Chapter 6

UNDERSTANDING A DYNAMIC LANDSCAPE: LAND USE, LAND COVER, AND RESOURCE TENURE IN NORTHEASTERN CAMBODIA

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Abstract **This paper seeks to describe changes in land cover, land use practices, and tenure systems in several villages in northeast Cambodia over the last 50 years. The project integrated the development of a spatial database (based on 1953 and 1996 aerial photographs and 1:50,000 base maps) with socioeconomic information collected for a development project, and an analysis of relevant socioeconomic policies. Over the last half-century, land use and total tree cover have remained stable, but fragmentation of the tree cover has increased extensively. Land use has begun to change recently as both Cambodian and foreign investors invest in industrial agricultural crops such as palm oil, rubber, cassava, and kapok. In the past, farmers had a clear sense of village lands, but specific boundaries between villages were not traditionally required. This study suggests that national land tenure policies are making it increasingly difficult for farmers to maintain their traditional swidden land use practices. Simultaneously, market pressures -- the commercialization of subsistence resources and the substitution of commercial crops for subsistence crops -- are encouraging farmers to engage in new and different forms of commercial agriculture. Combined, these forces will eventually cause a major change in land use practices from swidden agriculture to commercial crops, and a change in land cover from secondary vegetation to monocultural agriculture. These changes have significant implications for biodiversity, watershed hydrology, and carbon sequestration, as well as the lives and livelihoods of local people.**

INTRODUCTION

Scientists, resource managers, policy-makers, and planners increasingly recognize that land-use change is a major driver of global change, through its

impacts on climate, ecosystem processes, biogeochemical cycles, biodiversity and, even more importantly, human activities (Nunes and Auge 1999). To understand land-use changes, scientists and resource managers must consider the roles played by individual farmers, decision-makers, institutions—including land tenure, and the inter-level integration of processes at one level with those at other levels of aggregation. As Nunes and Auge (1999) point out, a village connected by paved roads to world markets feels the pressure of international commodity price shifts a great deal more than communities with poor road infrastructure, and are likely to make very different decision about land use. Without understanding the human dynamics behind land use change, we cannot understand changes in land cover, nor predict the outcomes of policy intervention

The world knows little about land cover in northeast Cambodia or about the customary land use practices and tenure systems of the highland people, who have inhabited this area for generations. The little evidence available suggests that land cover in the area is being transformed by rapid and extensive political, economic, and ecological changes (Global Witness 1998). If trends from elsewhere in Southeast Asia hold in Cambodia, then much of this change is being driven by various types of market pressures: the commercialization of subsistence resources, the substitution of commercial crops for subsistence crops, and the growth of outside control over the production or extraction and marketing of local resources (Young 1999). It is important to generate baseline data on the effects of commodification on local resource management systems to understand the impact of these changes on land cover, sustainable resource use, and landscape transformation (Nunes and Auge 1999). There is also an urgent need for a comprehensive study of traditional land use practices and systems of customary tenure to recognize and protect the rights of the indigenous peoples (Peluso 1992).

Recently, a few research teams have begun linking social science, remote sensing, and other spatial data at the community and household levels to understand land use and land cover change (e.g., Guyer and Lambin 1993, Skole et al. 1994, Moran et al. 1994, Fox et al. 1995, Walsh et al. 1999). These researchers come from diverse research communities and have diverse theories and substantive interests; yet they all recognize the need to link specific remotely sensed pixels and spatial coordinates to specific decision-makers (households and communities). Among these teams at least two types of social science methodologies are used. One group collects quantitative social science data at the household level using formal questionnaires (Walsh et al. 1999). The power of longitudinal designs is well established in the social sciences, providing numerous analytical and statistical advantages to cross-sectional designs. The other group uses participatory assessment techniques to solicit non-quantitative information in a manner that is more relevant, timely, usable, and inexpensive than sample surveys (Reid 2000, Fox et al. 2000). Development workers have adopted participatory assessment techniques to enable local communities to

speak for themselves, to organize themselves, and to identify and solve their own problems (Chambers 1994). Scientists use participatory assessment techniques, such as semi-informal and group interviews to develop a set of hypotheses about the causes and consequences of changes in land use and land cover.

This project integrated title development of a spatial database with information collected through participatory assessment techniques. This paper describes changes in land cover, land use practices, and tenure systems in several villages of Ratanakiri province over the last 50 years. The paper concludes with two policy recommendations for preserving ecological diversity in the region and protecting the stability of the human-forest relationship.

GEOGRAPHY OF RATANAKIRI

The Cambodian province of Ratanakiri, "the mountain of precious stones," lies about 600 km northeast of Phnom Penh. It is bordered by Vietnam on the east and Laos on the north, and covers approximately 12,500 km^2 (Figure 1). Due to its distance from major regional centers and high prevalence of malaria, the province remained remote and isolated from Western influences until recently (Bourdier 1995). With the exception of two ethnographies (Fontanel 1967, Matras-Troubetzkoy 1967-1968, published in 1983), no study of human geography or anthropology had been undertaken in the province until the 1990s.

The Sesan and Srepok Rivers cross the province flowing west from Vietnam to the Sekong River, a tributary of the Mekong (Figure 1). The northern portion of the province, between the Sesan River and the Laotian border, is covered with broadleaf evergreen forest. Approximately 12,600 people, 18% of the province's population, live there. South of the Srepok River, the province is covered with a tropical deciduous forest. Approximately 7,000 people, 10% of the population, live there (Bourdier 1995). The remaining area, between the two rivers, is composed of red basaltic soils on a high plateau (300 m in elevation) and is covered with tropical secondary forests, forests "formed as a consequence of human impact" (Brown and Lugo 1990:3). This area includes the provincial capital, Ban Lung. Approximately 51,000 people, over 70% of the population of the province, live there. Ethnic communities in Ratanakiri include the Brao, Jarai, Kachah, Kraveth, Krung, and Tampuen (Lebar et al. 1964).

This study was conducted in the high plateau area in *Khum* (commune) Poey of O Chum district, which consists of 10 villages *(phum*) covering approximately 100 square kilometers. Poey is located on the unimproved road that runs north from Ban Lung to the Vietnamese border (Figure 1). Elevation ranges from 100 to 400 m. The region has a monsoonal climate, with a rainy season beginning in May or June and lasting until October or November. Annual rainfall is always above 2,000 millimeters, and can reach 2,950 millimeters in Ban Lung (Bourdier 1995). Almost no rain falls between December and April. Vegetation is composed primarily of broadleaf evergreen

and deciduous forests (Bourdier 1995). People of Krung ethnicity populate the 10 villages of Khum Poey.

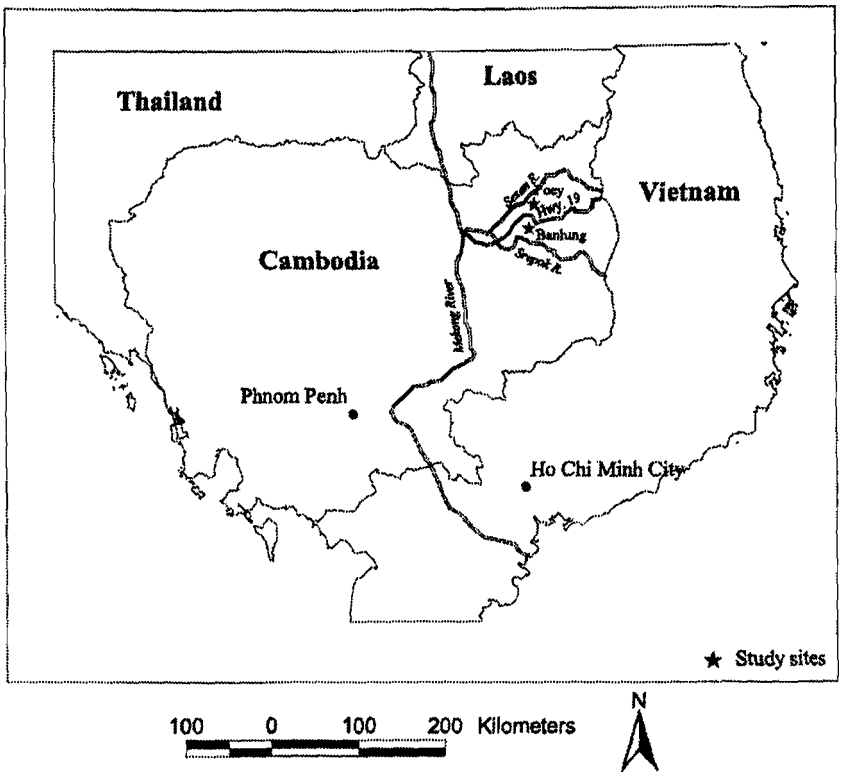

Figure 1. **Study sites in Ratanakiri Province, northeast Cambodia.**

Swiddening, called c*hamkar* by the Krung, and also known as slash-and-burn, or shifting cultivation, is the major land use practice in the village and is practiced by households in all ten villages. Swiddening involves cutting living vegetation in the dry season, letting it dry, burning it late in the dry season, and then planting a crop in the ashes early in the wet season. *Chamkar* fields are cleared in January; burning commences in March and continues through April; the first com is planted in May and rice seeds are sown in June or July; com is harvested in August and rice in October and November. The different components of the agricultural season (clearing, burning, planting, weeding/growing, and harvesting) are noted with small ceremonies or agricultural rituals. All livestock raised in the village, (i.e., buffalo, pigs, and chickens) are used for these ceremonies and for appeasing forest spirits when people fall sick or have bad dreams (Matras-Troubetzkoy 1983).

In a swidden agricultural system the perceived dichotomy between agriculture and forest is for the most part artificial. Swidden fields, secondary forests, and mature forests are all part of the same agroecosystem. Farmers manage vegetation to optimize the production of useful products (edibles, medicinals, thatch, lumber, etc.), while minimizing labor inputs. In many swidden systems a portion of the landscape is managed as a forest reserve for the

production of materials not generally available in secondary forests (i.e., wildlife, building timber, rattan, certain medicinals, mushrooms, etc.; see Brookfield 1988, National Research Council 1992, Kellman and Tackaberry 1997).

METHODS

The project integrated the development of a spatial database with information collected through semi-informal interviews with farmers and other key informants and analysis of relevant socioeconomic policies. Interviews were conducted in both Khmer and Krung languages and translated into English by experienced field workers. This database served as a framework for analyzing changes in land cover and forest patterns, as well as a tool for analyzing the information and insights collected in interviews and policy analysis (Fox et al. 1995).

Approximately 40 semi-structured interviews were conducted with people from four villages: Kres, Kralaa, Tannich, and Ganchueng (Figure 2) during five field visits between June 1995 and October 1998. People interviewed included local key informants and farmers including traditional village chiefs, community leaders, and older people who could provide holistic histories of land use dynamics in the study area. Household interviews were conducted with individual farmers to collect data on how families arrange their swidden fallow plots across the landscape, how they collaborate with neighboring farmers and communities for allocating and zoning land use, and how they control fires.

Semi-structured interviewing (Chambers 1985, Grandstaff and Grandstaff 1987) is a methodology developed to enable outsiders to learn about rural conditions in a more cost-effective manner than formal survey questionnaires. Semi-structured interviewing uses no question list, printed questionnaire, or other means of strictly controlling the interview. Informants are selected opportunistically rather than randomly. The interviewer starts with the guiding issues in mind, curiosity, and willingness to analyze issues and responses as the interviews develop. Interviewer and informant interact and explore issues using specific questions until a logical and internally consistent picture is pieced together. The interview depends upon mutual rapport and the interviewer's ability to evaluate responses and to respond with relevant follow-on questions. For example, interviewer and informant can talk about farming practices, including various costs, the returns to the different enterprises, related problems, and other income sources. By the end of the interview, income can be calculated without the interviewer ever asking the usually inappropriate question "What is your income?" Farmer identified problems and practices and perceptions new to the interviewer are also explored. Semi-structured interviewing is not designed to solicit data that can be analyzed in a quantitative manner; rather it is an exploratory and iterative tool that allows a process of rapid and progressive learning to take place.

Recent aerial photographs (1996) were used in the field as tools for soliciting discussion from local leaders and farmers on past land use practices, present land use conflicts, and plans for the future. Local people made sketch maps delineating customary land use boundaries, tenure boundaries, sites of conflicts, and the location of valuable resources. Important boundaries demarcating features such as community-protected forests, and mining roads and pits were mapped using GPS technology and the guidance of local people.

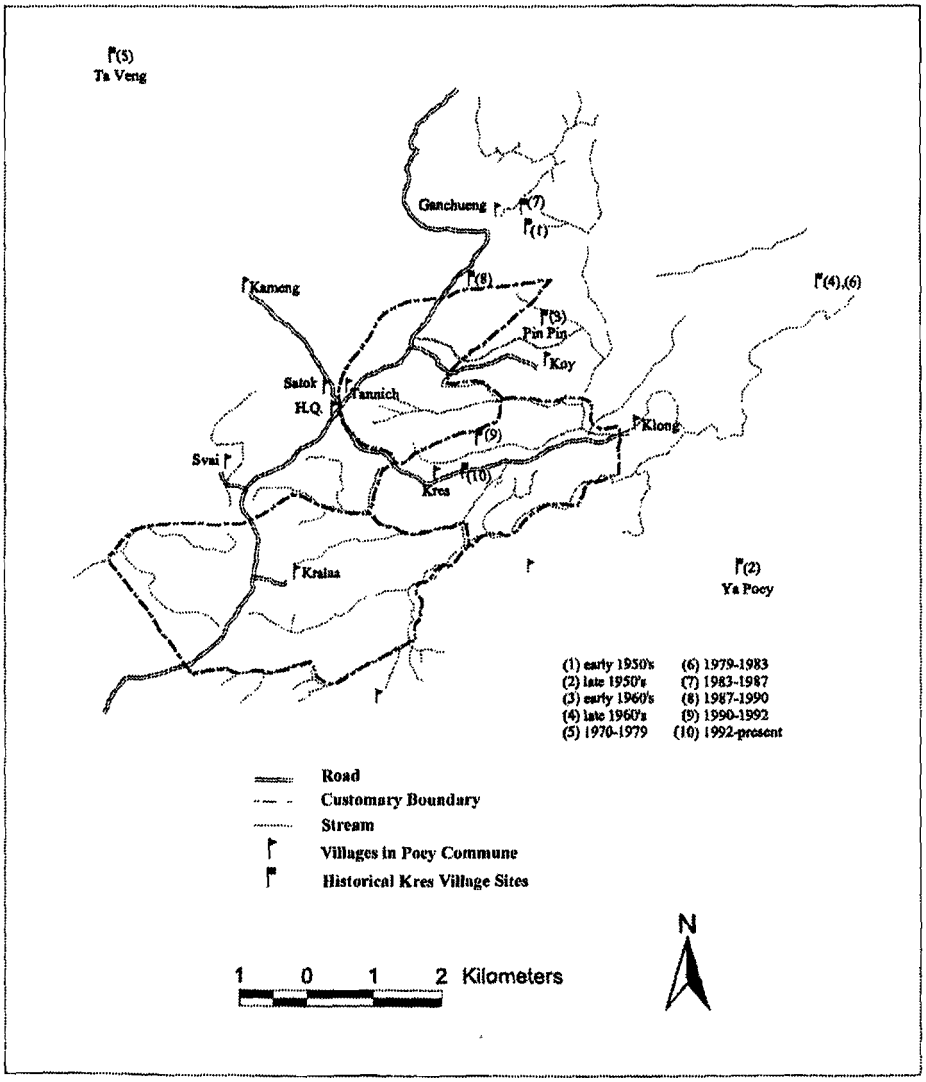

Figure 2. **Spatial history of Kres village between the early 1950's and today.**

A spatial database of the study site was developed using 1996 color aerial photographs (nominal scale: 1:25,000—FinnMapp). Aerial photo interpreters at the Cambodian Integrated Resource Information Center in Phnom Penh manually interpreted the aerial photographs (with the aid of a stereoscope), classified land cover into seventeen classes, and digitized the maps. These classes were then consolidated into six types to compare with similar studies in

other parts of mainland Southeast Asia (Fox et al. 1995, Long-Chun-lin et al. 1999, Xu et al. 1999, Fox et al. 2000). The six types included mature forests (broadleaf evergreen, broadleaf deciduous, and mixed deciduous/evergreen), secondary forest, swidden, paddy, plantations, and village/other lands. The secondary forest or successional vegetation was subdivided into three groups—closed-canopy forest; open-canopy forest; and grass, bamboo, and bushes (recent fallow) (Brown and Lugo 1990). Differences observed in color/tone, pattern, and texture on the aerial photographs were used to differentiate mature forest from secondary forest (and among the different types of secondary forest). The closed-canopy forests may or may not have been primary forest, but fieldwork in the region suggests that even areas usually classified as forest may be more accurately described as intermediate or advanced secondary vegetation (Potter et al. 1994).

A spatial database was also developed for an area adjacent to the southern boundary of the study site using panchromatic 1953 (nominal scale: 1:40,000) aerial photographs taken as part of a comprehensive mapping of Indochina undertaken by the French military in 1952-53; 1996 aerial photographs were also available, as mentioned above. Aerial images from 1952 were not available for the study area because the French government classified images of the Cambodian-Laos border. Land cover on the 1953 photographs was manually interpreted (using a stereoscope) and classified into nine classes (fewer classes were delineated on the 1953 photographs because some classes, such as lowland rice, did not exist in 1953, and also because of differences in scale and color of the two sets of photographs). These classes were then grouped into the same types as the 1996 images. All photographs were registered to a map base at a scale of 1:50,000. Land-cover categories were digitized and entered into a geographic information system (GIS) database (Arc/Info software on a Sun Sparc workstation).

Transition matrices showing changes in land cover through time were developed by overlaying grid-cell data for a given period with grid-cell data for different time periods. A grid program within the GIS was used to transform the classified polygonal data for 1953 and 1996 into a set of grid cells, each measuring 30 m by 30 m. These data were used to calculate the transition matrix for the 1953-1996 period,

RESULTS

Changes in Land Cover

In 1996 approximately 4% of the total area of Poey commune was devoted to active swidden (Table 1). Mature forest cover (primarily broadleaf evergreen) covered 50% of the landscape. Various types of secondary forests accounted for

another 46% of the landscape. Less than 1% of the landscape was devoted to villages and permanent agricultural fields.

Table 1. **Land Cover in Poey in 1996 (interpreted from aerial photographs).**

Land cover	Ha	%	No. of Fragments	Mean size (ha)
Forest	**4,663**	**50**	**52**	**90**
Secondary forest	**4,255**	**46**	**164**	**26**
• Closed-canopy forest	**3,536**	**38**	**53**	**67**
• Open-canopy forest	**476**	**5**	**56**	**9**
• Grass, bamboo, and bushes	**243**	**3**	**55**	**4**
Swidden	**419**	**4**	**143**	**3**
Paddy	**0**	**0**	**0**	**0**
Plantations	**3**	**<1**	**2**	**1**
Village and other	**37**	**<1**	**42**	**1**
Total	**9,377**	**100**	**401**	**23**

Land cover change in the area immediately to the south of Poey has been extensive over the last 43 years (Table 2). This area, which includes the provincial capital, Ban Lung, is more densely populated than Poey. In 1953, the Ban Lung area had only 18% forest cover (broadleaf evergreen), 60% secondary forest, and 21 % swidden cover. Little information on land use in the area exists for 1953, but these data suggest a fairly dense population actively involved in swidden agriculture. By 1996, forest cover had increased to 26% of the landscape, secondary forest had decreased to 51%, and swidden agriculture had decreased to 14% (Table 2). These data suggest a less densely populated landscape than in 1953 (as expected from the disruptions caused by the Khmer Rouge), but a landscape that is still more densely populated than is Khum Poey to the immediate north. Closed-canopy secondary forests decreased from 45% to 30%, while open-canopy secondary forests increased from 6% to 18%. Overall tree cover (forest and secondary forest) in Ban Lung remained constant during the 43-year period (Table 2). The greatest change during this period was a decrease in swidden (21% to 14%) and an increase in land devoted to villages and plantations, primarily rubber and palm oil (1% to 8%). In Poey, however, plantations still account for less than 1% of the landscape (Table 1).

Changes also occurred in the number and size of forest fragments. In 1953 there were 20 fragments of forest with an average size of 166 ha (total area was 3,319 ha). By 1996 this number had grown to 85 fragments with an average size of only 56 ha (total area was 4,769 ha). The number of secondary forest fragments grew from 93 (11,234 ha) to 444 (9,622 ha) and the mean size decreased from 121 ha to 22 ha (Table 2). Mean fragment size for forest and closed-canopy secondary forest categories has larger in Poey (90 ha and 67 ha respectively, Table 1) than in Ban Lung (56 ha and 34 ha, Table 2).

Table 2. **Land cover in Ban Lung in 1953 and 1996 (interpreted from aerial photos).**

Land cover	1953		1996		1953		1996	
	Ha	%	Ha	%	No. of Frag-ments	Mean size (ha)	No. of Frag-ments	Mean size (ha)
Forest	3,319	18	4,769	26	20	166	85	56
Secondary forest	11,234	60	9,622	51	93	121	444	22
• Closed-canopy • forest	8,415	45	5,646	30	27	312	167	34
• Open-canopy • forest	1,177	6	3,326	18	31	38	186	18
• Grass, bamboo and bushes	1,642	9	650	3	35	47	91	7
Swidden	3,951	21	2,638	14	175	23	706	4
Paddy	0	0	88	<1	0	0	22	4
Plantation	0	0	733	4	0	0	56	13
Village and other	148	1	808	4	35	4	51	16
Total	18,652	10	18,658	100	323	58	1,364	14

Table 3 is a transition matrix showing historical changes in land cover in the Ban Lung area. During the period 1953-1996, 43% of the mature forest cover that existed in 1953 was lost. Forest was converted primarily to closed-canopy secondary forest (17%), active swidden (11%), and open-canopy secondary forest (8%). On the other hand, 24% of the closed-canopy secondary forest, 14% of the active swidden, and 13% of land around villages, streams, and roads reverted to mixed broadleaf evergreen and deciduous forest (Table 3). The 57%

Table 3. **Transition matrix of land-cover classes in Ban Lung.**

1996	*Forest*	Secondary forest			Swid.	Paddy	Plan-tation	Village & other
1953	%	*Closed* %	Open canopy %	Grass %	%	%	%	%
Forest	57	17	8	3	11	<1	3	<1
Secondary forest	46	92	74	11	45	<4	12	17
• Closed-canopy	24	34	15	4	15	<1	4	4
• Open-canopy	11	34	22	3	19	1	4	6
Grass, bamboo bushes	11	24	37	4	11	2	4	7
Swidden	14	36	23	3	15	<1	4	5
Village and other	13	16	8	4	12	<1	3	44

broadleaf evergreen forest that remained stable between 1953 and 1996 (Table 3) represent approximately 10% of the landscape of the study area. Likewise, 34% of the closed-canopy secondary forest also remained stable throughout this period; this represents 15% of the landscape. In 1996, at least 25% of the landscape was covered with closed-canopy mixed broadleaf evergreen and deciduous forest that was more than 43 years old.

Shifting Villages and Customary Tenure

Using aerial photographs and sketch mapping techniques, we were able to trace the spatial history of what is now called Kres village through at least nine voluntaiy movements and one forced movement over the last 50 years (Figure 2). The oldest known location of Kres is reported as a village called Ban Poey located near present day Ganchueng (Figure 2). The village headman or elder at that time was Ta Van Poey. Ban Poey was inhabited in the late French and early Sihanouk period (early 1950s). The village then relocated to the southeast in what today is La Ak commune and became known as Ya Poey village led by Ya Nanch in the Sihanouk period (late 1950s). The ancestors of residents from present day Kres, Ganchueng, and Satok villages lived in both Ban Poey and Ya Poey. In the early 1960s, the village moved close to the site of present day Koy village. At that time the village was called Pin Pin and the village elder was Ya Bot. During the Lon Nol period in the late 1960s (a period of disruption), the village moved deeper into the forest to the east near the O Touk River (Figure 2). This is the first time that the village was known as Kres and it was led by Kan Thaw and Chanly.

A grid program within the GIS was used to transform the classified polygonal data into a set of grid cells, each measuring 30 x 30 m. This table was developed by overlaying grid-cell data for 1953 with grid-cell data for 1996. In the row labeled forest, 57% of what was classified as forest in 1953 was still classified as forest in 1996, 17% was classified as closed-canopy secondary forest in 1996, and so on.

It was from this site that the Khmer Rouge forcibly relocated farmers to Taveng District (north of their traditional homelands) to grow lowland irrigated rice (Figure 2). Farmers remained there until the fall of the Khmer Rouge in 1979 when they returned to Kres village. They stayed there, along with current day residents of Koy village, until 1983. In 1984 they and the Koy residents moved to a site near present day Ganchueng (Figure 2). They stayed in at least two different sites around Ganchueng until approximately 1990. They then moved to a site near the current Kres village for two years before moving to their present site.

In interviews, farmers in Poey Commune identified a clear sense of village lands. Specific boundaries between villages were not traditionally required unless cultivation areas of two villages met one another. Farmers expressed the

belief that if they farm on the other side of another village's *swidden* fields and have to cross that village's fields frequently, the spirits will be unhappy and cause misfortune or death. When a village's *swidden* fields are adjacent to those of another village, village elders may meet to decide the boundaries. In most cases the physical location of swiddens and the taboos against crossing each other's field for cultivation define the limits of cultivation.

Alternatively, from interviews it was also clear that village boundaries have become more firmly set in recent years. In 1997 the commune leader in Poey convened village headmen to discuss and delineate village boundaries. Between village boundaries, members of Poey Commune have started prohibiting the use of their lands for swidden by people from other villages (even in areas where other farmers do not have to cross their fields). Population data collected by village headmen suggest an average population density of approximately 30 people per km^2 in the five villages we mapped.

Farmers of Poey Commune reported that traditionally they would clear their swidden fields, use them, and then abandon them. Once a field was abandoned, a farmer had no future claim to that piece of land. Today, however, evidence from interviews suggests that many farmers in Poey Commune are beginning to consider their current swidden fields as private property. Neither customary nor government institutions currently exist for protecting this concept of private claims by swidden farmers of their agricultural lands.

Farmers in Poey reported limited interactions with government officials. While they report no agricultural extension or forest extension services, they are aware that the government prohibits them from cutting the forest for new swidden fields without government permission. Fanners reported that they do not have legal papers for any of their lands, although they would like to have legal title. They claim that they have managed their lands for several generations and that in their opinion it is their land. They claim they share their forest resources with neighboring villages and that they have few land conflicts within or between villages.

Land Use Practices

In interviews, farmers reported that they generally used their swidden fields for approximately three years and then abandoned them. They reported that they preferred to use their old fields as long as possible because they require less labor than opening new fields. Farmers reported that they initially choose their fields so as to be able to enlarge and expand around the sides of the originally cultivated fields and then only after three to five years shift to another place.

Farmers reported having two to four different sets of fields that they use for three to five years before fallowing. The number of fields a household manages depends on the amount of labor available within the household. The length of period a household uses a field depends on a number of variables, including rate of weed infestation, proximity to trails and passing livestock (a nuisance), and

opening of new fields elsewhere. Fallow periods may vary from 3 to 30 years depending on soil fertility and land availability, but most people reported leaving their fields fallow for approximately 7 years. Households reported having approximately one to three ha at each swiddening site. They reported that they preferred to locate their fields within a one-hour walk of the village as they usually go back and forth every day. They also prefer fields close to water.

Farmers reported they burned their *chamkar* when they perceive that the fields are ready and there is sufficient wind for a good bum. Each family decides when and where to bum. While farmers in general do not discuss burning with each other, a farmer should try to inform his or her neighbors before burning. If a fire spreads to neighbors' fields and the farmer has not informed them first, then he must help them prepare their fields to bum again.

The main crop is swidden rice, but farmers reported more than 20 to 30 varieties of vegetables, green leaves, and fruits are grown in the *chamkar.* Other crops include cassava, taro, sugarcane, maize, sweet potatoes, yams, gourds, beans, peppers, sesame, tobacco, pineapples, eggplants, tomatoes, pumpkins, and cucumbers. Fruit trees are grown in the villages and *chamkar,* bearing bananas, jackfruit, cashews, papaya, and mangos.

Farmers in Poey reported that they distinguish between nearby secondary forests and swidden fields that are part of the long-agricultural rotation system, and more distant forests with older growth. The more distant forest areas are less clearly delineated and are shared with other communities. Farmers reported different rules and taboos governing the use of shared old growth forests (Colm 1997, Poffenberger 1999). People believe that in some forests resident spirits forbid cutting and other activities. Different spirits, each with their own taboos or spiritual regulations that effectively provide for forest and wildlife conservation (Colm 1997, Poffenberger 1999), are reported to rule different forests. A careful inventory of Phnom Tapin Forest, one of four forests managed by the Ya Poey Forest Conservation Association, found close to 200 tree species and over 3,000 species of flora and saplings (Bahn 1997).

Farmers in Poey report that they subsist self sufficiently by swidden farming and collecting forest products. If the previous harvest is good they claim they can eat rice all year long. Non-timber forest products collected in the village include bamboo and bamboo shoots, rattan, forest resins, tubers, wild taro (used as a pig forage), wild pigs, deer, and free roaming chickens. In addition to using forest products as famine food, farmers sell forest products in the market. In interviews, farmers suggested that they earn their cash income from collecting and selling forest products (resin, fruit, leaves), and not from their agricultural fields.

Since 1993, when Cambodia opened up for international investment, over a dozen coffee, rubber, cashew and other estate crop concessions of 100 to 20,000 hectares have been granted in Ratanakiri (Poffenberger 1999). In addition, close to one-half of the 1.16 million hectares in the province have been set aside as protected areas. Finally, six dams are planned and, in some cases, flood areas

could stretch across nearly two-thirds of the province from Vonsai to the Vietnamese border. By one calculation (Butterfield 1997), 130% of the province's land area has either been granted as concessions or placed in protected status. This does not take into consideration the 72,000 people who live in the province and earn their living by farming, hunting, and gathering. These developments are happening in an unplanned fashion and without reference to land zoning or customary land use. The process of approving contracts and concessions is not clear. Prior consultation with existing communities (or even with the Provincial Government in the case of concessions) is poor or non-existent. In this study, farmers reported that they were unhappy with the "land grab" by commercial companies as well as government agencies. They see these developments as threatening their customary domain, their land use practices, as well as their remaining farmland and ancestral landscape (Colm 1997, Poffenberger 1999).

DISCUSSION

Land cover in the region has been both stable and dynamic. The GIS analysis revealed that between 1953 and 1996, 77% of the Ban Lung landscape remained under forest or some type of secondary forest, and in Khum Poey fully 96% of the landscape was still under forest or secondary forest as recently as 1996. The rise of the Khmer Rouge to power and the subsequent forced removal of farmers from the region in the 1970s had a significant but temporary impact on land use and land cover. The expulsion of farmers from their homelands and the prohibition of swidden agriculture are the most likely causes for the increase in forest cover observed in the Ban Lung area. When freed from enforced labor camps in the lowlands, farmers returned to their ancestral homelands and re-engaged in their traditional swidden agricultural practices. Since the 1960s, farmers have also devoted a small but growing portion of the landscape to growing cash crops, primarily rubber, palm-oil, and cashews. In the long run, the major change in land use occurring in this region is the slow but steady decrease in swidden agriculture and the concomitant growth in the area of cash crops.

When we look at any individual plot, however, land cover may have changed several times during this period. As a land use practice, swiddening results in relatively small patches of disturbance that, after they are abandoned, regenerate into secondary forest. The GIS analysis showed these patches to be dispersed non-uniformly across the landscape, and with few exceptions, such as the Khmer Rouge period, disturbed regularly through time. Swiddening thus causes fragmentation of forest cover as formerly homogeneous patches of forests are converted into a mosaic of tree cover in different stages of regeneration.

Government officials and policy makers in Phnom Penh, as well as at the provincial level in Ban Lung, generally regard the ethnic groups that inhabit this region as constantly moving their villages across the landscape. This study

suggests that during the last 50 years farmers in northeast Cambodia did not move as widely as generally perceived. When villages did move, it tended to be within the village's ancestral cultivation area and often only a few kilometers. Moves were generally for specific reasons: political upheaval, government relocation, bad omens, excessive illness, or other hardships at the current site. If part of a village decided to separate from the original group because of population increase or conflicts, the breakaway group looked for new, available land. Such occurrences generally happened only once in two or three generations. Kralaa village in Poey commune stayed in the same location from most of the last 100 years, while neighboring Kres village moved more than 10 times in the last 40 years.

In terms of land tenure, farmers in Khum Poey have always had a clear sense of village lands. However, specific boundaries between villages were not traditionally required unless the cultivated areas from two villages met one another. In response to pressures from government agents, land speculators, and others interested in acquiring or using land in the area, farmers have begun to demarcate village boundaries since 1998. While people of Krung ethnicity did not traditionally view land as a private resource, many farmers in Poey are beginning to consider their current swidden fields as their private property. This is probably because land is becoming scarcer. Neither customary nor government institutions currently exist for protecting the private claims of swidden farmers to their agricultural lands.

In terms of land use practices, the granting of the forest concession as well as the palm oil estates have negated the customary land tenure rights of most highland communities and hence put these communities into a position of inevitable conflict with the state. The national government is unofficially encouraging lowlanders to immigrate into this area from other provinces and to encroach on the lands that uplanders claim through customary tenure systems by allowing lowland settlers (but not uplanders) to apply for land certificates. In addition, commercial investments, supported by both Cambodian and foreign investors, are increasing, especially for industrial agricultural crops such as palm oil, rubber, cassava, and kapok (Colm 1997, Poffenberger 1999).

There is an urgent need to develop legal mechanisms for recognizing traditional land use practices and systems of customary tenure to protect the rights of the indigenous peoples. Ya Poey Community Forest is an excellent example of the positive type of community/government interaction that can be promoted through policies that recognize the land use practices and customary rights of the highlanders.

CONCLUSIONS

Findings from this study suggest that the practice of swidden cultivation and the extent of forest cover (including both mature and secondary forests) have remained stable in northeastern Cambodia over the last 50 years. This despite

the fact that national and provincial planners have attempted to "control" swidden cultivation through polices that ban shifting cultivation, declare forest reserves from which people are excluded, resettle people into the lowlands, and introduce settled agriculture either *in situ* or in a new location. The minor changes in land use that have occurred have involved a shift from swidden to monocultural tree crops — rubber and palm oil.

This suggests that two forces will increasingly determine land-use systems. First, national land tenure policies — the nationalization of forest lands and efforts to increase control over upland resources by the central and provincial governments — will make it increasingly difficult for farmers to maintain traditional swidden land-use practices. Second, market pressures—the commercialization of subsistence resources and the substitution of commercial crops for subsistence crops — will encourage farmers to engage in new and different forms of commercial agriculture and forest exploitation (Robinson and Bennett 2000). Combined, these "pushing" and "pulling" forces will eventually cause major shifts in land-use practices from swidden agriculture to commercial crops, and a change in land cover from secondary forest to commercial agriculture, most likely a monoculture.

This study also suggests that although swidden cultivation is responsible for maintaining a large portion of the landscape under some type of secondary vegetation, swiddening has also led to the fragmentation of forest cover, producing a highly heterogeneous and fragmented cover of secondary vegetation. This research suggests that the negative effects of swiddening on land cover (changes from homogeneous forest to highly heterogeneous cover of secondary vegetation) may be offset by the stability of swidden agriculture as the primary land use system in the region and the fact that swidden systems protect secondary forest cover. It supports the argument that true deforestation will occur through the replacement of swidden by permanent agriculture, if current land tenure and economic policies are not modified (de Jong 1997).

Chazdon (1998) suggests that tropical biodiversity conservation is undergoing a conceptual transition: the true value of isolated forest fragments, logged forests, and secondary forests is gradually being recognized. This study reinforces this new conservation paradigm that encompasses human-impacted lands (Schelhas and Greenberg 1996). Government officials and resource managers in Cambodia should respond in two ways. First, they should work to improve swidden systems through greater investments in research on maintaining the biodiversity of fallows, while also increasing their productivity and soil-sustaining properties. Second, they should facilitate the design and implementation of appropriate land tenure and economic policies that will empower local people to manage and utilize their own land and forest resources. In this way they can work toward preserving the ecological diversity and stability of human-forest relationships.

Finally, this study demonstrates the value of using participatory assessment techniques in collecting information in less developed countries. The social

economic information collected in Khum Poey was not collected in a quantifiable manner nor from a random sample of farmers, yet the reiterative nature of the exercise as well as the logical and internally consistent story that has been pieced together assures us of the accuracy of the information. This information was collected in an on-going project to enable farmers in Khum Poey to make legal claim to the forestlands they have traditionally managed. This effort resulted in the formalization by community members of rules for using their communal forestlands. These rules were later endorsed by the heads of the District Provincial Forestry, Agriculture, Environment and Land Titles offices in the province. According to the Governor, this process represents a *de facto* recognition at the provincial and local government level for Ya Poey Community Forest. This contract approved a ninety-nine year forest protection concession for the Ya Poey Community Forest Association (Paterson 1997).

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