic minorities represent more than half (64 percent) of the resident population.

Moreover, some mountain minority populations are the fastest-growing segment of the Thai population. Compared with estimates from the same source in 1972 (Kunstadter et al. 1978), highland groups have experienced population increases of nearly 10 percent per year, whereas midland groups have experienced growth rates of only about 2 and 3 percent in the north and in Chiang Mai province, respectively. This compares with an average annual growth rate of total population of approximately 2 percent in Chiang Mai and northern Thailand since 1972.

Agricultural Change

Expansion of area dedicated to agriculture and changes in product mix have been brought about by opium crop replacement projects in the highlands and by the expansion of now–land-constrained lowland agroindustry (TDRI 1994). Work in northern Thailand on replacement of opium with intensive commercial crops was pioneered largely by projects under the king's patronage, followed by a set of public and private projects in various northern areas. Although some highland production activities (e.g., cabbages [*Brassica* spp.], barley [*Hordeum vulgare* L.], ginger [*Zingiber officinale* Roscoe], and some fruit crops) are now conducted through private channels, Royal

Project centers specializing in fruits, vegetables, or ornamental plants are under the umbrella of the Royal Project Foundation, and some products are marketed under their own Doi Kham brand name (for details see Royal Project Foundation 2002).

In addition to these project-motivated changes in product mix, expanding Thai agroindustry is being displaced in urbanizing lowland areas and is pushing field crop and horticultural production onto hillsides and into mountain valleys in the midland zone. Examples of products produced in these new areas include soybean (*Glycine max* [L.] Merr.), maize (*Zea mays* L.), potato (*Solanum tuberosum* L.), longan (*Dimocarpus longan* Lour.), mango (*Mangifera indica* L.), and lychee (*Litchi chinensis* Sonn.). Although these efforts often have the blessing of rural development and poverty reduction programs, success in achieving these program objectives has varied substantially spatially and over time and has been hampered generally by the high investment requirements, higher agricultural risk, and lower profitability characteristic of agriculture in marginal areas, especially when pursued under highly fluctuating economic conditions.

Government Policy Incentives

Forest policy has resulted in the establishment of forest reserves, national parks, wildlife sanctuaries, and protected watershed forests that preclude formal recognition of private land ownership claims in most mountain areas. The importance of reserved and protected areas to populations living above 600 m a.s.l. is suggested in table 16.4. In some areas, land has been degazetted from reserved or protected status when local communities have demonstrated long-term residency and met other requirements. In all midland and highland areas, though, the absence of property rights may affect incentives to invest in more sustainable land management and agricultural activities. Note that the ASB benchmark site (Mae Chaem) is well placed to study issues asso-

Table 16.4 Spatial Distribution of Populations Living Above 600 m Above Sea Level, by Geographic Area and Land Status, 1997

Land Category	National	Northern Thailand	Chiang Mai	Mae Chaem
Reserved forest	611,400	589,279	174,224	30,794
National parks	39,421	37,877	15,742	311
Wildlife sanctuaries	40,600	30,900	6,755	—
No-hunting areas	2,001	1,957	1,895	—
Degazetted areas	283,878	250,104	46,689	3,309
Planned reserves	8,322	8,322	8,322	4,615
Military lands	5,500	—	—	—
Total	991,122	918,439	253,672	39,029

Source: Adapted from Hilltribe Welfare Division (1998).

ciated with communities living in reserved forest, planned reserves and parks, and degazetted areas.

The perceived importance of watershed issues has prompted another set of policies directly related to land use in the mountainous areas of northern Thailand. A watershed classification system was developed and implemented throughout the country, initially under the aegis of the National Research Council and subsequently under the Ministry of Science, Technology, and Environment. Five watershed classes were identified using 1:50,000 scale topographic maps, and land use regulations were developed for each class; land use was most restricted in Class 1 areas and least restricted in Class 5 areas (Chunkao 1996).

Table 16.5 presents the spatial distribution of watershed classes nationally, for the northern region, for the Ping Basin, and for the ASB site located in the Ping Basin. Although proportions of land in classes with severe restrictions appear modest at national level, this proportion increases rapidly as one moves upstream. For example, although only 26 percent of the nation's land falls into Class 1 and Class 2 (the most limiting land use restriction categories), the proportion in these classes is twice that for the northern region and the Ping and climbs to about 90 percent in the Mae Chaem watershed, a major tributary of the Ping River.

But hydrologic services are not the only concern in mountainous areas. Illegal logging, production, and processing of narcotics and national security all contribute to the felt need for government policy action in midland and highland areas, and the sources of policy action are becoming more diverse. For example, whereas in the past rural poverty programs in the mountains have been conducted largely through the Public Welfare Department, in the contexts of special projects, or by missionaries (Renard et al. 1988), since constitutional reform was enacted in 1997 rural development decision making has been shifting to elected local governments. Various new provisions that shift responsibility and authority for watershed management from national to local policymakers, including a community forestry law, are now being considered by Parliament.

Table 16.5 Distribution of Land by Watershed Class at National and Subnational Levels

Geographic Area	Distribution of Land by Watershed Classification (%)				
	Class 1	Class 2	Class 3	Class 4	Class 5
Thailand	18.1	8.3	7.7	15.8	49.0
North	32.6	15.0	10.8	9.5	31.8
Ping Basin	38.3	14.2	9.6	8.9	28.3
Mae Chaem (ASB site)					
Overall	63.9	25.0	8.7	1.8	0.7
Highlands	82.6	14.5	2.9	0.0	—
Midlands	54.7	32.4	10.2	2.7	—
Lowlands	17.7	41.9	28.2	6.0	6.1

Area covered by water are not included in this table, so rows do not sum to 100%.

Sources: Chunkao (1996), International Center for Research in Agroforestry unpublished data.

Infrastructure Development, Market Access, and Public Services

Programs to eradicate opium production and to promote national security have increased efforts to expand road infrastructure in mountain regions. Expanded road networks have had direct and indirect negative environmental effects; road construction and roads themselves disrupt ecosystems, and improved access to forests can fuel illicit logging and forest extraction operations. On the other hand, roads have brought market access for alternative cash crop production to many remote areas. Expansion of public services is another public policy objective, including registration of minority communities, the provision of improved education and health services, and increased access to electricity and mass media, all of which increase opportunities to integrate these communities into national society.

Urbanization, Industrialization, and Tourism

Tourism, resorts, and recreational facilities are bringing new claims, pressures, and opportunities to mountain areas (Dearden 1996). Urbanization and industrialization have also begun affecting various aspects of life and decision making in mountainous areas. For example, land in these areas is coming to be valued as a tradable commodity and a store of wealth rather than simply an input into an agricultural production process (Thomas 1996). The consequences of this shift for land values, land use, poverty, and environmental services are not known.

Environmentalism

Rapid growth of environmental awareness has been associated with both a populist element calling for more local control over natural resource management and a more ecocentric element that believes local communities should be excluded from protected areas for the longer-term benefit of larger society. Although these two factions were allies during the early emergence of the environmental movement into the national public policy arena, they have since split into camps that often oppose each other (Thomas 1997). Tension between these elements is substantial and growing and occasionally breaks out into open conflict.

Effects of Incentives and Pressures on Traditional Mountain Land Use Systems

The effects of these incentives and pressures on the natural resource base and on human welfare are conditioned by the traditional land use systems developed for specific altitude zones and by ethnic groups that practice them. Three general categories of traditional systems have evolved in the mountain ecosystems of northern Thailand: highland, midland, and lowland. These systems reflect the natural forest types that exist in the area—which are strongly associated with altitude, as modified by geology, aspect, fire, and other factors—and the cultural diversity of the region (Grandstaff 1976; Kunstadter et al. 1978; Schmidt-Vogt 1999). Table 16.6 presents some of the basic features of these three altitude-specific zones, as of about 1960, that are important for understanding the distribution of resources, people, and activities in northern Thailand and other parts of the MMSEA.

Traditional highland land use systems are generally characterized as pioneer systems and are practiced by mobile villages using long cropping cycles and very long "abandoned" forest fallow cycles that are viable only in areas with small populations with access to extensive areas (Grandstaff 1976; Kunstadter et al. 1978; Sheng 1979).

Traditional midland land use systems are associated with more established villages and systematic, short cropping cycles, long rotational forest fallow systems that often include paddy rice land where topography and water allow, and systematic management of landscape components including areas kept under permanent forest cover (Grandstaff 1976; Kunstadter et al. 1978; Chammarik and Santasombat 1993; Thomas et al. 2000). Some of these managed forest parcels include miang or jungle tea production, where *Camellia sinensis* L. is planted as an understory tree in hill evergreen forest. Leaves are steamed and sold with or without fermentation for chewing as a traditional stimulant. Livestock also grazes in these midland systems (Preechapanya 1996, 2001).

Traditional lowland land use systems have focused largely on irrigated paddy rice production and home gardens (Preechapanya 2001), sometimes with supplemental short-fallow cropping practiced on nearby slopes.

Table 16.6 General Features of Traditional Land Use Systems, by Altitude Zone and Natural Forest Type

Zone Label	Altitude Range (m a.s.l.)	Natural Forest	Ethnic Groups	Traditional Agricultural Practices
Highlands	1000–1800	Hill evergreen and coniferous	H'mong, Lisu, Akha, other	Pioneer shifting cultivation (perhaps with opium)
	1000–1200		Thai, Karen	Jungle tea (in some areas)
Midlands	600–1000	Mixed deciduous	Lua, Karen	Paddy (limited) and rotational long-fallow shifting cultivation
Lowlands	<600	Dry deciduous and swamp	Thai	Paddy, gardens (perhaps with short-fallow shifting cultivation)

Source: Adapted from International Center for Research in Agroforestry and Royal Forest Department unpublished data.

As indicated earlier, over the past 30 years or more, the incentives and pressures for change have altered product mix and production technology within and across the traditional altitude zones, with consequences for producers, consumers, and the environment (Chammarik and Santasombat 1993; Rerkasem and Rerkasem 1994; TDRI 1994; Thong-ngam et al. 1996; Kaosa-ard 2000; Thomas et al. 2000, 2002; Thomas 2001). Table 16.7 (and the following text) summarizes these changes.

- **Highlands.** Pioneer shifting cultivation and opium production have been largely replaced by commercial vegetable production that is now pushing from the highlands down into the midlands (TDRI 1994). There is growing downstream concern about impacts on stream flow, erosion, and pesticide water pollution.
- **Midlands.** Pressures from population growth, expanding lowland and highland systems, and government policy have reduced land availability, often resulting in much shorter forest fallow cycles and some conversion to permanent fields. In some cases, sacred tree groves are being threatened.
- **Lowlands.** Field crop production systems, and in some cases orchards, have moved from lowland areas into forested watersheds above rice paddies and are pushing up into the midland zone.

Spatial Distribution of Land Use Change

Neither the factors influencing land use change nor the changes themselves are distributed uniformly within or between altitude zones. Estimates of the proportions of

Table 16.7 Changes in Land Use and Their Consequences, by Altitude Zone

Zone Label	Altitude Range (m.a.s.l.)	New Land Uses	Producer and Consumer Issues	Environmental Issues
Highland	1000–1800	Commercial horticulture, grasslands, forest plantations	Crop markets, land security	Deforestation, reduced stream flow, water pollution
	1000–1200	Jungle tea (in some areas)	Crop markets, land security	Less forest buffer
Midlands	600–1000	Paddy (limited) and short-rotation shifting cultivation, permanent upland fields	Food security, land security, crop markets	Deforestation, reduced stream flow, water pollution
Lowlands	<600	Paddy, gardens, upland field crops, orchards	Crop markets, irrigation water, land security	Deforestation, reduced stream flow, water pollution

Source: Adapted from International Center for Research in Agroforestry and Royal Forest Department unpublished data.

Table 16.8 Distribution of Land Cover Type, by Geographic Area, 1990

Geographic Area	Proportion of Total Area (%)		
	Forest	Agriculture	Nonforest
Thailand	27.3	41.2	31.5
Northern Thailand	46.4	28.0	25.6
Mae Chaem (ASB)	79.4	1.5	19.0
Highlands	81.5	0.4	18.1
Midlands	74.8	1.6	23.7
Lowlands	85.4	7.5	7.1

Sources: Adapted from Charuppat (1998) (Royal Forest Department) and unpublished International Center for Research in Agroforestry data.

land in forest, agriculture, and other nonforest categories at national, regional, and site levels are presented in table 16.8. As one moves from the nation to the watershed level, forest cover increases (e.g., from 27 to 46 to 79 percent) and area dedicated to agriculture decreases (e.g., from 41 to 28 to 1.5 percent). Within Mae Chaem, roughly similar patterns occur among altitude zones that comprise the site. One must be cautious in interpreting such data, however, because issues of measurement error loom large, especially for midland and highland land systems; boundaries of components of these systems are located using remote sensing techniques that have difficulty distinguishing between some system components, such as between fallow and forest cover.

Table 16.9 Subdistricts of the Mae Chaem Benchmark Watershed, by Altitude Zone

Subdistrict Labels	Total Area (ha)	Altitude Zones (percentage of total land)			Land Use Features
		Highlands	Midlands	Lowlands	
Ban Chan	18,504	92	8	—	High-value horticulture
Chaem Luang	24,851	84	15	—	Med-SC, veg., park
Pang Hin Fon	24,167	75	25	—	Short-SC, veg., park
Mae Daet	16,453	70	31	—	Med-SC, veg., park
Mae Suk	68,200	60	38	3	Med-SC, veg.
Mae Na Chon	72,545	45	51	3	Short-SC, veg., park
Ban Tub	40,647	36	53	11	Short-SC, veg., park
Kong Khaek	36,918	18	61	21	Fixed fields, park
Ta Pha	10,672	25	45	30	Fixed fields, park
Chang Koeng	19,961	22	52	26	Town, fixed fields, park
Total	332,918	51	41	7	

Med-SC, medium-cycle, shifting cultivation; veg., vegetable crop production; park, parkland; short-SC, short-cycle shifting cultivation.

Sources: Adapted from unpublished Royal Forest Department, International Center for Research in Agroforestry, and Care-Thailand data and unpublished Ministry of Interior data.

Policy domains can also influence spatial patterns of land use. For example, the 4000-km^2 Mae Chaem watershed can be disaggregated into administrative subdistricts, or tambons, ten of which make up about 90 percent of the watershed. These subdistricts are increasingly important decision-making units for natural resource management, especially since the 1997 constitution changes that delegated power and responsibility for many such decisions to local authorities. Table 16.9 indicates the relative size of these subdistricts, how their land is distributed between altitude zones, and a few major features of land use within their domains. Differences within altitude ranges across subdistricts are explained by natural factors such as geology and geography and by policy decisions related to road access, current and past project activities, and government programs.

EFFORTS TO ADAPT TO CHANGING CONDITIONS

In response to these incentives, pressures, and resulting patterns of change, innovative farmers and pilot projects have been seeking ways to improve livelihoods while reducing pressure on forests and protected watersheds. Some of these are local efforts by individual households or local leaders, and others are facilitated or promoted by projects executed at various scales by government agencies or nongovernment organizations (NGOs) (TDRI 1994; Thomas 1996; Kaosa-ard 2000). ASB Thailand seeks to learn from, build on, and support such efforts. In addition to the continuing efforts of the Royal Project Foundation, several projects are providing useful insights regarding organized efforts to influence land use change.

SAM MUN PROJECT

One particularly noteworthy project is the 1987 to 1994 Sam Mun Highland Development Project (hereafter called the Sam Mun Project), an interagency project led by the Royal Forest Department in collaboration with the Office of the Narcotics Control Board, with funding assistance from the United Nations Drug Control Program and the Ford Foundation (Limchoowong 1994; Thomas 1997). The 2000-km^2 project area is located in the midland and highland zones of a ridge of mountains beginning northwest of Chiang Mai City and extends to the Myanmar border. This area, like some of the ridges in the ASB Thailand benchmark watershed, was once an important opium production area; opium poppies occupied more than 800 ha in 1989. Although one of the last internationally supported projects focusing on opium crop substitution, it is generally recognized as the most effective and the most integrated in its approach. Its Thai leaders made serious efforts to learn from previous projects, and even academics usually very critical of forestry policies and projects have recognized the value of their approach (Ganjanapan 1997:208).

To paraphrase a former project director, the Sam Mun Project focused on strengthening the capacity of community organizations so they could be self-reliant in managing their communities, food supplies, and natural resources (soil, water, and forest) in a manner that was appropriate to their lifestyles and values, ensured community stability, and developed their community and environment in response to local needs and government policies, including reductions in opium production (Limchoowong 1994:11). The project assumed that people and forests could live in harmony and emphasized food self-sufficiency, income generation, reduced use of chemicals in agriculture, reduced swidden agriculture, increased forest protection, initiation of watershed management networks, and the development of tools for local land use planning. Many of the methods and tools pioneered by this project, such as participatory land use planning (PLP, explained later in this chapter) (Tan-kim-yong et al. 1994) and three-dimensional village land use models, are now being used and further adapted by projects in Thailand and neighboring countries. In addition to promoting important changes in land use in the project area (e.g., area under shifting cultivation was reduced by more than 80 percent and forest cover more than doubled; Tan-kim-yong et al. 1994), the project also helped communities gain access to health and education services, citizenship, and infrastructure improvements needed to implement their development plans. Finally, as regards opium production, the project was highly successful; area dedicated to opium decreased by about 90 percent from 1989 to 1994 (figure 16.2).

Queen Sirikit Forest Development Project (*Suan Pah Sirikit*)

Building on previous smaller-scale efforts, this interagency project in the Mae Chaem watershed has been conducted under the patronage of H.M. the Queen of

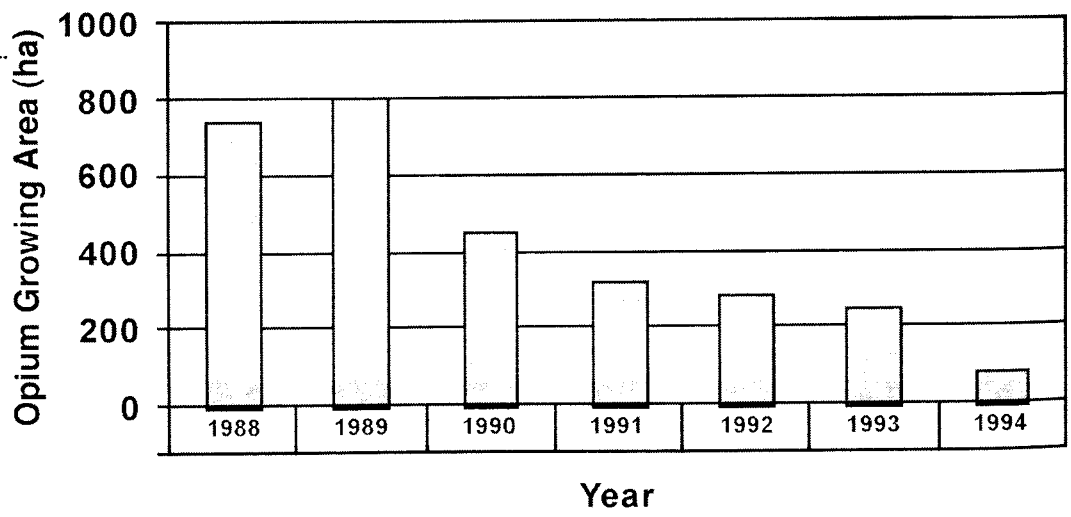

Figure 16.2 Opium-growing area in the Sam Mun Highland Development Project, by year (Limchoowong 1994).

Thailand since 1996 (Suan Pah Sirikit Project 2000). The Royal Forest Department has a leading role in implementation through its ten watershed management units in the area. The project philosophy is that people can live in harmony with the forest through community participation in conservation and forest resource development. Collaboration between villagers and government agencies in developing and implementing local land use plans is viewed as essential to improving livelihoods in ways that protect watershed headlands. Initial work began in response to rapid deforestation after the end of a foreign-funded project in the late 1980s that, despite major reductions in opium production and some useful innovations, had no lasting positive impact on watershed management. The Suan Pah Sirikit project has built on promising innovations and adapted several participatory methods and tools used in the Sam Mun Project, along with experience from various Royal Projects and other sources.

CARE-Thailand Integrated Natural Resources Conservation Project

The Integrated Natural Resources Conservation Project sought to conserve watersheds in the northern provinces of Chiang Mai (Mae Chaem district) and Mae Hong Son that had been degraded by illegal logging, forest fires, and agricultural expansion. From 1994 to 1999 the project worked with local communities to promote sustainable agriculture and the improved management of fragile watershed forests. Project components included agroforestry, soil and water conservation, paddy rice and fish pond development, and nonfarm income-generating activities. Project partners included the Royal Forest Department, agencies of the Ministry of Agriculture and Cooperatives, and the local governments. They also worked closely with Chiang Mai University to study and implement approaches for promoting community participation in sustainable land use. The project provided valuable assistance during establishment of the ASB Thailand benchmark site, and ASB is a partner in the implementation of their follow-on project focusing on strengthening local institutions associated with natural resource management launched in 2000.

Other Development and Conservation Projects

The ASB Thailand is also seeking to learn from the experience of previous projects, including the Thai–German Highland Development Project, the Thai–Australian Highland Development Project, and the Thai–U.S. Agency for International Development Mae Chaem Development Project, and from other current efforts being conducted by Thai NGOs, local groups, and government agencies.

PROMISING AGRICULTURAL INNOVATIONS

Drawing on experience of these projects, including numerous examples of ideas and adaptations that came directly from farmers, among the most promising technical approaches to improving livelihoods while reducing pressure on forest or watersheds are those that focused on decreasing the area dedicated to upland rice production and those that increased trees on the landscape.

Meeting Food Security Needs with Less Area Dedicated to Rice Production

Three approaches have been proposed for meeting food needs while decreasing the total area dedicated to food production, all of which presume that agricultural intensification will reduce pressure on forests.

Expanding Paddy Rice Production

Preliminary findings suggest that expansion of irrigated paddy rice land, in the small niches where terrain and water resources allow, can greatly reduce land dedicated to upland rice production. Given the higher productivity per hectare of paddy rice compared with upland rice, every hectare of paddy rice added can reduce by 10–20 ha the amount of upland rice area needed to meet food needs, depending on paddy yields and the length of the swidden fallow cycle. The response by farmers to paddy rice incentives provided by the Sam Mun Project was substantial (Limchoowong 1994), especially during the initial phase of the project (figure 16.3).

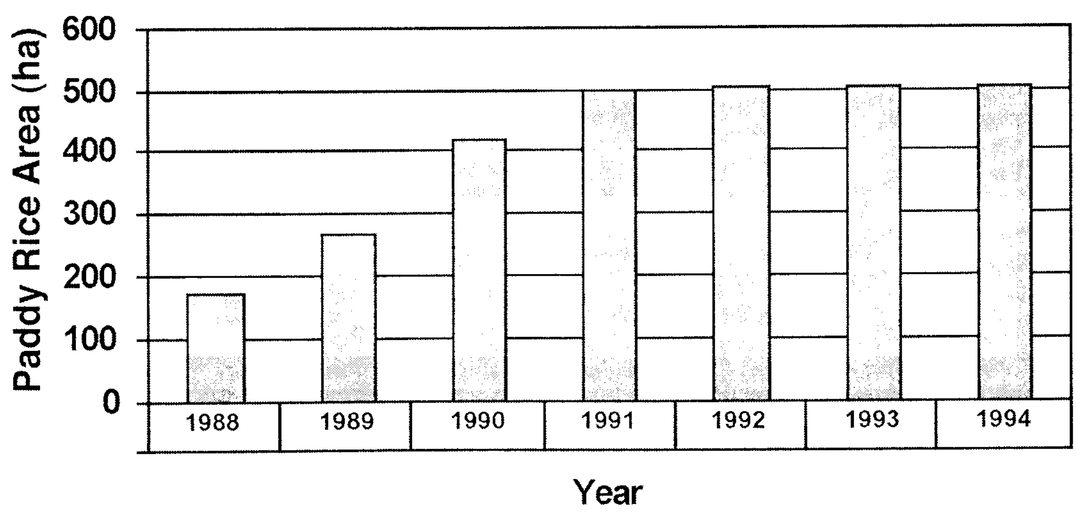

Figure 16.3 Paddy rice area in the Sam Mun Highland Development Project, by year (Limchoowong 1994).

Preliminary data from a range of sites in the ASB benchmark watershed (Thomas et al. 2002) indicate that paddy rice production is much more profitable than upland rice production (in short fallow or permanent field systems), primarily because of high labor needs for weeding, the cost of chemical inputs, and the low productivity and higher variability of upland fields. Experiments have also been launched under ASB using new rice varieties to explore the possibility and potential impacts of double-cropping of rice in midland paddies.

Permanent Field Upland Rice Production

In areas in the Suân Pah Sirikit Project where terrain or water availability does not allow sufficient expansion of paddy to meet local food needs, some farmers have developed a crop rotation system for permanent upland fields in which upland rice is rotated with soybean every third year. This has allowed farmers to reduce substantially the total area needed for upland rice production and has also provided a new source of income from the sale of soybeans. Land taken out of upland rice is converted to permanent community-protected forest. Farmers who have used this system for up to 10 years report no decline in yields. Because of the need for purchased inputs (at least fertilizer and herbicides), however, profitability is lower than in medium- to long-cycle forest fallow systems. Although forest fallows as short as 5 years can be sustainable without chemical inputs (Wangpakapattanawong 2001), yields are much lower than those in 10-year cycles (Thomas et al. 2002), which are now increasingly rare. Moreover, low soybean prices have caused many farmers to switch to maize as their main cash crop; it is not yet clear whether or how this substitution will affect sustainability or farmer incomes. The ASB Thailand is conducting agronomic and economic studies of this system.

Permanent Fields of High-Value Commercial Vegetables

This approach involves meeting food security needs by generating cash income and is particularly suited to highland areas where the climate supports production of temperate zone vegetables. One example of this approach is the Ban Chan subdistrict of Mae Chaem, where a project of the Royal Project Foundation has been operating for many years (Royal Project Staff 1999). There, many villagers are producing high-value specialty vegetables that are marketed largely through the Royal Project. These intensive systems use much less land than shifting cultivation, and although profits can be quite high, crops suffer from periodic severe damage caused by pests and weather shocks. Drastic price fluctuations also affect profits. Many villagers are responding to these factors by diversifying their production into two or more crops (B. Ekasingh, unpublished data 1999), in some cases including fruit trees. Land use change in this area is being studied in depth (Peters 2000), where traditional forms of shifting cultivation are now quite rare and land ownership has largely been privatized. These and other cash crop systems with various degrees of diversification are also components of land use patterns found in other areas of the watershed (Thomas et al. 2002).

But vegetable production can damage the environment. For example, highland cabbage production has come under strong criticism because of planting on steep slopes (and consequent soil erosion) and the heavy application of pesticides (and consequent water pollution) (Tangtham 1999). Projects are trying to introduce soil conservation practices and alternative pest management strategies, but with little success so far (Royal Project Foundation 2002).

Improving Livelihoods Through Agroforestry

There have been three major approaches to increasing the number of trees on midland and highland landscapes.

Simple Agroforestry

This approach has centered on inducing farmers to plant fruit trees in fields, following approaches pioneered by the Royal Project. In the highlands, temperate zone fruits such as Japanese apricot (*Prunus mume* Siebold & Zuccarini), Japanese plum (*Prunus salicina* Lindley), Asian pear (*Pyrus pyrifolia* [N.L. Burman]), and persimmon (*Diospyros* spp.) were introduced. In the midlands, subtropical fruits such as lychee were introduced. Results of efforts to encourage fruit tree production in the Sam Mun Project are presented in figure 16.4. These data probably understate the full impact of agroforestry inducement efforts because many trees were also planted in areas that

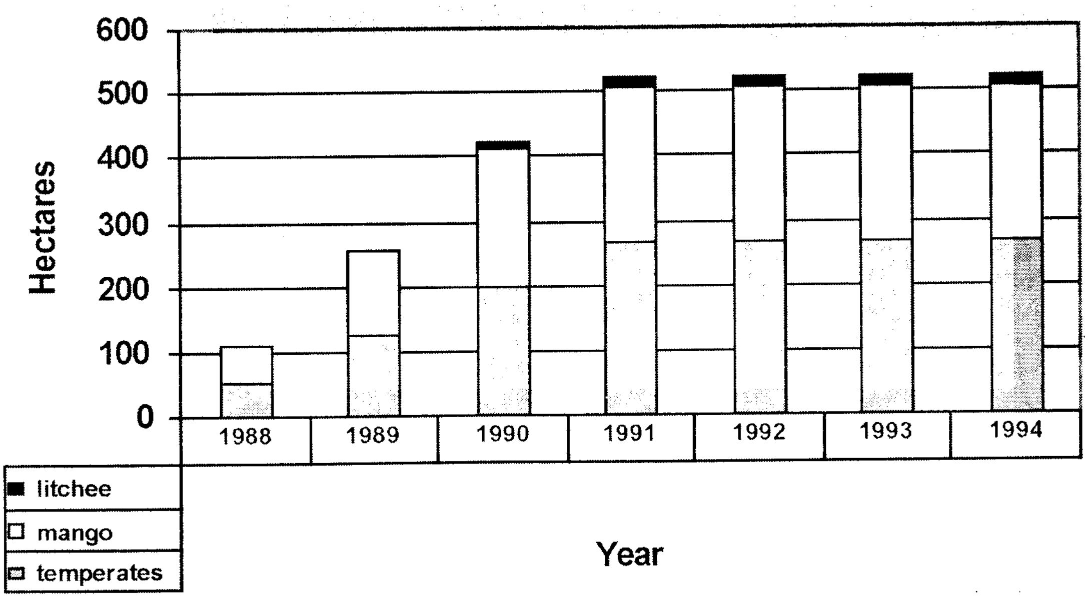

Figure 16.4 Area in fruit trees in the Sam Mun Highland Project, by year (Limchoowong 1994). *Temperates* refers to temperate zone fruits (e.g., plums, apricots, pears).

were not included in agroforestry area tallies, such as around houses and along field boundaries. Note that the gains were largest during the initial phase of the project; further planting has continued after the end of the project. A preliminary ASB study of fruit tree agroforestry in Sam Mun Project areas reports a substantial range of strategies and planting configurations (Withrow-Robinson et al. 1998; Withrow-Robinson 2000).

Complex Agroforests

The primary example of an indigenous complex agroforest in northern Thailand is the miang or jungle tea plantations embedded in hill evergreen forest (described in Preechapanya 1996, 2001). Although changing consumption patterns especially among young consumers have decreased demand, prices for miang tea appear to have recovered from the low levels of the early 1990s, and many producers now claim that their biggest problems are finding hired labor and fuelwood needed to process the tea. The Sam Mun Project had some success in helping Karen producers manage debt and obtain higher product prices.

An interesting variant of this system with potentially large implications for development projects has been observed among farmers in an area adjacent to the Sam Mun Project area (Castillo 1990). There, farmers have gradually transformed miang complex agroforests by substituting fruit trees and seed crops for many or most of the forest and tea trees. During this process farmers are careful to maintain a very complex structure that mimics the complexity of the original tea forest system (Tanpanich 1997).

Community-Managed Forests

This approach seeks to expand the area of permanent forest that local communities protect and manage as components of their overall mosaic agroforestry landscapes (Thomas et al. 2000, 2002; Thomas 2001). Efforts build on traditional concepts and beliefs of midland groups (in particular) to find ways to maintain traditionally conserved forest areas (Chammarik and Santasombat 1993), convert forest fallow in fragile areas to permanent forest, or reforest degraded areas by planting trees or protecting areas where natural regeneration is occurring. In the context of the Sam Mun Project, the forest department reforested 4855 ha using standard planting techniques. Villagers responded by using these techniques to recover 242 ha but chose to protect the natural regeneration of nearly 60,000 additional hectares (Limchoowong 1994). The keys to the success of this approach were reaching a clear mutual agreement on land use plans and establishing active community participation in controlling access, use, fires, and other factors. Although the project was initially successful, researchers and others are concerned that communities that switch from shifting cultivation to permanent forest cover will lose access to important natural products they obtained from forest fallow fields during intermediate stages of regeneration (Thomas et al. 2002). Natural products are a strategically important livelihood component for many mountain households (Nawichai 2000; Preechapanya 2001).

A fourth type of innovation quietly developed primarily by local farmers themselves is just beginning to emerge. Various examples of reduced-fallow upland rice systems that use improved fallow management to maintain higher yields are being documented and explored (Rerkasem et al. 2002).

PROMISING INSTITUTIONAL INNOVATIONS

Although technological advances can help induce land use change, institutional changes are also needed. Three important examples follow.

Land Use Planning

Pilot experiments have shown that it is possible to reach mutually acceptable land use agreements between villagers and agency officials using participatory methods (Kaosa-ard 2000). Pioneering efforts under the Sam Mun Project developed the now widely accepted approach known as participatory land use planning (PLP). In the words of its chief architect, "PLP can be defined as an operational tool or process which creates conditions of frequent communication and analytical discussions, hence strengthening local organizations by generating common understandings and shared rights and responsibilities among project partners, who carry out activities that lead to the solving of local forest management problems and other related community problems" (Tan-kim-yong et al. 1994:6). The conceptual framework of PLP focuses on identifying and resolving conflicts associated with natural resource management and development. Establishing a broad set of objectives and setting in place institutions to achieve them entails changes in the roles and responsibilities of stakeholders, both of which can emerge as parties come to understand each others' positions. Open access to information for all participants, involvement of a third party as moderator or facilitator, and the presence of long-term community workers were all essential ingredients to success. One overarching objective was to help upland villagers become active participants in watershed forest protection rather than unwilling subjects of government control.

Once basic agreements were reached, villagers articulated their own sets of rules, penalties for violation, and mechanisms for enforcement. Local penalties often included fines substantially higher than those imposed by lowland law, and communities subsequently proved their willingness and ability to enforce their rules. When outsiders challenged village rules and their right to enforce them, local leaders sought assistance from project staff or local authorities.

Various tools were used to help facilitate this process and to document mutual agreements that were reached. Particularly useful tools include scale contour maps and scale three-dimensional models of the local landscape, which served as a centerpiece for discussions and negotiations and as a clear and accessible record of changes in land use zones and forest use rights that were established through mutual agreement. This approach and its tools are being adapted and refined by various projects, including those conducted by ASB pilot project partners in Mae Chaem (Thomas et al. 2000, 2002).

Watershed Management Networks

With increased levels of upstream–downstream conflict over water use and quality being encountered in many areas, projects and organizations are promoting watershed management networks. Projects have experimented with local, multivillage and multi–ethnic group watershed management networks to coordinate land use management across areas that sometimes comprise several subwatersheds. Building on earlier work, the Sam Mun Project facilitated the establishment of watershed networks and encouraged groups to formulate their own rules, penalties, and enforcement mechanisms (Limchoowong 1994). The approach was basically an application of the PLP process at a broader scale and involved communities already familiar with PLP at village level. A recent study suggests that watershed management networks can be institutionally sustainable even after project establishment funds and guidance are withdrawn (Kaosa-ard 2000).

Constitutional and Legal Reform

Under the 1997 constitution and related legal reforms, opportunities are emerging that may allow arrangements such as those being formulated and mapped using PLP to gain formal recognition. Examples include the constitutional provision for local participation in natural resource management, a set of laws and programs to strengthen elected local governments, and community forestry legislation now under consideration by Parliament. Yet practical issues of implementation remain unresolved. For example, it is not clear how to strengthen embryonic subdistrict governments often found in poor mountain ethnic minority areas, nor have effective and efficient methods been discovered for agencies such as the forest department to interact with the thousands of local government entities in these areas.

ASB IN THAILAND

As we have seen, land use in northern Thailand is in transition. Although this transition has had some negative environmental consequences and conflicts between stakeholders are becoming more numerous and intense, a growing body of experience suggests that the ongoing land use transition can generate environmental and welfare benefits and that policy has a role in managing the direction and pace of change. However, effective and efficient natural resource management is hampered by gaps in knowledge and insufficient methods and tools. The Royal Forest Department has given a mandate to ASB Thailand to assist in addressing these issues.

To facilitate ASB collaboration, the Royal Forest Department has officially established the Northern Mountain Area Agroforestry Systems Research and Development Project, an open-ended project with a national steering committee and administrative support. The project facilitates interdisciplinary, multi-institutional research by the ASB Thailand Consortium in subject areas of mutual interest in Thailand, collaboration with international researchers, and information exchange (Thomas 2002). The ASB Thailand seeks to build on existing knowledge and experience, to strengthen ongoing research and development efforts by identifying and filling strategic gaps in knowledge, and to undertake pilot project testing to improve policies and expand adoption of promising approaches. Particular emphasis is on landscape agroforestry in upper tributary watershed areas (Thomas 2001). Key partners in the Mae Chaem watershed include the Suan Pah Sirikit Project and the Collaborative Natural Resources Management Project launched by Care-Thailand and the Raks Thai Foundation. The ASB Thailand consortium expects to make major contributions in five areas.

Measuring and Predicting the Costs, Benefits, and Tradeoffs of Land Use Change

One of the key weaknesses of pilot efforts to improve land use technologies has been the lack of data on their effects on local livelihoods or environmental services (watershed services, biodiversity, and climate change). These data are essential for measuring the tradeoffs between these societal objectives and for assessing the prospects for longer-term sustainability. Moreover, this information is critical for formulating and justifying changes in land use and forestry policies. Therefore, the first stage of ASB Thailand's research activities has focused on providing such data by completing the ASB matrix for important and emerging land use systems in northern Thailand (Buddhaboon 2000; Gillison and Liswanti 2000; Thomas et al. 2002).

Addressing Policy Issues at the Landscape Scale

The second major ASB research activity focuses on scaling up these analyses to levels that are ecologically, economically, and politically relevant for mountain areas of northern Thailand. At this more aggregate level, broader land use mosaic patterns become relevant, and the socioeconomic and biophysical interactions that occur at that level become parts of the research agenda. One study of two villages in the Sam Mun Project found that although villagers perceived substantial improvement in forest components of their landscape over the past decade, water and wild animals have become more scarce, prompting farmer concerns regarding future food and economic security (Kaosa-ard 2000). Access to natural products was a factor that interacted with various forms of social capital in shaping the response to and impact of the Asian economic crisis on mountain households and communities in Mae Chaem (Geran 2001).

Expanding on pioneering work (Ekasingh et al. 1996), studies in several subwatersheds of the ASB site with different land use mosaics are being conducted. One of the next major tasks will be to identify suitable criteria for assessing livelihood and environmental impacts and potential carrying capacities of major types of land use mosaics. These criteria must be associated with standards that accurately reflect management goals and indicators that can be used to assess current status and progress toward meeting those goals. We also seek to understand the socioeconomic, biophysical, and political factors that influence the establishment and maintenance of major land use mosaics (Thomas et al. 2002). A geographic information system (GIS) for the ASB Thailand benchmark watershed is in place (Thomas et al. 2000). Future work will use this system to develop and validate analytical models capable of predicting the effects of policy and technology changes on the adoption and performance of alternative land use mosaics in agroforestry landscapes.

Information Systems to Support Land Use Planning, Watershed Networks, and Local Governance

The third major area of activity is to develop and test methods to support local institutions, government agencies, and NGOs involved in the development and implementation of land use plans and watershed management networks (Kaosa-ard 2000). Particular emphasis is placed on establishing criteria for use in negotiating, establishing, and monitoring local land use agreements developed using PLP; developing and disseminating simple tools based on science and local knowledge to measure effects of land use change on watershed functions at local level for use in resolving local disputes and documenting local conditions; and developing information systems to monitor compliance and provide transparency and accountability in enforcing land use agreements and to monitor welfare and environmental conditions. Pilot efforts have developed a simplified GIS node in Mae Chaem to link PLP land use maps with ASB's GIS system in Chiang Mai to support ongoing local planning activities and to monitor compliance with existing local land use agreements in upper watershed areas. An expanding number of local pilot watershed management networks in Mae Chaem are also using basic tools to monitor watershed functions (Thomas et al. 2000, 2002).

Moving Beyond the Benchmark Site

In collaboration with the Royal Forest Department and other organizations and agencies, ASB Thailand will provide technical support for the formulation and implementation of larger-scale pilot activities beyond the benchmark site. The primary objective of this activity is to improve the capacity of the forest department and related natural resource management groups and institutions to design, implement, and assess the impacts of programs throughout Thailand.

International Research Collaboration and Information Exchange

The final major area of ASB activity aims to facilitate information exchange and collaboration with groups conducting related work in neighboring countries of MMSEA and at other ASB sites (Thomas 2001, 2002). Our vision is to help strengthen Thailand's ability to function as a peer-to-peer node, both contributing to and benefiting from the emerging global web of scientific infrastructure aimed at addressing rural poverty, land use, and environmental issues. The Royal Forest Department is working closely with the International Center for Research in Agroforestry and ASB Thailand to further develop and strengthen specific partnerships and activities to accomplish this goal.

CONCLUSION

Land use in upper tributary watersheds in northern Thailand is in transition. Ecological and cultural diversity in these mountainous areas have led to the development over many years of altitude zone–specific traditional land use systems that comprise both permanent and shifting agriculture practices alongside and within forests. An array of local, regional, national, and international factors have combined recently to put pressure on these traditional systems and landscapes. In response, land uses are changing, and the poor in these areas may not be prepared to manage or benefit from these changes. Indeed, little is known about how to improve traditional systems and practices in the zones for which they were developed, and perhaps more important, we cannot predict the environmental and human welfare consequences of agricultural activities suited for one zone but being practiced in another. In addition, there is growing concern about the downstream environmental and other consequences of land use change in upland landscapes. Although some pilot development projects are demonstrating the effectiveness of participatory approaches to improved land use management in these areas and the environmental and welfare benefits of certain types of land use change that can emerge, there is still inadequate knowledge to assess the feasibility and implications of efforts to replicate or scale up these approaches. Mechanisms to monitor and assess their longer-term impacts and effectiveness over large areas are not in place. Finally, the role of government and civil society at all levels in managing land use transitions in the mountainous areas must be reviewed and refined. The ASB's research, capacity strengthening, and outreach activities in Thailand address these issues.

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V. CROSS-SITE COMPARISONS AND CONCLUSIONS

Slash-and-Burn Agriculture

THE SEARCH FOR ALTERNATIVES

Edited by Cheryl A. Palm, Stephen A. Vosti, Pedro A. Sanchez, and Polly J. Ericksen

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