A study of resin-tapping and livelihoods in southern Mondulkiri, Cambodia, with implications for conservation and forest management

WILDLIFE CONSERVATION SOCIETY

JANUARY 2003

A STUDY OF RESIN-TAPPING AND LIVELIHOODS IN SOUTHERN MONDULKIRI, CAMBODIA, WITH IMPLICATIONS FOR CONSERVATION AND FOREST MANAGEMENT

by

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Introduction and background

This report describes a survey of livelihoods and forest use amongst an indigenous ethnic group (the Phnong) conducted during February-August 2002 in southern Mondulkiri Province, Cambodia. The area is inhabited by many small Phnong communities, is experiencing high immigration by ethnic Khmer people near its borders and is also included in a large commercial logging concession held by Samling International. In 2002 the area was also declared a special Biodiversity Conservation Area by Ministerial Decree and has become the target for active conservation efforts. The current study provides some of the information necessary to find effective compromises between these differing land and resource uses.

The overall goal was to develop an understanding of the demographic trends and main livelihood activities of Phnong communities in the study area. The positive and negative connections between various livelihood activities and wildlife conservation were identified wherever possible. Early in the study it became clear that the most important activity for detailed study was the practice of resin-tapping. Hunting of wild animals is a relatively minor part of most peoples' livelihoods but has disproportionate conservation impacts, so this activity was also studied in some detail.

The study area forms the middle part of the Biodiversity Conservation Area (or core area). Most of the core area is moderately hilly and covered with a mosaic of lowland deciduous and evergreen forest types plus small areas of shifting cultivation.

The Phnong are a part of the Mnong ethnic grouping who speak the Phnong (or Bu Nong) language. "Phnong" is sometimes used as a derogatory blanket term for Cambodian ethnic minorities but is used with pride by the studied population to describe themselves. They have been in the area since long before colonial French times, living in small rural villages and following a mixed livelihood of shifting cultivation and collection of forest products. They have long been socially disadvantaged.

Population density in the core area in the 1960s was probably slightly lower than that today but in 1970 the whole population of the core area and its surroundings was moved out by the Khmer Rouge. Significant numbers of families only started returning from 1988 onwards, nearly 20 years later. From about 1996 forest concession activities began in the study area, including heavy logging of several coupes and improvement plus realignment of the Snuol-Sen Monorom trunk road. Legal logging has been suspended since 1999 due to national forestry policy.

The core area supports important populations of many wildlife species threatened with global extinction including Gaur, Banteng, Elephant, Tiger, smaller cats, bears, primates and Green Peafowl. According to surveys in 2000 hunting is the biggest threat to these species. Hunting was severe through the 1990s, especially once logging activities began. It is less now that the logging teams have gone and most guns have between confiscated under a national programme, but shooting and snaring remain major threats to wildlife. Shifting cultivation is not thought to be a threat at present. Intensive logging would be harmful to many species, especially if combined with heavy hunting, but sustainable logging together with hunting controls and protection of existing local livelihoods might be compatible with wildlife conservation.

Methods

Research methods included a desk study of relevant literature and laws and fieldwork using a mix of Rapid Rural Appraisal and ecological techniques, especially the following:

- semi-structured interviews with key informants (traders and groups of resin-tappers);
- structured family interviews (using a carefully pre-tested questionnaire);
- forest visits to groups of resin trees, collecting two types of information - the locations of outer groups of resin trees around each village and the characteristics of a random sample of groups (tree size, tapping practices, damage levels etc.).

An emphasis was placed on cross-checking key information using more than one method. Studies covered four administrative village units (Ph. Pu Char, Ph. Kati, Ph. Andong Krolung and Ph. Roka Thmei) including 14 settlements in total.

Results

Demography

The 14 settlements contain 211 families, 970 people. Ninety percent of families were interviewed. About 95% of families in the study area are ethnically Phnong. The villages were established at various times during 1930-1960. After the 1970 forced migration most were re-established from 1988 onwards but Ph. Roka Thmei was only re-established in 1998.

In each existing village immigration showed an early peak followed by a decline and it now seems to be almost zero in three of the villages. Ph. Roka Thmei is expected to show small net immigration in the coming years, whilst in Ph. Kati there has been net emigration over the past 2 years. This may be related to the lack of available resin trees for any newly arrived families. However, significant fresh immigration by Phnong is expected at newly established or planned settlements which have available land for paddy rice. These sites are often critical habitats for wildlife conservation. Most of these people will come from the Memong area to the north.

There has been negligible immigration by Khmer people to the study area so far but it has been heavy in areas just to the west. There is a risk of them moving into the study area in large numbers, especially along the main roads. The possible future cessation of the logging concession contract may make this much easier.

The population trend due to births was not studied, but it is expected to be growing.

Livelihood comparison

Almost all families consider themselves primarily rice farmers. They view other activities as supplementary, even though rice production may be a minority of total family income. Shifting cultivation is practised by 86% of families (usually of hill rice mixed with vegetables, using a ten year fallow period). Areas of cultivation and fallow are small relative to the area of forest, and shifting cultivation is not currently thought to have significant negative environmental impacts in the study area. Only 24% of families have rice paddies, almost all in Ph. Pu Char, the one village on flatter ground. About 5% of families do not farm. Overall rice sufficiency is 4.6 months per year, with village averages ranging from 2.6-6.1 months. Low productivity is due to the scarcity of paddy, poor soils, irregular rainfall, low-input techniques and losses to wild animals. Many subsistence needs other than rice (e.g. vegetables, fish, rattan, bamboo) are collected from the forest.

Rice deficits are covered by cash income from other activities, and this usually leaves a small or moderate net income for other purposes. None of the villages is wealthy, but they maintain a moderate standard of living compared to many rural Cambodian communities. The main reason for this is their freedom to collect and sell resin, which provides them with a good income that is relatively stable from year to year.

Cash income was divided into major and supplementary sources. The only common, major source was resin-tapping (162/189 families interviewed). Eight families keep shops, 14 reported doing some wage labour and a handful draw police, teacher or commune chief salaries. About four families are thought to get significant income from hunting large mammals.

Supplementary incomes were diverse within and between villages but together provide much less income than resin-tapping. Common types were transporting resin short distances; hunting lizards/turtles for sale; gathering malva nuts ('samraong'); collecting hard resin from *Shorea* spp.; and growing small areas of cash crops (e.g. cashew, beans, fruit trees). If resin-tapping were to stop, none of them could expand to replace the lost income, except, perhaps cash crop planting. If economically feasible this would probably take years and would require extensive forest clearance.

Resin-tapping

Overview

Liquid resins mostly come from *Dipterocarpus* species - *D. kerrii* in Malaysia, *D. alatus* and various other species in Laos, Cambodia and Thailand. The resin is used domestically for low-grade lighting and commercially for boat caulks, paints, varnishes and probably also as an ingredient in perfumes. The latter use began for *D. kerrii* in the 1970s and led to dramatic price rises; this probably also applies to the Cambodian species. Cambodian resin is mostly exported unprocessed.

A tap is cut in medium or large trees and burnt briefly each week to stimulate fresh resin flow. Past reports suggest that tapping does not harm the tree and can continue for decades, but precise data

are rare. Commercial tapping in Cambodia has been done since the 1930s and probably much earlier, but reportedly only began in the study area in the late 1980s. However, trees have been tapped there for family use for many decades. Tapping is widespread in north and north-east Cambodia and is believed to be a key source of income for many people, but published data are lacking.

Tapping by villagers is unrestricted but export (and possibly transport) by traders requires permits. Resin trees have some legal protection from logging but there are large loopholes and great numbers have been felled recently across the country. Future legal changes may increase protection but also raise the possibility that villagers may require (and be denied) permits to tap.

In the study area traditional ownership is held by the first person to find and tap a tree. The trees can then be given, inherited or sold within and between villages. Other forest resources amongst the trees are not 'owned' in the same way, but young or exhausted resin trees are.

Some villages have access to a wide selection of traders and can shop around for the best prices, whilst in other places poor road access, debt ties and/or buyers' monopolies reduce prices for the tapper. Prices also vary seasonally, the stated reason being that rainwater contaminates wet season resin, but other factors may also be acting. Traders move out of the study area both east and west, to several border crossings.

Trees suitable for resin-tapping grow widely but patchily across the study area in Evergreen, Semi-evergreen and Mixed Deciduous Forest types. People mostly travel a few km on day trips to tap resin; about 10% of tree groups require overnight stays in the forest. Tapping areas mapped for three villages hardly overlap with each other or their neighbours, but they do all meet one another and there are thought to be very few untapped trees remaining. Tapping areas of some other villages overlap much more. Tapping areas tend to enclose most of the areas of forest used regularly by that village for other purposes, but this is coincidence rather than the result of planning or special agreements. It happens because people mostly visit the forests nearest to their village. There is no strong customary control on the areas one may fish, hunt or collect other forest products.

Economics

Overall 86% of families tap resin and they own an average of 77 trees/family (range 52-135 in different villages). *Dipterocarpus alatus* makes up 92% of trees (according to interviews) or 97% (according to forest visits); the remainder are almost all *D. intricatus.* The three villages where mapping was done are estimated to use about 14,000 trees across 32,000 ha of forest - averaging 0.44 trees/ha (including some unsuitable deciduous forest). The yield per tree is 30-40 litres per year.

Dry season prices were mostly 21,000-23,000 Riel/30 litre container (9,000-13,000 in one village) falling to 8,000-18,000 Riel/30 litres in the wet season. Mean income per family was $340/year (range of means $299-377 across the four villages). Total resin income across the four villages is approximately $61,000/year.

If we subtract each family's reported rice-buying needs from their resin income then net incomes available for other purchases are mostly $1-200/family/year. To this can be added a modest amount from supplementary activities.

Effects of logging

Legal and illegal logging of resin trees has been heavy in the study area. The four villages reported losses of 30%, 26%, 20% and 0% of trees that they were tapping before logging began. Some families lost 100% of their trees. Some trees have been found and tapped since logging, but they are few and are mostly smaller, less productive trees. Some unsuccessful efforts were made to prevent felling of tapped trees; some tappers received compensation of $1.25-2.5/tree, but many did not. Changes in availability of other forest products was not studied.

After four years the villages have still not been able to replace much of the income lost through logging. The main alternatives have reportedly been to increase the area of shifting cultivation, to increase the hunting of turtles and lizards for sale and to look for more wage labour, but all of these are limited.

If logging continues as planned, all resin trees larger than 60 cm dbh will probably be cut, leaving only the smallest, least productive 22% of currently tapped trees. This will cause more severe hardship than has been experienced so far.

Impacts of tapping and yield

Over 2500 trees were measured and examined. For currently productive trees mean diameter at breast height was 82 cm, mean basal area was 0.59 m^2 and these varied little between villages. The smallest tree tapped was 33 cm diameter but 96.5% were >45 cm diameter and 78% were >60 cm. Tappers only select large, healthy trees. Tapped trees range up to over 2 m diameter. The larger trees give more resin and there is no upper limit to this.

Resin-tapping does not cause significant damage to the trees (except in very rare cases) or a significant increase in mortality. Damage was recorded on a 4-point scale. Among active taps 93% scored 1 or 2, indicating either no damage or some limited burning of the outer bark. Only 7% had an area with the bark gone and the wood becoming burnt, but this was usually only a small area. There was no evidence that trees tapped for longer had higher damage scores. Only four tapped trees were seen to have died, two for reasons probably related to tapping. This is a very small percentage of the total number observed. Negative effects such as reduced growth or fruiting might be occurring but would be very hard to measure and they were not examined in this study.

Individual taps eventually stop yielding and are replaced with new ones. The mean number of active taps per tree is 1.14; 85% of trees have only one, 11% two and 1% have more (3-5 taps). Taps are replaced very gradually - only 13% of trees have any exhausted taps so far, after periods ranging from 4 to 10 years.

About 2% of trees have never produced resin despite being tapped, usually because they were found to have a hole in the centre, or were simply too small. So far a further 6% have started giving resin and then stopped after a few months or years. It is not clear whether the number of exhausted trees is still increasing, but it is such a small proportion that it is not a significant current management issue. There was no evidence that exhausted trees were sick or damaged and the reason they became exhausted is unclear.

Mean tree size was strongly related to yield per tree in that group - big trees are markedly more productive. Many other factors clearly play a part too, but these were not identified. Duration of tapping is probably an important factor determining yield but data were inconclusive. Some tappers report declines in yield compared to when they first started, but it is not clear whether these will continue to zero or just level off. Other research approaches will be needed to understand this subject.

Hunting

Hunting is illegal, so information on it was only collected when it would not interfere with questioning on other subjects. It can be divided into two classes.

- Hunting of large mammals by specialist hunters

This kind of hunting has high impacts on the most threatened species (e.g. Tiger, Gaur, Banteng, bears). Much is done by visitors to the area, often soldiers or police, who use both guns and snares. Hunting by local residents is also significant, and is often done by a relatively small number of Phnong men borrowing guns from local soldiers or police. A few local residents get significant income from this activity but most get little or no benefit. Resin-tappers rarely carry guns, crossbows or bows on tapping trips, and this type of hunting is mainly done on separate special trips.

- Hunting of small or large animals by non-specialists

Some pigs are snared around chamkars. Although this is probably the biggest source of wild meat eaten it is much less significant than fish for most people. Turtles and monitor lizards are caught with dogs for food or sale, mostly in the early rainy season. Much of this hunting is done during resin-tapping - dog owners always take their dogs with them on tapping trips.

Commercial electrofishing is also done in the small rivers around two of the villages. In one of these it is causing serious fish shortages for resident families.

Conclusions

There is an opportunity to co-operate with resident Phnong communities over conservation issues. This is because they are present at low densities and are almost all currently following a livelihood (resin-tapping plus small-scale shifting cultivation) with few, if any, significant environmental impacts. Current levels of shifting cultivation are also thought to be having low impacts, although this has been

studied in less detail. Their livelihoods also give them an interest in preventing forest clearance or degradation by other groups, at least for the time being.

Although the interests of Phnong communities overlap widely with conservation interests, there are important points of difference that require negotiated solutions. These include:

- the issue of continuing immigration, especially by families wanting to establish rice paddies at new settlements in critical habitats.
- the longer-term question of intrinsic population growth, which will cause a steady increase in pressure on resources.
- increasing material aspirations. These cannot be satisfied by expanding or intensifying resin production since all suitable trees are being tapped at what are thought to be maximum levels.
- increasing interest in cash-crop agriculture. This may result in increased forest clearance and possibly enable further immigration by other Phnong families.
- hunting of turtles and lizards with dogs. This is having moderate conservation impacts on some species.
- hunting of threatened large animals by a minority of families.

A resumption of logging in the area in the future could potentially causes many impacts of wildlife and local communities. Looking specifically at resin-tapping it is clear that the incomes of most families in the study villages would decline very drastically following logging and there is no locally-available alternative that could replace this income. Destructive activities such hunting of threatened species would probably increase as a result of logging, and shifting cultivation might increase to a level where it was causing significant harm.

Recommendations

In order to maintain the conservation value of the area the following steps are suggested:

1) **Continue and expand current conservation activities** by the joint team from the Department of Forestry and Wildlife/Ministry of the Environment/Wildlife Conservation Society. These include patrolling, monitoring and high-level liaison.

2) **Plan to prevent the impacts of resumed logging.** If logging is to be resumed, develop a clear strategy that acknowledges and prevents or fully mitigates impacts on local peoples' livelihoods and on wildlife.

3) **Deal with some specific, urgent management problems**. These are as follows:

A) Immigration and paddy expansion at critical sites

- Liaise with the District governor with the aim delaying, preventing or redirecting the establishment of a new village at Buy Phlok.
- Investigate the best way to slow, prevent or even reverse the establishment of new paddies at Trapeang Khlong and Trapeang Royiaw.
- Conduct research to find out when the old village of Ph. O Tamarr may be re-occupied, and exactly where it is.
- Try to clarify the future of Ph. O Pour, which the District authorities are apparently planning to move.
- Conduct rapid demographic surveys of the remaining unstudied villages in the core area to identify which are currently growing and to collect reports of plans to establish other villages.

B) Hunting by outsiders in the Ph. Roka Thmei area

- This reportedly involves regular visits by soldiers or policemen from Memong. Investigation and follow-up actions can be done by the area patrol teams.

C) Electrofishing in Ph. Pu Char and Ph. Roka Thmei

- This reportedly being done by outsiders in Ph. Pu Char and by local residents in Ph. Roka Thmei (1). Investigation and follow-up can be done by the area patrol teams.

4) **Start a program of long-term community-based work in Phnong villages**

The aim should be to develop a constructive, long-term working relationship that makes it possible to discuss and resolve conflicts between community wishes and conservation objectives. Although this should build upon existing traditional beliefs and respect for the forest where possible, material benefits are likely to be the main motivation for these communities to make compromises for conservation.

The outreach team needs to conduct a background review of the literature and to visit the field sites of other organisations with similar objectives.

Initial village-level activities should concentrate on confidence building and exchanging ideas. Priorities held by the communities should be identified, and assistance given in resolving a small but significant problem. This should hopefully lay the basis for tackling larger problems and agreeing conservation measures to be conducted by the villages.

It is important to communicate closely with the NGO Satrey Santepheap Daoembei Parethan, which is also active in forestry and community development in the same general area.

5) **Conduct further research**. Suggested topics are as follows:

- Is there any way that resin quality can be improved, and thus prices?
- What are the long term trends in resin yield from tapped trees?
- What are the opportunities for village-level processing to improve prices?
- What are the trade routes and marketing constraints?
- What roles do wild meat and fish play in the diets of Phnong communities?
- What are the cultural and medicinal roles of wild animals in Phnong culture?
- What is the agricultural potential of the area?
- What is the environmental effect of forest fires in the area?

សេចក្តីសង្ខេប

សេចក្តីផ្តើម

របាយការណ៍នេះពិពណ៌នាអំពីការសិក្សាពីជីវភាពរស់នៅ និង ការប្រើប្រាស់ព្រៃឈើក្នុងចំណោមក្រុមជនជាតិភាគតិច (ជនជាតិភ្នង)ដែលបានធ្វើនៅចន្លោះខែ កុម្ភៈ ដល់ខែ សីហា ឆ្នាំ ២០០២ នៅ ផ្នែកខាងត្បូង បំផុតនៃខេត្តមណ្ឌលគីរីនៃប្រទេសកម្ពុជា ។ នៅតំបន់នេះមានសហគមន៍ជនជាតិភ្នងតូចៗរស់នៅហើយ ក៏មានជនជាតិខ្មែរចូលមកតាំងទីលំនៅ នៅតំបន់ជិតៗនោះផងដែរ ដែលរួមបញ្ចូលទាំងនៅក្នុងតំបន់ព្រៃ សម្បទានរបស់ក្រុមហ៊ុនព្រៃសម្បទានផងដែរ។ នៅថ្ងៃទី ១២ ខែ សីហា ឆ្នាំ ២០០២ តំបន់ព្រៃ សម្បទានសាមលីញត្រូវបានប្រកាសជាតំបន់អភិរក្សជីវចំរុះដោយប្រកាសរបស់រដ្ឋមន្ត្រីក្រសួងកសិកម្ម រុក្ខាប្រមាញ់ និង នេសាទ ហើយដែលក្លាយជាតំបន់គោលដៅសំរាប់កិច្ចប្រឹងប្រែងក្នុងការអភិរក្ស ។ ការសិក្សានាពេល ថ្មីៗនេះបានផ្តល់នូវពត៌មានដ៏មានសារៈសំខាន់សំរាប់ស្វែងរកនូវការសំរបសំរួលរវាងការប្រើប្រាស់ដីខុសៗគ្នា។

ទិសដៅនៃការសិក្សានេះគឺដើម្បីធ្វើការអភិវឌ្ឍន៍ និង ការយល់ដឹងអំពីនិន្នាការស្ថិតក្រួសារ និងសកម្មភាពក្នុងជីវភាពរស់នៅសំខាន់ៗរបស់សហគមន៍ជនជាតិភាគតិចភ្នងក្នុងតំបន់សិក្សា។ ទំនាក់ទំនងទាំងវិជ្ជមាន និង អវិជ្ជមានរវាងសកម្មភាពក្នុងជីវភាពរស់នៅផ្សេងៗគ្នានិង ការអភិរក្សសត្វព្រៃត្រូវបានធ្វើអត្តសញ្ញាណ តាមដែលអាចធ្វើទៅបាន។ តាមរយៈការសិក្សាជំហានដំបូងបានបង្ហាញយ៉ាងច្បាស់ថាសកម្មភាពសំខាន់បំផុតសំរាប់ការសិក្សាលំអិតគឺការចោះជ័រ។ ការបរបាញ់សត្វព្រៃគឺមានចំណែកតិចតួចនៅក្នុងជីវភាពរស់នៅរបសប្រជាជន ក៏ប៉ុន្តែវាក៏មានផលប៉ះពាល់ជាវិសមាមាត្រ ដល់ការអភិរក្សផងដែរដូចនេះ សកម្មភាពនេះក៏ត្រូវបានសិក្សាលំអិតខ្លះៗដែរ ។

តំបន់ដែលបានសិក្សាស្ថិតនៅផ្នែកកណ្តាលនៃតំបន់អភិរក្សជីវចំរុះ ឬតំបន់ស្នូល។ នៅតំបន់ស្នូលភាគច្រើន គឺជាតំបន់ភ្នំហើយគ្របដណ្តប់ដោយព្រៃល្បោះទំនាប និង ប្រភេទព្រៃស្រោងស្ថិតនៅជាដុំៗ ហើយបន្ថែមតំបន់កសិកម្មពនេរចរតូចៗជាច្រើន។ ប្រភេទព្រៃស្រោងគ្របដណ្តប់ភាគច្រើននៅផ្នែកដែស្ថិតនៅជិតព្រំប្រទល់វៀតណាម ភ្នងគឺជាផ្នែកមួយនៃក្រុមជនជាតិមួង ដែលនិយាយភាសាភ្នងឬ ប៊ូនង។ ភ្នងជួនកាលត្រូវបានគេ ប្រើសំរាប់និយាយក្នុងលក្ខណៈប្រមាថសំរាប់ជនជាតិភាគតិចកម្ពុជានេះ ក៏ប៉ុន្តែពាក្យនេះត្រូវបានប្រើប្រកបដោយមោទនៈភាពដើម្បីរៀបរាប់ពីខ្លួនពួកគេផ្ទាល់ នៅពេលដែលក្រុមយើងធ្វើការសិក្សាពីចំនួនប្រជាជន។ ពួកគេរស់នៅក្នុងតំបន់នេះតាំងពីសម័យអាណានិគមបារាំងមកម្លេះ ដោយរស់នៅ

ក្នុងភូមិតូច១និងមានជីវភាពរស់នៅដោយពឹងផ្អែកលើកសិកម្មពនេរចរ និងរុករកផល-អនុផលព្រៃឈើ ផ្សេងៗ។ ពួកគេមានការចាញ់ប្រៀបនៅក្នុងសង្គមតាំងពីយូរមកហើយ។ នៅទសវត្សឆ្នាំ១៩៦0 ដង់ស៊ីតេប្រជាជន នៅក្នុងតំបន់នេះអាចមានចំនួនប្រហែលនឹងបច្ចុប្បន្ននេះ ប៉ុន្តែនៅឆ្នាំ ១៩៧0ប្រជាជនទាំងអស់ដែលរស់នៅតំបន់ ស្នួល និងតំបន់ជុំវិញត្រូវបានជំលៀសចេញដោយរបបខ្មែរក្រហម ។ ប្រហែលនៅឆ្នាំ ១៩៩៦ សកម្មភាពរបស់ ព្រៃសម្បទានបានចាប់ផ្តើមនៅក្នុងតំបន់ដោយរួមមានទាំងការធ្វើអាជីវកម្ម នៅតាមបណ្តាព្រៃគុបមួយចំនួន ការតភ្ជាប់ និង ការធ្វើអោយប្រសើរឡើង នូវ បណ្តាញផ្លូវរវាងស្នួលនិងសែនមនោរម្យ។ នៅឆ្នាំ១៩៩៩ ក្រុមហ៊ុនបានផ្អាកការធ្វើអាជីវកម្ម ព្រៃឈើ អាស្រ័យដោយគោលនយោបាយ ព្រៃឈើរបស់ រាជរដ្ឋាភិបាល។

តំបន់ស្នួលជើរតួនាទីយ៉ាងសំខាន់ក្នុងការទ្រទ្រង់នូវបណ្តាប្រភេទសត្វស្លាប និង ថនិកសត្វដែលទទួលរងនូវការគំរាមកំហែង ដោយដាច់ពូជនៅក្នុងពិភពលោកដែលរួមមាន: ខ្លែង ទន្សោង ដំរី ខ្លា ពពួកអំបូរខ្លាតូច១ ខ្លាឃ្មុំ ពពួកពានរ និង ក្ងោក ។ យោងលើការសិក្សាស្រាវជ្រាវនៅឆ្នាំ ២000 ការបរបាញ់គឺជាការគំរាមកំហែងដ៏ខ្លាំងក្លាចំពោះពពួកសត្វទាំងនេះ។ ការបរបាញ់មានលក្ខណៈធ្ងន់ធ្ងរកើតឡើងក្នុងទសវត្សឆ្នាំ ១៩៩0 ជាពិសេស នៅពេលដែលសកម្មភាពធ្វើអាជីវកម្មព្រៃឈើបានចាប់ផ្តើម ។ ក៏ប៉ុន្តែនៅពេលបច្ចុប្បន្ននេះ សកម្មភាពក្នុងការបរបាញ់នៅសល់តិចតួចប៉ុណ្ណោះនៅពេលដែលពុំមានក្រុមធ្វើអាជីវកម្ម ព្រៃឈើ ហើយ កាំភ្លើងភាគ ច្រើន ត្រូវបានគេដកហូតដោយកម្មវិធីដកហូតអាវុធរបស់ជាតិ ក៏ប៉ុន្តែការបរបាញ់ និង ដាក់ អន្ទាក់នៅតែជាការ គំរាមកំហែងយ៉ាងខ្លាំងក្លាចំពោះសត្វព្រៃ ។ បច្ចុប្បន្ននេះការធ្វើកសិកម្មពនេរចរពុំទាន់មានការគំរាមកំហែងនៅឡើយទេ ។ ការធ្វើអាជីវកម្មព្រៃឈើយ៉ាងខ្លាំងក្លានាំអោយមានផលប៉ះពាល់យ៉ាងធ្ងន់ធ្ងរដល់ពពួកប្រភេទសត្វជាច្រើនជាពិសេស បើមានការបរបាញ់យ៉ាងក្លាំងក្លាជាបន្ថែមទៀតនោះ ។ ក៏ប៉ុន្តែការធ្វើអាជីវកម្មព្រៃឈើប្រកបដោយនិរន្តរភាពដោយភ្ជាប់ជាមួយ នូវយន្តការក្នុងការត្រួតពិនិត្យ និង ការការពារការបរបាញ់ដែលកើតឡើងនៅក្នុងជីវភាពរស់នៅរបស់ប្រជាជនក្នុងស្រុកអាច ស្របទៅនឹង ការអភិរក្សសត្វព្រៃ ។

វិធីសាស្ត្រ

វិធីសាស្ត្រក្នុងការស្រាវជ្រាវរួមមានការសិក្សាស្រាវជ្រាវនូវបណ្តាឯកសារពាក់ព័ន្ធ ឯកសារច្បាប់ និង ការធ្វើការងារនៅនឹងមូលដ្ឋានដោយប្រើប្រាស់នូវបច្ចេកទេសការវាយតំលៃជនបទដោយរហ័ស(RRA) និង បច្ចេកទេសអេកូឡូស៊ីជាពិសេស បច្ចេកទេសដូចខាងក្រោមត្រូវបានប្រើប្រាស់ដូចជា :

- ការធ្វើសំភាសន៏ពាក់កណ្តាលគ្រោងការជាមួយអ្នកផ្តល់ពតិមានសំខាន់ៗដូចជា: អ្នកជំនួញនិងប្រជាជនដែលប្រកបរបរចោះជ័រ ។

- ការធ្វើសំភាសន៏ដោយត្រង់ការជាមួយគ្រួសារប្រជាជនក្នុងភូមិ(ដោយការប្រើប្រាស់នូវសំនួរសាកល្បងជាមុន ដោយ ប្រុងប្រយត្ន) ។

- ការចុះសិក្សានៅព្រៃដោយពិនិត្យផ្ទាល់នូវបណ្តាក្រុមដើមជ័រ ដោយប្រមូលនូវពត៌មានពីរប្រភេទគឺ ទីតាំងរបស់ក្រុមដើមជ័រស្ថិតនៅឆ្ងាយជាងគេបំផុតដែលជាកម្មសិទ្ធិរបស់ភូមិនិមួយៗ និងភិនភាគលក្ខណៈនៃ ក្រុមដើមជ័រគំរូដែលបានធ្វើការជ្រើសរើសដោយចៃដន្យដូចជា: ទំហំនៃដើមច្បោះជ័ររបៀបច្បោះជ័រ ភិរិតក្នុងការខូចខាតរបស់រណ្តៅជ័រ ។ល។

ការសិក្សានេះត្រូវបានធ្វើយ៉ាងល្អិតល្អន់ជាមួយអ្នកផ្តល់ពត៌មានសំខាន់ៗដោយប្រើប្រាស់វិធីសាស្ត្រជាច្រើន ។ ការសិក្សានេះផ្តោតទៅលើ៤ ភូមិសំខាន់ៗគឺ ភូមិ ពូចារ ភូមិកាទី ភូមិអណ្តូងក្រឡឹង និង ភូមិ រការថ្មីដែលនៅក្នុងភូមិ៤នេះមានភូមិតូចៗផ្សេងៗគ្នាសរុបចំនួន ១៤ ភូមិ។ ក៏ប៉ុន្តែលទ្ធផលនៃការសិក្សាត្រូវ បានបែង ចែកជា៤ ភូមិប៉ុណ្ណោះដូចជា: ចំនួនប្រជាជន ការធ្វើការប្រៀបធៀបនូវជំរើសក្នុងជីវភាពរស់នៅ ការសិក្សាលំអិតលើការចោះជ័រនិងការអង្កេតលើការបរបាញ់។ ក្នុងចំណោម ១៤ ភូមិតូចៗនោះរួមមាន ២១១ គ្រួសារនិងមានមនុស្សចំនួន ៩៧0នាក់។ ដែលក្នុងចំនួននេះមានប្រជាជនចំនួន ៩0% ដែលបាន ធ្វើសំភាសន៏ក្នុងតំបន់ដែលបានសិក្សាមានគ្រួសារចំនួនប្រហែល ៩៥% គឺជាជនជាតិភ្នង។ បណ្តាភូមិទាំងអស់នេះត្រូវបានបង្កើតឡើងនៅរវាងចន្លោះឆ្នាំ ១៩៣0-១៩៦0 ។ ក្រោយឆ្នាំ ១៩៧0 ប្រជាជនទាំងអស់ត្រូវបានជំលៀសចេញពីភូមិទាំងបង្ខំ។ ចាប់ពីឆ្នាំ ១៩៨៨ បណ្តាភូមិភាគច្រើនបានបង្កើតឡើងវិញជាបន្តបន្ទាប់ លើកលែងតែ ភូមិរការថ្មីដែលបានបង្កើតឡើងវិញនៅឆ្នាំ ១៩៩៨ ។

នៅភូមិនិមួយៗប្រជាជនវិលត្រឡប់មករស់នៅភូមិកំណើតវិញមានចំនួនច្រើននៅពេលដំបូងហើយបានថយចុះជាបណ្តើរៗ មកដល់បច្ចុប្បន្ននេះភូមិចំនួនបីពុំមានមានប្រជាជនចូលមកតាំងទីលំនៅទៀតឡើយ។ ក៏ប៉ុន្តែភូមិរការថ្មីអាចនឹងមានអ្នកមកតាំងទីលំនៅបន្ថែមទៀតនៅឆ្នាំក្រោយ តែមានចំនួន តិចតួច ។ ប៉ុន្តែនៅភូមិកាទីប្រជាជនដែលចូលមកតាំងទីលំនៅចុងក្រោយបំផុតកើតមានឡើងតាំងពីឆ្នាំមុនមកម្លេះ បញ្ហានេះប្រហែលមកពីជាប់ពាក់ព័ន្ធនឹងកង្វះខាតដើមជ័រនៅក្នុងព្រៃសំរាប់គ្រួសារដែលមកតាំងទីលំនៅថ្មី។ ទោះបីយ៉ាងណាក៏ដោយការមកតាំងទីលំនៅរបស់ប្រជាជនជាជនជាតិ ភ្នង ដែលមានចំនួនគួរអោយកត់សំគាល់ នឹងអាចកើតមាននៅកន្លែងតាំងលំនៅដែលបង្កើតថ្មី ឬ គ្រោងបង្កើតឡើង ដែលនៅទីនោះមានដីគ្រប់គ្រាន់សំរាប់ធ្វើស្រែដែលតំបន់ទាំងអស់នេះ គឺជាជំរកសំរាប់ការអភិរក្សសត្វព្រៃ ។ ប្រជាជនភាគច្រើនដែលគ្រោង នឹង មករស់ ក្នុងនៅកន្លែងនេះមកពីប៉ែកមេម៉ង់។

មានប្រជាជនខ្មែរតិចតួចប៉ុណ្ណោះដែលចូលមករស់នៅក្នុងតំបន់ដែលបានសិក្សាក៏ប៉ុន្តែមានចំនួនច្រើននៅប៉ែកខាងលិច។ ជាការប្រឈមមុខនឹងគ្រោះថ្នាក់ប្រសិនបើមានប្រជាជនច្រើន រស់នៅក្នុង តំបន់ដែល

បានសិក្សាជាពិសេសនៅតាមផ្លូវធំៗ ។នាពេលអនាគតកិច្ចសន្យាព្រៃសម្បទានអាចនឹងត្រូវឈប់ដែលអាចនាំមានសកម្មភាពក្នុងការទន្ទ្រានចូលទៅរស់នៅក្នុងតំបន់នេះមានលក្ខណៈងាយស្រួល។ ចំនួនប្រជាជននៅតំបន់ កើន ឡើងយ៉ាងឆាប់រហ័សទោះបីជាពុំបានសិក្សាអំពីកំណើនប្រជាជនក៏ ដោយ ។

ការប្រៀបធៀបទៅនឹងជីវភាពរស់នៅ

ស្ទើរតែគ្រប់គ្រួសារទាំងអស់ចាត់ទុកខ្លួនគេជាកសិករដែល ពឹង ផ្អែក យ៉ាងសំខាន់លើការ ធ្វើស្រែចំការ ពួកគេចាត់ទុកសកម្មភាពផ្សេងៗជាការបន្ទាប់បន្សំប៉ុណ្ណោះ ទោះបីជាផលិតផលស្រូវផ្តល់ផលចំណូលដ៏តិចតួចបើប្រៀបធៀបទៅនឹងផលចំណូលផ្សេងៗសំរាប់គ្រួសារក៏ដោយ។ មានគ្រួសារ ប្រជាជនចំនួន ៨៦% ប្រកបរបរកសិកម្ម ពនេរចរ (ជាទូទៅធ្វើនៅតំបន់ភ្នំ និង ដាំបន្ថែមបន្ថែផ្សេងៗទៀត ការដាំស្រូវ ចំការ នេះ មានរយៈពេលខួបវិលជួបវិញប្រហែល ១០ឆ្នាំ)។ មានគ្រួសារប្រហែល ២៤% ប៉ុណ្ណោះដែល ធ្វើ ស្រែ ហើយស្ទើរតែទាំងអស់ស្ថិតនៅភូមិពូចារ ដែលជាភូមិមួយ ដែលមានដីទំនាបហើយមានគ្រួសារប្រហែល ៥% ដែល ពុំធ្វើស្រែ។ជាមធ្យមស្រូវដែលអាចហូបបានប្រហែល ៤.៦ ខែប៉ុណ្ណោះក្នុង១ឆ្នាំ ដែលជារួមមាន ចាប់ពី ២.៦ ទៅ ៦.១ខែទៅតាមភូមិផ្សេងៗគ្នា។ ផលិតផលស្រូវទាបនេះគឺដោយសារកង្វះខាតដីស្រែ ដីខ្វះ ជីជាតិ ភ្លៀង ធ្លាក់ពុំទៀងទាត់ យថាផល និងការបាត់បង់ដោយសត្វព្រៃបំផ្លាញ។ ក្រៅពីស្រូវប្រជាជនបានរក ត្រី ផល-អនុផលព្រៃ ឈើផ្សេងៗទៀតសំរាប់ទ្រទ្រង់ជីវភាពរស់នៅដូចជា: បន្លែ ផ្តៅ ឬស្សី ។ល។

ប្រាក់ចំណូលដែលបានមកពីការចោះជ័រ រឺ សកម្មភាពការងារផ្សេងៗទៀត គឺសំរាប់បំពេញបន្ថែមនូវ កង្វះខាតអង្ករសំរាប់បរិភោគ ។ ដូចនេះហើយដែលនាំអោយប្រាក់ចំណូលនៅសល់តិតតួច ឬមធ្យមសំរាប់បំពេញតំរូវការផ្សេងៗ។ពុំមានអ្នកភូមិណាមួយជាអ្នកមានទេប៉ុន្តែពួកគេមានជីវភាពរស់នៅមធ្យមបើ ប្រៀបធៀបទៅនឹងសហគមន៍ជនបទផ្សេងៗទៀត។ ប្រាក់ចំណូលត្រូវបានបែងចែកជា ប្រភពសំខាន់ និង ប្រភព បន្ទាប់បន្សំ ។ ជាទូទៅប្រភពចំណូលសំខាន់បានមកពីការលក់ជ័រ (មាន ១៦២ គ្រួសារដែល ប្រកបរបរ ចោះជ័រក្នុងចំណោម ១៨៦ គ្រួសារ ដែល បានធ្វើ សំភាសន៍)។ មាន ៨ គ្រួសារដែលលក់ដូរបន្តិចបន្តួច ១៤ គ្រួសារ លក់កំលាំងពលកម្មជាប៉ូលីសជាគ្រូបង្រៀន ឬមេឃុំ ដែលមានប្រាក់ប្រៃវត្ស។ មានប្រហែល ៤គ្រួសារ ដែលត្រូវបានគិតថាមានចំណូល បានមកពីការបរបាញ់សត្វធំៗ។ ប្រាក់ចំណូល បន្ទាប់បន្សំផ្សេងៗទៀតមានភាពខុសៗគ្នារវាង អ្នកនៅក្នុងភូមិ និងពីភូមិមួយទៅ ភូមិមួយទៀត ក៏ប៉ុន្តែ ផលចំណូលនេះ មានចំនួនតិចតួចណាស់បើប្រៀបធៀបទៅនឹងចំណូលដែលបានមកពីការលក់ ជ័រទឹក។ បណ្តាផលចំណូលបន្ទាប់បន្សំទាំងនេះរួមមានការដឹកជញ្ជូនជ័រ

ទឹកក្នុងចំងាយផ្លូវជិតៗ ការចាប់ ត្រកួត អន្សង ឬ អណ្តើក សំរាប់លក់ការបេះផ្លែសំរង រើសជ័រចុង និង ការដាំដំណាំដែលអាចលក់បានប្រាក់ (ឧ: ស្វាយចន្ទី សណ្តែកខ្សៀវ និង ដំណាំ ហូបផ្លែ)។ ប្រសិនបើគេបញ្ឈប់ការចោះជ័រគឺពុំមាន មុខរបរណាដែលអាចពង្រីកបន្ថែមដើម្បីជំនួស នូវផលចំណូល ដែលបានមកពីការលក់ជ័របានឡើយ ប៉ុន្តែប្រហែលគេជ្រើសរើសយកការដាំដំណាំសំរាប់លក់។ ប្រសិនបើអាចធ្វើទៅបាននិងពុំអស់ប្រាក់ច្រើន ហើយការងារនេះប្រហែលទាមទារពេលវេលាច្រើនឆ្នាំ ហើយអាចនាំអោយមានការកាប់ព្រៃពង្រីកបន្ថែម ។

ការចោះជ័រ

ឥដ្ឋភាពទូទៅ

ជ័រទឹកភាគច្រើនបានមកពីពពួកអំបូរឈើទាល *(**Dipterocarpus** sp.)* ។ ពពួក ***Dipterocarpus kirri*** នៅក្នុងប្រទេសម៉ាឡេស៊ីពពួក ***Dipterocarpus alatus*** (ឈើទាលទឹក)និង ពពួកប្រភេទឈើផ្សេងៗ ទៀតនៅក្នុងប្រទេសឡាវកម្ពុជានិងថៃឡង់ដ៏។ នៅក្នុងស្រុកគេប្រើជ័រទឹកសំរាប់ធ្វើ ចន្លុះដុតបំភ្លឺនិង ការប្រើ ប្រាស់ផ្នែកពាណិជ្ជកម្មសំរាប់: បិត ទូកលាប វ៉ែនី ហើយប្រហែលជាវត្ថុផ្សំសំរាប់ធ្វើទឹកអប់ ។ ការប្រើ ប្រាស់ ជ័រទឹកដំបូងបំផុត ចាប់ផ្តើមក្នុងទស្សវត្ស ឆ្នាំ១៩៧0 ហើយបានមកពីឈើប្រភេទ ***Dipterocarpus kirri*** ហើយតំលៃកើនឡើងគួរអោយចាប់អារម្មណ៍ដែលអាចនាំអោយជាប់ពាក់ ព័ន្ធនឹងប្រភេទ ជ័រទឹកនៅ កម្ពុជាដែរ ។

ជ័រទឹករបស់ប្រទេសកម្ពុជាស្ទើរតែទាំងអស់ត្រូវបាននាំចេញដោយពុំបានកែច្នៃឡើយ។ ប្រជាជនច្បោះរណ្តៅ ជ័រ នៅនឹងដើមឈើដែលមានទំហំមធ្យម ឬ ធំ ហើយដុតកំដៅក្នុងរយៈពេលយ៉ាងខ្លីជារៀងរាល់សប្តាហ៍ ដើម្បី ជំរុញអោយទឹកជ័រថ្មីៗហូរមកក្នុងរណ្តៅ រហាយការណ៍មុនៗបាននិយាយថា ការចោះជ័រពុំផ្តល់ផលអា ក្រក់ ដល់ដើមជ័រទេហើយអាចអនុវត្តបន្តបានក្នុងរយៈពេលជាច្រើនសិបឆ្នាំ ក៏ប៉ុន្តែពុំមានទិន្នន័យពិតប្រាកដទេ។ ការចោះជ័រសំរាប់ធ្វើពាណិជ្ជកម្មក្នុងប្រទេសកម្ពុជាចាប់ផ្តើមឡើងនៅមុនទសវត្សឆ្នាំ ១៩៣0 ក៏ប៉ុន្តែតាម ដឹងនៅតំបន់ដែលបានសិក្សា ចាប់ផ្តើមក្នុង ទសវត្សឆ្នាំ ១៩៨0 ។ ទោះបីយ៉ាងណាក៏ដោយ នៅតំបន់នេះ ដើមឈើទាលដែលត្រូវបានបានគេចោះជ័រសំរាប់ប្រើ ប្រាស់ក្នុងគ្រួសារអស់រយៈពេលជាច្រើនទសវត្សមកហើយ។ ការចោះជ័រត្រូវបានរីករាលដាលនៅប៉ែកខាងជើង និង ឥសាន្តនៃប្រទេសកម្ពុជាហើយវាគឺ ជាប្រភពចំណូលដ៏សំខាន់សំរាប់ប្រជាជនកម្ពុជាជាច្រើន ក៏ប៉ុន្តែទិន្នន័យសំរាប់ចងក្រងជាឯកសារនៅខ្វះខាត នៅឡើយ ។

ការចោះជ័រសំរាប់អ្នកភូមិពុំត្រូវបានគេដាក់កំហិតនៅឡើយទេក៏ប៉ុន្តែការនាំចេញ(ការដឹកជញ្ជូន) ដោយឈ្មួញទាមទារការអនុញ្ញាត្តិ។ ដើមច្បោះជ័រត្រូវបានការពារដោយច្បាប់ដោយពុំអនុញ្ញាត្តិអោយកាប់ឡើយប៉ុន្តែមានដើមដែលច្បោះជ័រជាច្រើនត្រូវបានគេផ្តួលរំលំនាពេលថ្មីៗនេះនៅពាសពេញប្រទេស។ នាពេលអនាគតច្បាប់មានការផ្លាស់ប្តូរអាចនាំអោយកើនឡើងនូវការការពារដើមជ័រក៏ប៉ុន្តែទាមទារអោយអ្នកស្រុក សុំការអនុញ្ញាត្តិដើម្បីចោះជ័រ ។

នៅតំបន់ដែលបានសិក្សា តាមលក្ខណៈប្រពៃណីភាពជាកម្មសិទ្ធិគឺផ្តល់អោយអ្នកដែលរកឃើញ និង ចោះដើមជ័រមុនគេជាម្ចាស់ដើមជ័រ ។ ដើមជ័រអាចត្រូវបានគេផ្តល់អោយ បន្តកេរ្តិ៍មរតក ឬ លក់នៅក្នុងភូមិឬរវាងអ្នកភូមិផ្សេងៗទៀត ។ធនធានព្រៃឈើផ្សេងៗទៀតក្រៅពីដើមជ័រគឺពុំត្រូវបានគេកាន់កាប់ឡើយ ក៏ប៉ុន្តែ ពួកគេកាន់កាប់ដើមឈើទាលតូចៗ និងដើមឈើទាលដែលអស់ទឹក ។

នៅតាមភូមិខ្លះៗអ្នកភូមិអាចធ្វើការជ្រើសរើសអ្នកទិញជ័រទឹកបានយ៉ាងល្អហើយពួកគេអាចដើរសាកសួរតំលៃពីឈ្មួញផ្សេងៗពីគ្នាដើម្បីជ្រើសរើសយកអ្នកដែលផ្តល់តំលៃថ្លៃជាងគេតែនៅកន្លែងផ្សេងៗទៀតអាស្រ័យដោយផ្លូវលំបាកបំណុលឬអ្នកទិញមានតែម្នាក់ដែលជាហេតុនាំអោយតំលៃចុះទាបសំរាប់អ្នកចោះជ័រ។ តំលៃ ទឹកជ័រក៏ប្រែប្រួលតាមរដូវកាលផងដែរ ដែលហេតុផលសំខាន់គឺនៅរដូវភ្លៀងទឹកភ្លៀងចូលក្នុងទឹកជ័រ ក៏ប៉ុន្តែ អាចមានកត្តាផ្សេងៗទៀតរួមផ្សំដែរ ។ ច្រកព្រំដែនទាំងខាងកើតនិងខាងលិចជាច្រើនគឺ ជាច្រកសំរាប់នាំជ័រ ចេញពីតំបន់ដែលបានសិក្សា ។

ដើមជ័រដែលសមស្របសំរាប់ការចោះជ័រដុះយ៉ាងច្រើន ក៏ប៉ុន្តែផ្តុំជាដុំៗនៅពាសពេញតំបន់សិក្សាក្នុងតំបន់ព្រៃ ស្រោង ព្រៃពោក់កណ្តាលស្រោង និង ប្រភេទព្រៃរបោះចំរុះ ប្រជាជនភាគច្រើនធ្វើដំណើរជាច្រើនគីឡូម៉ែត្រ ក្នុងមួយថ្ងៃដើម្បីទៅប្រមូលទឹកជ័រហើយក្នុងនោះមានក្រុមនៃដើមជ័រប្រហែល១០% ដែលម្ចាស់ស្នាក់នៅពេលយប់នៅក្នុងព្រៃពេលប្រមូលផលជ័រ។ នៅតំបន់ចោះជ័រដែលបានធ្វើផែនទីសំរាប់ភូមិទាំងបីនេះពុំត្រួតស៊ីគ្នារវាងភូមិទាំងបីនេះឬភូមិដែលនៅជាប់គ្នាទេ ក៏ប៉ុន្តែនៅក្នុងតំបន់និមួយៗស្ទើរតែទាំងអស់ត្រូវបានគេចោះជ័រហើយនៅសល់តិចតួចបំផុតដែលពុំទាន់បានចោះ។ តំបន់ចោះជ័ររបស់ភូមិផ្សេងៗទៀតគឺមានភាពត្រួតស៊ីគ្នាច្រើន។ តំបន់ដែលចោះជ័រនេះក៏អាចបញ្ជាក់បានជាតំបន់ដែលប្រជាជនប្រើប្រាស់សំរាប់គោលបំណងផ្សេងៗទៀតដែរ ក៏ប៉ុន្តែនេះគឺជាតំបន់ដែលមានលក្ខណៈជួនគ្នាតែប៉ុណ្ណោះពុំមែនបានមកពីការលើកជាគំរោងផែនការឬការយល់ព្រមជាពិសេសទេ។ វាកើតឡើងដូចនេះបានពីព្រោះ ប្រជាជនភាគ ច្រើនចូលទៅក្នុងព្រៃណា ដែលស្ថិតនៅជិតភូមិពួកគេបំផុត។ នៅក្នុងតំបន់នេះពុំមានការត្រួតពិនិត្យតាមលក្ខណៈប្រពៃណីចំពោះ ការនេសាទ ការបរបាញ់ ឬ ការរុករកអនុផលព្រៃឈើផ្សេងៗ ទៀតឡើយ ។

សេដ្ឋកិច្ច

មានគ្រួសារចំនួន ៨៦%នៃចំនួនគ្រួសារទាំងអស់ដែលប្រកបរបរចោះជ័រហើយគ្រួសារនិមួយៗ មានដើមជ័រជាមធ្យមចំនួន ៧៧ ដើមក្នុងមួយគ្រួសារ (មានចាប់ពី ៥២-១៣៥ ដើមតាមភូមិផ្សេងៗ គ្នា)។ ពពួកអំបូរឈើទាលទឹកមានរហូតដល់ ៥២% នៃប្រភេទឈើដែលប្រជាជនចោះជ័រ (តាមការសំភាសន៏) និង មានរហូតដល់ ៥៧% (តាមការចុះមើលនៅព្រៃផ្ទាល់) ចំណែកនៅសល់គឺ ពពួកត្រាច ***(Dipterocapus intricatus)***។ នៅក្នុងភូមិទាំងបីនេះដែលបានធ្វើជាផែនទីបានប៉ាន់ ប្រមាណឃើញថា មានដើមច្បោះជ័រប្រមាណ ១៤ 000ដើម ដែលត្រូវបានប្រើប្រាស់ និងស្ថិតលើផ្ទៃដី ព្រៃចំនួន ៣២ 000 ហិតា ជាមធ្យមចំនួន 0,៤៤ ដើមក្នុងផ្ទៃដីមួយហិតា (រួមបញ្ចូលទាំងព្រៃល្បោះ ខ្លះដែលពុំមានដើមជ័រ) ដែលទឹកជ័រមានពី ៣0-៤0 លីត្រក្នុង មួយឆ្នាំ ។

តំលៃជ័រទឹកនៅរដូវប្រាំងមានចាប់ពី ២១ 000-២៣ 000 រៀលក្នុង ៣0លីត្រ(ប៉ុន្តែនៅភូមិ មួយមានតំលៃ តែពី ៥000-១៣000 រៀលក្នុង ៣0លីត្រ) ហើយតំលៃជ័រទឹកចុះតំលៃនៅសល់ពី ៨000-១៨000រៀល ក្នុង ៣0លីត្រនៅរដូវភ្លៀង។ ផលចំណូលជាមធ្យមក្នុងមួយគ្រួសារគឺ ៣៤0 ដុល្លា ក្នុងមួយឆ្នាំ (មានចាប់ពី ២៥៩- ៣៣៧ ដុល្លាក្នុងមួយគ្រួសារសំរាប់ក្នុងភូមិបួនដែលបានសិក្សា)។ ផលចំណូល សរុប ដែលបាន មកពី ការលក់ជ័រក្នុងភូមិទាំងបួននេះមានប្រហែល ៦១000ដុល្លា ក្នុងមួយឆ្នាំ។ ភូមិចំនួនបីដែល បានធ្វើជាផែនទីរួច ហើយបានបង្ហាញថាចំណូលមានចំនួន ១,៩ដុល្លាក្នុង មួយហិតាក្នុងមួយ ឆ្នាំ (មានចាប់ពី 0,៩-២,២ដុល្លាតាម ភូមិនិមួយៗ) ឬ ៣,៦ដុល្លាក្នុងមួយដើមក្នុង មួយឆ្នាំ (មានពី ២,៤- ៤,៩ ដុល្លា) ។ ប្រសិនបើយើងដកស្រង់យកពតិមានអំពីការទិញអង្ករសំរាប់ បំពេញតំរូវការ ដោយយកចំណូលបានមកពីការលក់ជ័រទឹកគឺមានពី ១ ទៅ ២00ដុល្លាក្នុងមួយគ្រួសារ ក្នុងមួយឆ្នាំ ដោយបន្ថែមនូវចំណូលបាន មកពីការធ្វើការងារបន្ទាប់បន្សំ ផ្សេងៗ ទៀត ។

ការប៉ះពាល់មកពីការធ្វើអាជីវកម្មព្រៃឈើ

ការធ្វើអាជីវកម្មព្រៃជាពិសេសឈើទាលទឹកដោយស្របច្បាប់និងមិនស្របច្បាប់មានលក្ខណៈធ្ងន់ ធ្ងរណាស់នៅតំបន់សិក្សា ។ អ្នកភូមិបានផ្តល់ពតិមានថាមានគ្រួសារខ្លះបានបាត់បង់ដើមជ័រ ២៦% ទៅ ៣0% នៃចំនួនដើមជ័រទាំងអស់ ដែលពួកគេបានចោះមុនពេលចាប់ផ្តើមធ្វើអាជីវកម្មព្រៃឈើ គ្រួសារខ្លះ បានបាត់បង់ដើមជ័ររហូតដល់១00% ។ មានដើមជ័រខ្លះត្រូវបានគេរកឃើញ និង ចោះនៅពេលដែលមាន អាជីវកម្មឈើ ក៏ប៉ុន្តែមានចំនួនតិចតួច ហើយមានទំហំតូចនិងផ្តល់ផលតិច។ ប្រជាជនដែលជាម្ចាស់ដើម

ជ័របានធ្វើការតវ៉ាដើម្បីកុំអោយគេកាប់រំលំដើមច្បោះជ័រតែត្រូវបរាជ័យ។ ម្ចាស់ដើមជ័រខ្លះបានទទួលសំណងពីរ ១,២៥ - ២,២៥ ដុល្លាក្នុង១ដើម ក៏ប៉ុន្តែម្ចាស់ដើមជ័រ ភាគច្រើនពុំបានទទួលសំណងនេះទេ។ បំលាស់ប្តូរនូវផលិតផល ផ្សេងៗទៀតពុំបានសិក្សាទេ។

ក្រោយរយៈពេល៤ ឆ្នាំអ្នកភូមិនៅតែពុំទាន់អាចមានលទ្ធភាពដើម្បីរក មុខរបរ ណាដែល អាចជំនួសនូវ ផលចំណូលភាគច្រើនដែលបានបាត់នៅពេលដែលធ្វើអាជីវកម្មព្រៃឈើ។ ជំរើសសំខាន់ផ្សេងៗទៀតដែលប្រជាជនបានធ្វើគឺការពង្រីកនូវផ្ទៃដីសិកម្មពលចរ បង្កើនការបរបាញ់ពពួកសត្វ ព្រៃដូចជា: ត្រកួត អន្សង និង អណ្តើកសំរាប់លក់និងស្វែងរកការងារសំរាប់ធ្វើបន្ថែមក៏ប៉ុន្តែការងារទាំងអស់នេះមានកំរិតកំនត់។

ប្រសិនបើការធ្វើអាជីវកម្មព្រៃឈើនៅតែបន្តតាមផែនការនោះដើមជ័រទាំងអស់ដែលមានអង្កត់ផ្ចិតធំជាង ៦0 ស ម នឹងត្រូវគេកាប់ដោយបន្សល់ទុកនូវដើមជ័រតូចៗផ្តល់ផលទាប ដែលបច្ចុប្បន្ននេះមានប្រហែលជា ២២% នៃដើមច្បោះជ័រទាំងអស់ ។បញ្ហានេះនឹងបណ្តាលអោយមានផលវិបាក យ៉ាងធ្ងន់ធ្ងរជាងពេលកន្លងទៅទៀត ។

ទិដ្ឋភាពនៃជីវសាស្ត្រនិងទិន្នផល

មានដើមជ័រជាង ២៥00 ដើម ត្រូវបានវាស់វែងនិងពិនិត្យមើល។ បច្ចុប្បន្ននេះដើម ច្បោះជ័រដែលផ្តល់ផលមានអង្កត់ផ្ចិតជាមធ្យមនៅកំពស់ត្រង់ទ្រូងមានទំហំ៨២ សម និង បរិមាត្រមធ្យម គឺ 0-៥៩ សមដែលទំហំទាំង អស់នេះខុសប្លែកគ្នាពីភូមិមួយទៅភូមិមួយ។ ដើមច្បោះជ័រ តូចបំផុតដែលគេចោះជ័រមាន ទំហំអង្កត់ផ្ចិត ៣៣សម ក៏ប៉ុន្តែមានដើមច្បោះជ័រចំនួន ៩៦% មានអង្កត់ផ្ចិតធំជាង ៤៥ ស ម និង ៧៨% មាន អង្កត់ផ្ចិតធំជាង៦0សម។ អ្នកច្បោះជ័រធ្វើការជ្រើសរើសយកដើមជ័រដែលមានទំហំធំហើយមានសុខភាពល្អ។ ដើមឈើដែលបានចោះជ័រមានអង្កត់ផ្ចិតរហូតដល់ជាង ២ម៉ែត្រ។ ជាទូទៅដើមឈើធំផ្តល់ទឹកជ័រច្រើន ហើយ ពុំមានកំរិត អំពីទំហំដើមឈើនេះទេ ។

នៅពេលរណ្តៅជ័រណាមួយឈប់ផ្តល់ផលគេនឹងចោះរណ្តៅថ្មីបន្ថែមទៀតនៅលើដើមដដែល។ ចំនួនរណ្តៅជ័រដែលនៅផ្តល់ផលជាមធ្យមមានចំនួន ១,៤ រណ្តៅក្នុង១ដើម ហើយមានដើមជ័រចំនួន ៨៥%ដែល មានរណ្តៅតែមួយ ១១%មាន២ រណ្តៅក្នុង១ដើម និង ១% មានច្រើនរណ្តៅក្នុង១ដើម (២ -៥ រណ្តៅ)។ រណ្តៅជ័រនឹងត្រូវគេជំនួសបន្តិចម្តងៗមកដល់បច្ចុប្បន្ននេះមានរណ្តៅជ័រចំនួន១៣% ដែលឈប់ផ្តល់ផលក្រោយរយៈពេលពី ៤ -១0ឆ្នាំទៅមុខទៀតអាចមានរណ្តៅជ័រច្រើននឹង ឈប់ផ្តល់ផល។

មានដើមជ័រប្រហែល ២% ដែលពុំផ្តល់ទឹកសោះនៅពេលចាប់ផ្តើមចោះដំបូង ពីព្រោះដើមជ័រប្រភេទ នេះមានប្រហោងនៅកណ្តាលឬដើមតូចៗ។ មកដល់ពេលនេះមានដើមជ័រ៦%ដែលនៅពេលចោះ ដំបូងផ្តល់ទឹក ជ័រក៏ប៉ុន្តែឈប់ផ្តល់នៅក្រោយរយៈពេល ២-៣ខែ ឬ ច្រើនឆ្នាំ។ យើងពុំអាចធ្វើការប៉ាន់ប្រមាណ អំពីរចំនួនដើមឈើដែលអស់ទឹកនឹង នៅតែបន្តកើនឡើង ក៏ប៉ុន្តែវាមានចំនួនភាគរយតិចតួចដែលវាពុំមែនជាបញ្ហាក្នុងការគ្រប់គ្រងសំខាន់នៅពេលបច្ចុប្បន្ននោះទេ។ ពុំមានភស្តុតាងដែលថាឈើដែលអស់ទឹកត្រូវបាន ឈឺឬខូចខាតហើយមូល ហេតុ ដែលបណ្តាលអោយអស់ទឹកគឺពុំទាន់ច្បាស់។

ក្រុមសិក្សាបានបែងចែកចំណាត់ថ្នាក់រណ្តៅជ័រជា ៤ ថ្នាក់ ហើយក្នុងចំណោមរណ្តៅដែលផ្តល់ជ័រទាំងអស់មាន ៩៣% ដែលស្ថិតក្នុងលំដាប់ថ្នាក់១និង២ ដែលចំណាត់ថ្នាក់នេះបញ្ជាក់អំពី រណ្តៅដែលពុំទទួលរងការខូខាតឬមានការឆេះសំបកខាងក្រៅនៃរណ្តៅជ័រតិចតួច។មានរណ្តៅចំនួន ៧០%ដែលសំបកខាងក្រៅឆេះអស់រហូតឆេះដល់ឈើខាងក្នុង ក៏ប៉ុន្តែបញ្ហានេះកើតឡើងក្នុងទ្រង់ទ្រាយតូចប៉ុណ្ណោះ។ ពុំមានភស្តុតាងដែល បញ្ជាក់ថារណ្តៅជ័រដែលគេចោះរយៈពេលយូរមានកិរិតខូចខាតដល់ រណ្តៅខ្ពស់នោះទេ។ មានដើមឈើដែល គេចោះជ័រចំនួន ៤ប៊ុណ្ណោះ ដែលងាប់ក្នុងនោះមាន២ដើម ដែលប្រហែលមកពីការចោះជ័រ។ នេះគឺជា ចំនួនភាគរយដ៏តូចបំផុតក្នុងចំណោម ដើមជ័រទាំងអស់ដែលបានសិក្សា ដូចនេះបើយើងលើកលែងករណីដែលកើតមានដោយកំរបំផុតនេះយើងអាចបញ្ជាក់បានថា ការចោះជ័រពុំបណ្តាលអោយមានការ ខូចខាតជាដុំកំភួន ដល់ឈើទេឬបណ្តាលអោយស្លាប់ដល់ដើមឈើទេ តែអាចមានផលប៉ះពាល់ដល់ការ លូតលាស់ ឬផ្លែផ្កា របស់ ដើមឈើ ក៏ប៉ុន្តែមានការលំបាកប៉ាន់ស្មានអោយត្រូវ។

ទំហំដើមឈើមានទំនាក់ទំនងយ៉ាងខ្លាំងជាមួយទិន្នផលរបស់ដើមឈើនិមួយៗនៅក្នុងក្រុមឈើតាមការកត់សំគាល់ដើមឈើធំផ្តល់ផលច្រើន។ ក៏ប៉ុន្តែមានកត្តាជាច្រើនផ្សេងៗទៀតដែលរួមចំណែក ក្នុងបញ្ហានេះដែរ ក៏ប៉ុន្តែពុំបានធ្វើការសិក្សាលើបញ្ហានេះទេ។ រយៈពេលក្នុងការចោះប្រហែលជាកត្តាដ៏សំខាន់ ក្នុងការកំនត់នូវទិន្នផលប៉ុន្តែទិន្នន័យពុំទាន់ប្រាកដ។ អ្នកច្បោះជ័រខ្លះៗបានប្រាប់អំពីការថយចុះនូវទិន្នផលទឹកជ័របើ ប្រៀបធៀប ទៅនឹងពេលចោះដំបូងក៏ប៉ុន្តែពុំប្រាកដថាតើទិន្នផលទឹកជ័រនៅតែបន្តថយចុះរហូតដល់ អស់ រឺ នៅ ត្រឹមកិរិតណាមួយ បញ្ហានេះទាមទាអោយមានការសិក្សាជាបន្ថែមទៀតដើម្បីអោយយល់កាន់តែច្បាស់។

ការបរបាញ់

ការបរបាញ់ជាការល្ហើសច្បាប់ ដូចនេះការប្រមូលពតិមានអំពីការបរបាញ់គឺធ្វើនៅពេលដែល សមស្រប

និងពុំប៉ះពាល់ដល់សំនួរដែលសួរលើប្រធានបទផ្សេងៗទៀត ។ការបរបាញ់ចែកចេញជា ២ប្រភេទ:

- ការបរបាញ់សត្វធំៗដោយអ្នកជំនាញក្នុងការបរបាញ់

ការបរបាញ់ដោយអ្នកប្រមាញ់ជំនាញមានផលប៉ះពាល់យ៉ាងខ្លាំងដល់ពពួកសត្វដែលទទួលរងការគំរាមកំហែងដូចជា: ខ្លា ខ្លឹង ទន្សោង និងខ្លាឃ្មុំ ។ ការបរបាញ់ភាគច្រើនធ្វើឡើង ដោយអ្នកមកពីខាងក្រៅតំបន់ នេះ ជួនកាលជាយោធា ឬ ប៉ូលិសដែលប្រើប្រាស់ទាំងកាំភ្លើងនិងអន្ទាក់ ។

ការបរបាញ់ដោយប្រជាជនក្នុងភូមិក៏មានលក្ខណៈគួរអោយកត់សំគាល់ដែរជារឿយៗធ្វើឡើងដោយពួកបុរសជនជាតិភ្នង ដែលទៅខ្វីកាំភ្លើងពីយោធា ឬ ប៉ូលិសនៅមូលដ្ឋាន។ មានអ្នកភូមិតិចតួចប៉ុណ្ណោះដែលទទួលផលចំណូលពីការបរបាញ់នេះក៏ប៉ុន្តែភាគច្រើនទទួលបានតិចតួចឬអត់បានទទួលសោះ។ អ្នកចោះជ័រពុំដែលយកកាំភ្លើង ស្នា ធ្នូ ឬ អន្ទាក់ តាមខ្លួនឡើយនៅពេលដែលពួកគេទៅកាប់រណ្តៅជ័រហើយការបរបាញ់ច្រើនធ្វើឡើងនៅពេលផ្សេង ។

- ការបាញ់សត្វតូចឬសត្វធំៗដោយអ្នកមិនមែនជំនាញក្នុងការបរបាញ់

ជ្រូកព្រៃខ្លះៗត្រូវចាប់បានដោយដាក់អន្ទាក់នៅជុំវិញចំការ។ ជ្រូកព្រៃជាប្រភពសាច់សត្វព្រៃ ដ៏សំខាន់សំរាប់បរិភោគ ប៉ុន្តែវាមានចំនួនតិចជាងបើប្រៀបធៀបការបរិភោគត្រីដោយប្រជាជន។ ប្រជាជនប្រើឆ្កែសំរាប់រកអណ្តើកនិងត្រកួត នៅពេលដែលគេធ្វើដំណើរទៅកន្លែងដើមជ័រ ដើម្បីបរិភោគនិងលក់។ ការឆក់ត្រីសំរាប់លក់ធ្វើឡើងនៅតាមភូមិដែលស្ថិតនៅក្បែរអូរ មានភូមិពីរដែលទទួលរង នូវសកម្មភាពឆក់ត្រី ដែលបានបណ្តាលអោយអ្នកភូមិមានកង្វះខាតត្រីយ៉ាងខ្លាំងសំរាប់បរិភោគ ។

សន្និដ្ឋាន

យោងតាមការសិក្សាបានបង្ហាញថា យើងអាចមានឱកាសដើម្បីសហការជាមួយ សហគមន៍ជនជាតិភ្នង លើបញ្ហានៃការអភិរក្ស ។ពីព្រោះនាពេលបច្ចុប្បន្ននេះប្រជាជនទាំងអស់នោះមានដង់ស៊ីតេទាបនៅឡើយហើយពួកគេភាគច្រើនមានជីវភាពពឹងផ្អែកទៅលើការចោះជ័រ ហើយអាចមានសកម្មភាពតិចតួចប៉ុណ្ណោះ ដែលនាំអោយប៉ះពាល់បរិស្ថាន។ ដោយប្រជាជនទាំងអស់មានជីវភាពដោយពឹងផ្អែកលើធនធានធម្មជាតិដូចនេះ គឺអាចទាញនូវចំណាប់អារម្មណ៍របស់ពួកគេដើម្បីជួយក្នុងការការពារព្រៃឈើពីការកាប់ឬបំផ្លិចបំផ្លាញ ពីក្រុមដ៏ទៃទៀតនាពេលបច្ចុប្បន្ននេះ។ ទោះបីជាផលប្រយោជន៍របស់សហគមន៍ជនជាតិភ្នងមានលក្ខណៈដូចគ្នាជាមួយនឹងផលប្រយោជន៍ខាងការអភិរក្ស ក៏ដោយក៏មានចំណុចសំខាន់ៗដែលខុសប្លែកគ្នាហើយដែលទាមទារអោយមានដំណោះស្រាយដោយ ការចរចារ ។ ដែលបញ្ហានេះរួមមាន :

បញ្ហានៃការបន្តធ្វើអន្តោប្រវេសន៍ជាពិសេសបណ្តាក្រុមគ្រួសារដែលចង់ធ្វើស្រែនៅកន្លែងតាំងទីលំនៅថ្មីក្នុងតំបន់ជំរកសត្វព្រៃសំខាន់ៗ

- បញ្ហានាពេលអនាគតដែលជាប់ទាក់ទងនិងការកើនឡើងនៃចំនួនប្រជាជនដែលអាចបណ្តាអោយកើនឡើងនូវគំនាបលើធនធានទាំងនេះ ។
- ការកើនឡើងនូវតំរូវការខាងផ្នែកសំភារៈ ដែលតំរូវការទាំងនេះមិនអាចបំពេញបានដោយការពង្រីកឬបន្ថែមផលិតកម្មជ័រទឹកអោយកាន់តែខ្លាំងក្លាថែមទៀតបានឡើយដោយសារដើមជ័រទាំងអស់ត្រូវបានគេចោះរួចទៅហើយ ។
- បង្កើតនូវចំណាប់អារម្មណ៍ទៅលើដំណាំកសិកម្មដែលអាចលក់បានប្រាក់ ។បើធ្វើដូចនេះអាចនាំអោយកើនឡើងនូវការកាប់ព្រៃចេញសំរាប់ដាំដំណាំហើយអាចទាក់ទាញ នូវអន្តោប្រវេសន៍ចូលមកតំបន់នេះដោយគ្រួសារជន ជាតិភ្នងផ្សេងៗទៀត ។
- ការចាប់អណ្តើកនឹងត្រកួត ដោយប្រើឆ្កែរ ដែលសកម្មភាពនេះអាចមានប៉ះពាល់ខ្លះៗដល់ការអភិរក្សនូវប្រភេទសត្វខ្លះដែរ ។ ការបរបាញ់សត្វធំៗដែលទទួលរងការគំរាមកំហែងដោយក្រុមគ្រួសារជនជាតិភាគតិច ។

ការចាប់ផ្តើមបន្តធ្វើអាជីវកម្មព្រៃឈើនាពេលអនាគតនៅក្នុងតំបន់នេះបណ្តាលអោយមានផលប៉ះពាល់យ៉ាងធ្ងន់ធ្ងរដល់សត្វព្រៃនិងសមាគមន៍ក្នុងស្រុក ។បើសិនជាយើងក្រឡេកមើលតែទៅលើការចោះជ័រនោះបានបង្ហាញយ៉ាងច្បាស់ថាប្រាក់ចំណូលរបស់គ្រួសារជាច្រើននៅក្នុងភូមិដែលបានសិក្សាមានការ ធ្លាក់ចុះយ៉ាងកំហុកក្រោយពេលដែលមានអាជីវកម្មព្រៃឈើរួចមកហើយពុំមានជំរើសណាផ្សេងដ៏ទៃទៀតដែលអាចជំនួសនូវចំណូលនេះទេ ។ សកម្មភាពក្នុងការបំផ្លិចបំផ្លាញដូចជាកសិកម្មពនេចរនិងការបរបាញ់នូវប្រភេទសត្វដែលទទួលរងការគំរាមកំហែងអាចប្រហែលកើនឡើងដោយសារការធ្វើអាជីវកម្មព្រៃឈើ ។

ការផ្តល់អនុសាសន៍

១- បន្តនិងពង្រីកនូវសកម្មភាពអភិរក្សនាពេលបច្ចុប្បន្ននេះដោយរួមគ្នារវាងនាយកដ្ឋានរុក្ខា-ប្រមាញ់ក្រសួង បរិស្ថាននិងអង្គការសមាគមអភិរក្សសត្វព្រៃ ។ សក្ខភាពទាំងនេះរួមមានការល្បាតការត្រួតពិនិត្យការទាក់ ទងក៏រឹតខ្ពស់ ។

២-ធ្វើផែនការដើម្បីការពារនូវផលប៉ះពាល់ដោយការធ្វើអាជីវកម្មឈើឡើងវិញៈប្រសិនបើការធ្វើអាជីវកម្មឈើចាប់ផ្តើមដំណើរការឡើងវិញ យើងគួរធ្វើការអភិវឌ្ឍន៍នូវយុទ្ធសាស្ត្រអោយបានច្បាស់លាស់ ដែលធ្វើ

អោយមានការទទួលស្គាល់និងការពារឬបន្ធូបន្ថយនូវផលប៉ះពាល់លើជីវភាពរស់ នៅរបស់ប្រជាជន និង សត្វព្រៃ។

៣- ដោះស្រាយនូវបណ្តាបញ្ហាក្នុងការគ្រប់គ្រងអោយចំទិសដៅនិងជាបន្ទាន់ដូចខាងក្រោម:

ក- បញ្ឈប់ការធ្វើអន្តោប្រវេសន៍និងការពង្រីកដីស្រែនៅតំបន់សំខាន់ៗ

- ធ្វើទំនាក់ទំនងជាមួយអាជ្ញាធរស្រុកដោយផ្តោតទៅលើការពន្យា ការការពារកុំអោយបង្កើតភូមិ ជាថ្មីនៅ ប៊ិយ ភួក។
- ស្វះស្វែងរកនូវវិធីសាស្ត្រល្អបំផុតសំរាប់បន្ថយការពារឬបង្វែរនូវការបង្កើតវាលស្រែថ្មីៗទៀត នៅត្រពាំង ខ្លុងនិងត្រពាំងរយារ។
- ធ្វើការស្រាវជ្រាវដើម្បីរកអោយឃើញនូវពេលវេលាពិតប្រាកដណាដែលភូមិអូរតាម៉ាអាចត្រូវ បានបង្កើត ឡើងវិញ ហើយនៅទីណាពិតប្រាកដ។
- សាកល្បងដើម្បីបញ្ចាក់អោយបានច្បាស់លាស់អំពីអនាគតរបស់ភូមិ អូរប៊ែរ ដែលអាជ្ញាធរ ស្រុក មានផែន ការដើម្បី រើភូមិនេះចេញ។
- ធ្វើការសិក្សាដោយរហ័ស លើចំនួនប្រជាជនអោយរនៅតាមបណ្តាភូមិដែលពុំទាន់បានសិក្សា នៅក្នុងតំបន់ស្នូល ដើម្បីកំណត់អោយបានអំពីកំណើនរបស់ប្រជាជន និងដើម្បីប្រមូលពត៌ មានអំពី តំរោង នឹងបង្កើតភូមិថ្មីៗ។

ខ-ធ្វើការស៊ើបអង្កេតនិងធ្វើសកម្មភាពទៅលើរបាយការណ៍ស្តីពីការបបាញ់ដោយអ្នកមកពីខាង ក្រៅនៅតំបន់ភូមិរកាថ្មី។

- សេចក្តីរាយការណ៍រួមបញ្ចូលនូវវត្តមានរបស់យោធាឬប៉ូលិសមកពីម៉ែងម៉ង់និងខេត្ត។ ការស៊ើបអង្កេតនេះអាចធ្វើឡើងដោយក្រុមល្បាតនៅក្នុងតំបន់។

គ-ធ្វើការស៊ើបអង្កេតនិងធ្វើសកម្មភាពលើរបាយការណ៍ស្តីពីការឆក់ត្រីនៅភូមិពូចារ និងភូមិរការថ្មី

- តាមរបាយការណ៍បង្ហាញថា សកម្មភាពល្មើសនេះធ្វើឡើងដោយអ្នកមកពីខាងក្រៅសំរាប់ ភូមិ ពូចារនិង អ្នកក្នុងភូមិសំរាប់ភូមិរកាថ្មី ដែលការស៊ើបអង្កេតនេះធ្វើឡើងដោយក្រុម ល្បាតក្នុង តំបន់។

៤- ចាប់ផ្តើមកម្មវិធីសកម្មភាពការងារនៅនិងសមាគមន៍ដែលមានរយៈពេលវែងនៅក្នុងបណ្តាភូមិរបស់ ជនជាតិភ្នង

គោលបំណងនេះគឺដើម្បីកសាងនូវទំនាក់ទំនងការងារដែលមានរយៈពេលយូរអង្វែងដែលនាំអោយ មានភាងាយស្រួលក្នុងការពិភាក្សានិង ដោះស្រាយនូវជំលោះរវាងសេចក្តីប្រាថ្នារបស់សហគមន៍និង

គោលបំណងនៃការអភិរក្ស។ ការធ្វើដូចនេះគួរតែផ្អែកលើជំនឿនិងការគោរពមាន លក្ខណៈប្រពៃណីដែល មានស្រាប់សំរាប់ព្រៃណាដែលអាចធ្វើបាន ។ លទ្ធផលការងារណាដែលជាប្រយោជន៏សំរាប់អ្នកភូមិនិងស្តែងឡើងផ្ទាល់ៗ ប្រហែលជាការជំរុញទឹកចិត្តដ៏សំខាន់បំផុតសំរាប់សហគមន៏ក្នុងការសំរបសំរួលដើម្បីអភិរក្ស ។

ក្រុមអ្នកសិក្សានៅមូលដ្ឋានត្រូវបង្កើតឡើងនូវការសិក្សាស្រាវជ្រាវឯកសារផ្សេងៗ និងធ្វើទស្សនៈ កិច្ចសិក្សាទៅកាន់តំបន់ផ្សេងៗទៀតរបស់អង្គការដែលមានគោលបំណងដូចៗគ្នា ។
យើងគួរតែបង្កើតឡើងនូវសកម្មភាពផ្សេងៗនៅតាមភូមិដែលគួរផ្តោតទៅលើការកសាងនូវទំនុកចិត្តនិងការផ្លាស់ប្តូរយោបល់គ្នា ។បណ្តាបញ្ហាជាអទ្ធិភាពដែលលើកដោយសហគមន៏គួរតែធ្វើកំនត់សំគាល់និងផ្តល់ជាជំនួយការក្នុងការដោះស្រាយនូវបណ្តាបញ្ហាតូចតាច ក៏ប៉ុន្តែជាបញ្ហាគួរអោយកត់សំគាល់ ។ ធ្វើដូចនេះអាចជាការចាប់ផ្តើមបង្ហាញនូវទំនុកចិត្តសំរាប់ការដោះស្រាយបណ្តាបញ្ហាធំៗនិងឯកភាពលើវិធានការក្នុងការអភិរក្ស ដែលបង្កើតឡើងនៅតាមភូមិ ។

ជាប្រការសំខាន់ក្នុងការធ្វើទំនាក់ទំនងយ៉ាងជិតស្និតជាមួយអង្គការ ស្ត្រីសន្តិភាពដើម្បីបរិស្ថាន ។ ដែលបានចូលរួមយ៉ាងសកម្មក្នុងការអភិវឌ្ឍន៏ព្រៃឈើនិងសមាគមន៏នៅតំបន់ដូចគ្នា ។
៥- បណ្តាប្រធានបទដូចខាងក្រោម គួរតែធ្វើការស្រាវជ្រាវ:

- តើមានវិធីណាដែលអាចបង្កើតនូវគុណភាពរបស់ជ័រទឹកនិងតំលៃរបស់វា?
- តើធ្វើដូចម្តេចដើម្បីអោយផលិតផលជ័រទឹកមានរយៈពេលយូរអង្វែង ។
- តើអ្នកភូមិត្រូវធ្វើដូចម្តេចដើម្បីកែច្នៃជ័រទឹកក្នុងភូមិដើម្បីបង្កើនតំលៃរបស់វា?
- តើមានច្រកពាណិជ្ជកម្មនិងការដាក់ក៏រិតផ្តែកទីផ្សារអ្វីខ្លះ?
- តើសាច់សត្វព្រៃនិងត្រីមានសារៈសំខាន់យ៉ាងដូម្តេចនៅក្នុងជីវភាពរស់នៅរបស់ជនជាតិ ភ្នង?
- តើសត្វព្រៃដើរតួនាទីដូចម្តេចចំពោះវប្បធម៏ និងថ្នាំសង្កូវរបស់ជនជាតិភ្នង?
- តើនៅក្នុងតំបន់មានដំណាំកសិកម្មជាសក្តានុពលអ្វីខ្លះ?

Conventions

Village names

It is difficult to define exactly what is meant by a 'village' in the study area. Settlements are widely scattered and range from large groups of 30 or more houses down to tiny seasonal hamlets with 1-3 huts. A single 'village chief' tends to be responsible for one larger settlement and several smaller sub-villages and hamlets, some of which may be 2-3 hours walk away. Confusingly, the same name may be used both for the main settlement and for the whole network of settlements administered by a single village chief. In this report we use the term village in the administrative sense, which means that we surveyed four villages, covering a total of 14 named settlements. Table 1 shows the system of names we use for these settlements.

Table 1 System of names used for the settlements in the study area

Village	Ph. Pu Char	Ph. Kati	Ph. Roka Thmei	Ph. Andong Krolung
Main settlement	Ph. Pu Char (1)	Ph. Kati (1)	Ph. Roka Thmei (1)	Ph. Andong Krolung (1)
Other settlements	Ph. Pu Char Thmei	Ph. Kati Thmei Ph. O Tron	Ph. Dam Sway Ph. O Reang	Ph. Pu Chu (1) Ph. Pu Chu (2) Ph. Pu Clair Ph. Pu Poanh Ph. O Pour

Ph. = Phum (village)

Usually in this report we discuss all the settlements in one village together as a single unit, so we mainly use the names in the first line of the table. If the main settlement needs to be distinguished from the other, smaller settlements we add a (1) to the name.

No standard system of transliteration exists for Khmer places names, so we often had to make our own decisions about spellings. American 1:50,000 topographic maps are followed here where possible, but they show few modern place names and are sometimes inconsistent.

Use of the word Phnong

The term Phnong is used here to refer to the fairly small indigenous ethnic group who predominate in the study area and who speak Bu Nong, a language in the Mon-Khmer language family. In their own language they refer to themselves as the Bu Nong but Phnong is the form of this name that is in most common use amongst Khmer-speaking and English-speaking people and is thus felt the most appropriate for this report. The issue is discussed further in Section 2.2.4.

The term Phnong (or Pnong) has often also been used as a general term for all indigenous ethnic minorities in Cambodia, but this is a careless misuse of the term by people who are not able to differentiate the different minorities involved (e.g. Lebar *et al.* 1964, M. Guerin and P. Swift pers. comm. 2002). As a result of its use as a general term for all supposedly 'backward' minority groups, the term Phnong is sometimes used by prejudiced Khmer speakers in a way that has negative connotations of stupidity or ignorance. However, the name is used in a positive way by Phnong communities themselves, who take pride in their ethnic identity. For this reason the term is used throughout this report.

Definition of a family

'Family' is used in this report as a synonym for 'household' – that is a group of people, mostly or all close relatives, who live in the same house and are economically interdependent, sharing income, agricultural tasks and meals. The families given in the lists that were provided to us by each village chief usually fitted this definition well, so we were able to use those lists with little modification. However, a few 'families' in those lists were made up of a single elderly person who in fact no longer lived alone but had joined the household of a son or daughter. For the purposes of our analysis we merged these one-person families with the larger household that now supports them.

Multiple families living under the same roof but using separate groups of resin trees were treated as separate families since the shared part of their incomes (e.g. from communal rice cultivation) is probably less than the independent part. However, in some situations like this the degree of sharing may be higher than assumed here, reducing the vulnerability of some of the poorer households, and this

would have an influence on issues such as the degree of rice deficit or cash income deficit for individual families.

Definition of a group of trees
Individual trees are mostly aggregated into groups for analysis. A group is defined primarily in terms of the traditional ownership of the trees. All the trees in one geographical area (as defined by the tapper, mainly depending on access considerations) and belonging to one family are considered a single 'group'. The shape, size, dispersion and degree of overlap with neighbouring groups varies widely.

Definition of chamkar
The term chamkar is here used to refer to all upland cultivation practised by rural communities in the study area. It is used in contrast to paddy rice cultivation. Chamkar in this area is almost entirely done as shifting cultivation, usually of hill rice inter-cropped with vegetables. Apparently in some parts of the country a distinction is made between permanent upland gardens (chamkar) and shifting upland cultivation (chamkar boh neh joh) but this is not the case in our study area. Permanent upland gardens (e.g. of cashews) are a very recent development here.

Abbreviations and Acronyms

dbh	diameter at breast height - standard measure of tree diameter
DFW	Department of Forestry and Wildlife
HP	Hout Piseth
HM	Hang Mary
MAFF	Ministry of Agriculture, Forestry and Fisheries
MoE	Ministry of Environment
Ph.	Phum (= village)
PP	Phet Phaktra
TDE	Tom Evans
WCS	Wildlife Conservation Society

Acknowledgements

This work was undertaken as part of the WCS Cambodia Program's support to the Department of Wildlife and Forestry (DFW) of the Ministry of Agriculture, Forestry and Fisheries (MAFF). Specifically, the work is part of the DFW's integrated forest management program in southern Mondulkiri Province that has been active since early 2000. As such, we would like to thank His Excellency Chan Sarun, Minister of MAFF, for his personal commitment to this program.

We especially thank Ty Sokhun, Director of DFW, Chea Sam Ang, Deputy Director of DFW and Men Phy Mean, Director of the Wildlife Protection Office for their support. Further assistance was provided by Ly Chubieng, Vice Director of the Afforestation Office; Lao Setha Phal, Chief of the Community Component of the DFW, and Men Soriyun, DFW Project Manager in Keo Seimaa.

We also thank Chay Samith, Director of the Department of Nature Conservation and Protection; Lay Khim and Meng Monyrak, Director and Vice Director of the Protected Area Office of the Ministry of Environment (MoE). For their cooperation and logistical assistance in the field we thank Samling (SL International Ltd) and their staff, notably Henry Kong, Manager.

At the site-level, we are grateful to the village heads and individual people in Ph. Roka Thmei, Ph. Andong Krolung, Ph. Gati and Ph. Pu Char who contributed their time to interviews with our team, and who provided much hospitality. We also thank the many WCS field staff working at the southern Mondulkiri field site for their help and support.

The following people (in alphabetic order) have provided information, advice or practical help and we are grateful to all of them: David Ashwell, Ian Baird, Toby Carson, Tom Clements, Karen Coates, Andrew Cock, Pete Davidson, Etienne Delattre, Joost Foppes, Eva Galabru, Mathieu Guerin, Marcus Hardtke, Hean Sokhom, Khou Eanghourt, Andy Maxwell, Bruce McKenney, David Mead, Richard Paley, Colin Poole, Prom Tola, Jerry Redfern, Men Soriyun, Peter Swift, Sorn Pheakdey, Uck Kim Nary, Joe Walston and Laura Watson.

1 Introduction

1.1 Background

This report describes a survey of livelihoods and forest use amongst an indigenous ethnic group (the Phnong) conducted during February-August 2002 in southern Mondulkiri Province, Cambodia. During 2000 this area was identified as a site of high conservation significance by a joint survey team from the Wildlife Conservation Society Cambodia Program (WCS), the Ministry of Agriculture, Forestry and Fisheries (MAFF) and the Ministry of the Environment (MoE) (Walston *et al.* 2001). The area has since become the target for active conservation efforts and the current study was designed to support that process.

The area is inhabited by many small Phnong communities, is experiencing high immigration by ethnic Khmer people near its borders and is also included in a large commercial logging concession held by Samling International. In 2002 the area was also declared a special Biodiversity Conservation Area by Ministerial Decree. To find compromises between these differing land uses will require innovative solutions and these need to be built on a clear understanding of the situation on the ground. The current study provides some of the necessary information, and gives pointers for the next steps to take.

This final report supersedes the two interim reports already published (Evans 2002, Evans *et al.* 2002) since most of the analyses they contained have now been expanded and updated.

1.2 Objectives

The overall goal was to develop an understanding of the livelihoods of Phnong communities in the study area. This understanding is necessary as a basis for future collaborative work with the communities, aimed at improving wildlife conservation in the area. The positive and negative connections between various livelihood activities and wildlife conservation were identified wherever possible.

The three main objectives were:

1. To obtain clear information on past, present and future demographic trends in the area.
2. To identify the main livelihoods practiced by Phnong communities and their relative significance.
3. To obtain a detailed understanding, quantified where possible, of the most important livelihood activities identified in objective 2.

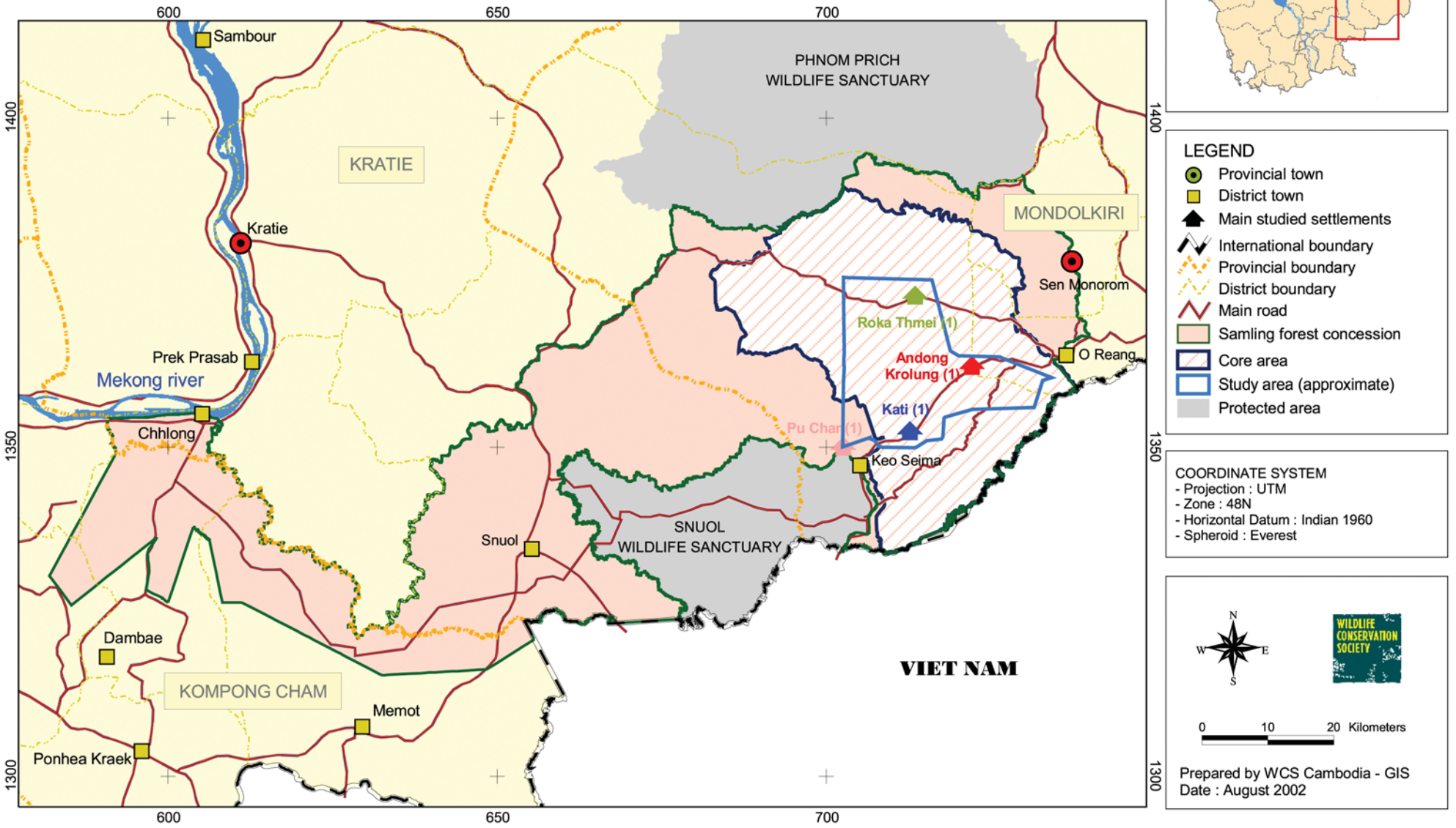
Early in the study it became clear that the most important activity for detailed study was the practice of resin-tapping, and most research effort was therefore spent on this subject. Hunting of wild animals is a relatively minor part of most peoples' livelihoods but has disproportionate conservation impacts, so this activity was also studied in some detail.

2 The study area and its surroundings

The study area is shown on **Error! Reference source not found.**. It forms the central part of the recently declared Southern Mondulkiri Biodiversity Conservation Area (hereafter referred to as the 'core area'). This core area in turn lies within a very large timber concession held by a Malaysian company, Samling International.

Figure 1 Location of study area.

Fig. 1 Location of study area

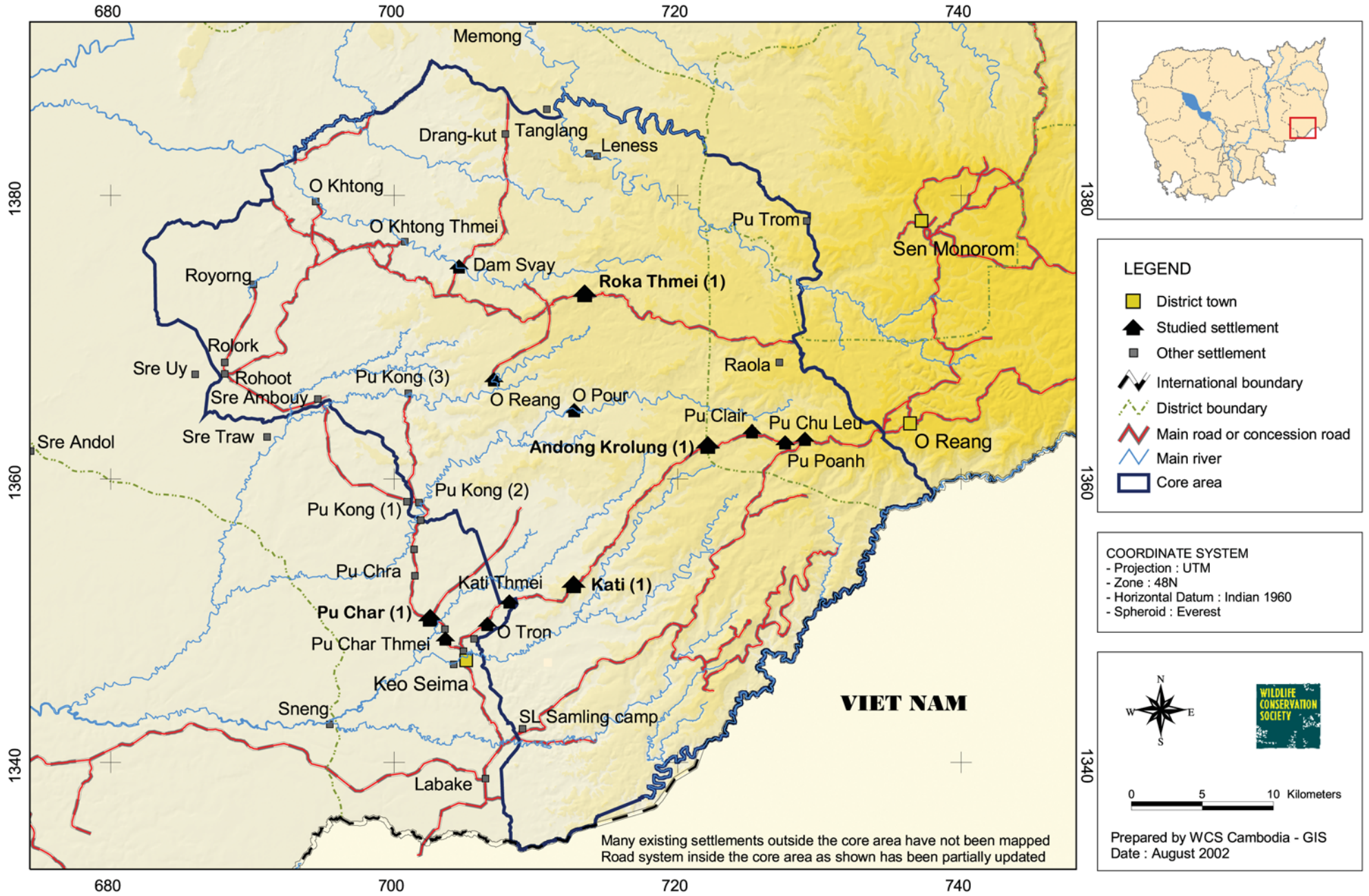


2.1 Physical geography

The area is described in detail by Walston *et al.* (2001), so only a brief outline is given here. The core area lies at 100-700 m (mostly 200-500 m) on the western slopes of the Sen Monorom Plateau, one of the southernmost ranges of the Annamite Mountain chain. In the north-west it includes areas of lowland plain dotted with seasonal pools but most of the area is made up of gently to moderately hilly terrain rising towards the southeast (**Error! Reference source not found.**). Most of the watercourses are seasonal but there are a few permanent streams, mainly flowing from southeast to northwest. These streams mostly drain into the Mekong via the Prek Chhlong or the Prek Te.

Figure 2 Village names and relief

Fig. 2 Village names and relief



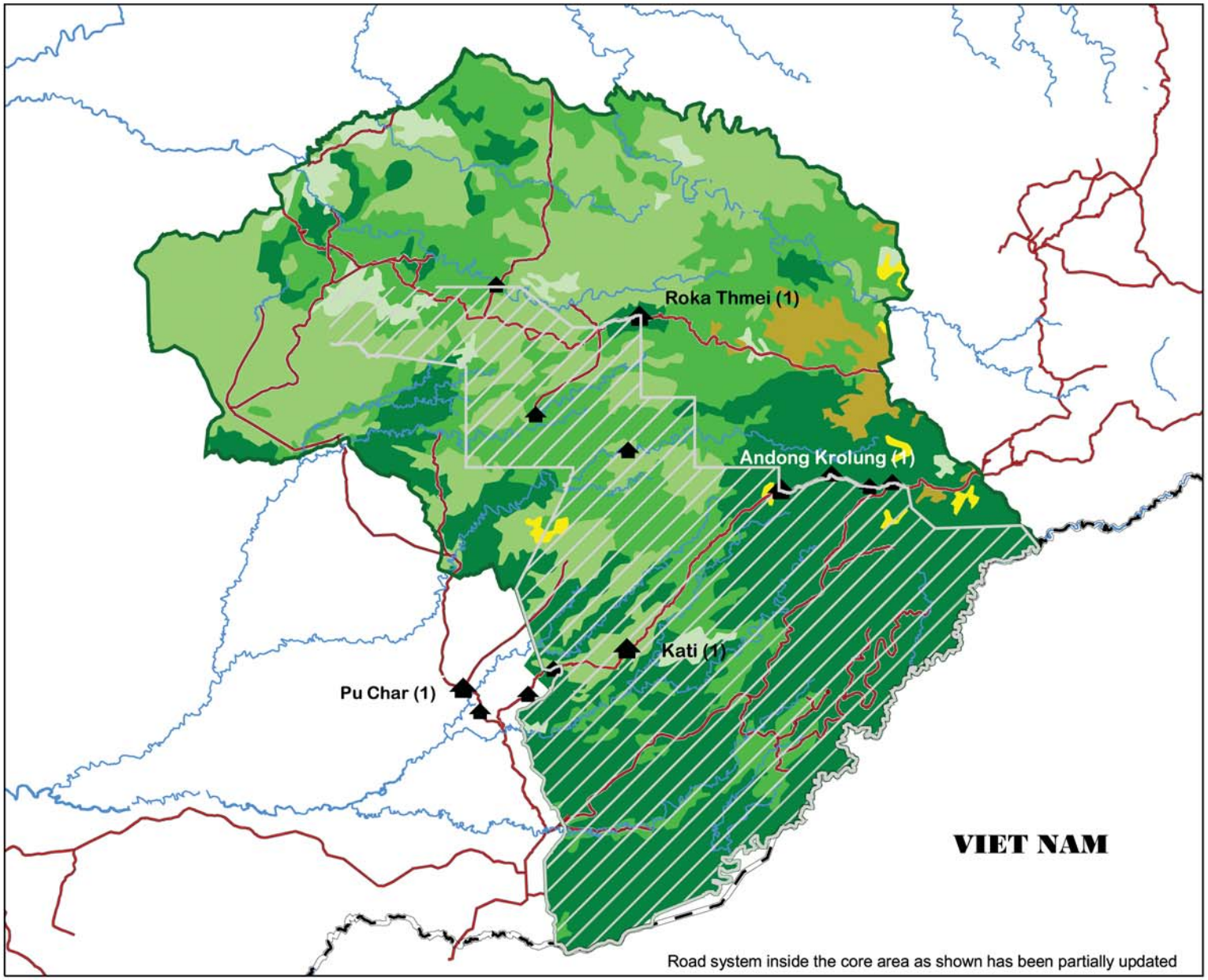
The climate is strongly seasonal with a single long dry season from approximately November to April and a rainy season from May to October. Annual rainfall in the area is approximately 2000-2500 mm, according to maps in Javier (1997). The rainy season is believed to be longer and more intense in areas closer to the Vietnamese border, with areas further northwest becoming progressively drier.

Most of the area consists of little-disturbed forest, but some limited areas have been heavily modified by people, especially on the margins and near existing settlements. Modified habitats include gardens, rice paddies, shifting cultivation fields, secondary regrowth after shifting cultivation and extensive stands of bamboo. On the eastern edge of the core area many hilltops are covered in short, uniform fields of grass that are burnt annually. This habitat has long covered large parts of the main Sen Monorom plateau (Wharton 1966) and is presumably a result of prolonged, heavy human use.

The ecological classification of natural habitats in Indochina is still in a state of flux and the forest types recognised by the most recent review (Rundel in prep.) still lack wholly satisfactory objective definitions. A recent pilot study (Zimmermann and Clements in prep.) has taken a step towards developing a biologically relevant habitat typology for the core area but this is not yet ready for widespread application. Several habitat maps do exist for the area (e.g. national landuse cover maps, concession inventories and 1:50,000 national topographic maps) but none corresponds exactly with the categories that a biologist would choose, so they need to be interpreted with great caution. For illustration Figure 3 shows the habitats as mapped by the national land use survey but there is little information available on how the named habitat types were defined (J. Walston pers. comm.).

Figure 3 Habitat types and key wildlife areas

Fig. 3 Habitat types and key wildlife areas



LEGEND

- Studied settlement
- Main road or concession road
- Core area
- Area of highest importance for wildlife

Landcover classes (1996/97)

- Evergreen forest
- Mixed forest
- Deciduous forest
- Wood - & shrubland
- Grassland
- Cropping mosaïc

COORDINATE SYSTEM
- Projection : UTM
- Zone : 48N
- Horizontal Datum : Indian 1960
- Spheroid : Everest

N
W E
S

WILDLIFE CONSERVATION SOCIETY

0 10 Kilometers

Prepared by WCS Cambodia - GIS
Date : August 2002

Using the broad habitat types recognised by Rundel (in prep.) and Walston *et al.* (2001), natural forest types in the core area range from open, low stature Deciduous Dipterocarp Forest to tall, dense Evergreen Forest. There are also extensive areas of Mixed Deciduous and Semi-evergreen forest, and these four main types occur in a complex mosaic of intergrading patches that appears to be determined by altitude, rainfall, aspect, soil type and levels of human disturbance. The proportion of Semi-evergreen and Evergreen forest in the mosaic increases from northwest to southeast so that the northwestern border is heavily dominated by Deciduous Dipterocarp Forest whilst the belt along the Vietnamese border is almost entirely Evergreen forest. In the middle part, where the study area lies, Semi-evergreen and Deciduous Dipterocarp forest are both common, with smaller but significant areas of Mixed Deciduous Forest.

There are a moderate number of static wetlands (in Khmer, 'trapeangs') in the study area, with more in flatter parts of the core area further north. These are predominantly shallow grassy marshes, sometimes with a pool of permanent water, sometimes without, but in either case flooding more deeply and extensively in the rainy season. Their vegetation has not been studied.

2.2 Human geography

2.2.1 Historical

The upland ethnic minorities in general are thought to have occupied northeast Cambodia for at least 2000 years (White 1996) but information on specific groups is lacking. The sparse data from pre-colonial times suggest that these groups lived at low densities and practised a traditional lifestyle of shifting cultivation and harvesting forest products, many elements of which would be familiar to people today. They have long been politically and socially disadvantaged (ADB 2000). The area was variously claimed by several neighbouring kingdoms and experienced some slaving raids before the time of French colonisation (White 1996), although the significance of these has perhaps been exagerrated (M. Guerin pers. comm. 2002).

During the French colonial era Mondulkiri received little active development, with few if any large plantations, and it remained sparsely populated (Meyer 1979). However, the French did build a road linking Sen Monorom with Kompong Cham, which must have improved trading opportunities. One of the military posts on this road, Poste Gatille, later became the civilian settlement of Ph. Kati, one of our study villages. There was initially some armed resistance to French control of the region and the Phnong in particular were noted as having a warrior-like reputation (White 1996). The study area lies in a zone that the French had no control over during the period 1914-1933 following the killing of some French civil servants and Khmer militia and settlers by Phnong people (M. Guerin pers. comm. 2002)

The French and later the independent Sangkum Reastr Niyum regime operated a gradual policy of education and increasing administrative control over the Phnong and other groups, with the long term goal of incorporating them into mainstream society ('Khmerisation'; Meyer date 1979, White 1996, Melville 2000). This included sending over 250 families of Khmer settlers to Mondulkiri (White 1996). This process was not entirely welcomed by the ethnic minorities (Meyer 1979, White 1996) but was apparently carried out in a relatively benign way and cases of brutality or repression were exceptions, at least at first (Melville 2000). Meyer (1979) considered that the process was conducted in an increasingly harsh, exploitative and arrogant way, leading up to a series of incidents at a rubber plantation in Ratanakiri in 1968 which caused an uprising. However, there was much less friction in Mondulkiri during this period, perhaps because there were fewer settlers and no large plantations.

Mondulkiri was only established as separate province in 1962 (according to the Royal Ordinance examined by M. Guerin, pers. comm. 2002) and was formerly the district of Chhlong Leu in Kratie Province. According to Melville (2000) the provincial administration in the early 1960s was based at O Reang (presumably the current district town of O Reang, just east of the study area). However, Meyer (1979) states that Sen Monorom was the capital. At some point in or shortly after the French period an airstrip was established at Buy Phlok (10 km west of modern-day Ph. Roka Thmei). People in Ph. Roka Thmei reported to us that Buy Phlok was the site of the provincial capital during the 1960s but this seems unlikely as the main road did not pass nearby.

Past population trends in the area are not clear but it seems numbers have always been small with several shifts in the main centres of population. French military censuses during 1937-1942 found about 1 person/km^2 in the Poste Gatille area and seem to have been fairly thorough (M. Guerin pers. comm. 2002). Population growth rates at that time were probably low or zero, due to severe infant

mortality, so the overall numbers during the 1960s were presumably not much higher. Nonetheless, local population density close to Buy Phlok during the 1960s was markedly higher then than it is now; some current villages were larger and the sites of several other large villages are no longer occupied. The local population density along the main road through Ph. Kati was also higher than today – for example Melville (2000) reports that by 1962 18 villages had been brought from the forest interior to live along the road between Lapalki (=Labake) and Ph. O Reang.

The province fell under Khmer Rouge control in 1969-70 and all inhabitants of the core area were translocated to Koh Nyek District to attempt collectivised paddy farming. For long there were no permanent settlements in the core area, although there was presumably some activity by Khmer Rouge and Vietnamese loggers and hunters. Former residents were only able to return to the core area from the late 1980s onwards, by which time mortality had seriously reduced their numbers. A detailed discussion of the pattern of return is given in Section 0.

Samling International began their operation in-country in about 1995. Work on upgrading the Snuol-Sen Monorom trunk road took place during 1997-1998. This had a significant effect on the core area since it allowed much easier access to the region. A major realignment of the road was also carried out in the core area, opening up a large stretch of previously inaccessible forest to vehicle-based hunting and harvesting. This was followed by extensive logging operations, mainly in the area between the new road and the Vietnamese border but also in several other places.

2.2.2 Current

Administratively the study area falls in Sre Preah Commune (Keo Seimaa District: Ph. Kati and Ph. Pu Char), and Sen Monorom Commune (O Reang District: Ph. Roka Thmei and Ph. Andong Krolung). Several other communes of Keo Seimaa district are also represented in the core area. Known settlements in and around the study area are shown on **Error! Reference source not found.**. Some smaller settlements may still be unrecorded, but most have probably been found. The system of names and their orthography is discussed in the 'Conventions' section.

Inhabitants of the study area are almost all ethnic Phnong (see 'Conventions' and Section 0 for a discussion of this term). As far as is known, all other villages in the northern part of the core area and in areas along its eastern boundary are also dominated by Phnong. To the north, the Memong area is a gold-mining boom town so both Phnong people and many recent non-Phnong immigrants are present, apparently living in separate parts of the town (M. Guerin pers. comm. 2002). Along the western side of the core area the situation is more complex. There are many many Phnong households but there are also some villages of the Stieng indigenous ethnic minority and one (Ph. Sre Ambouy) made of people resettled from a former Khmer Rouge stronghold in northern Cambodia. Recent Khmer immigrants make up a large and growing part of the population just west of the core area; they are concentrated near the market towns of Keo Seimaa and Labake, and also along the main road through Snuol Wildlife Sanctuary from Snuol to Labake.

2.2.3 Notes on the culture and status of the Phnong ethnic group

The Phnong are one of more than 20 small ethnic groups occupying the four north-eastern provinces of Cambodia and collectively referred to as hill-tribes, indigenous minorities or, in Khmer, '*chunchit*' or '*Khmer leu*' (upland Khmer). They are often the same as, or related to, ethnic groups occurring in the southern highlands of Vietnam, where they are called montagnards, or southern Laos, where they are called Lao Theung. In Cambodia these groups total over 100,000 people according to official figures but they were seriously under-recorded by recent national censuses (Hean Sokhom pers. comm. 2002) and there may be many more. The official figure represents about 1% of the national population but a much higher proportion of the sparsely populated north-eastern provinces – in Mondulkiri about 70% of the population belongs to these ethnic minorities (ADB 2000).

Despite their cultural diversity these groups share many socio-economic features (White 1996, ADB 200). In particular they are isolated from mainstream society by culture, language, geographical distance and prejudice so they tend to have low access to employment opportunities and public services such as health care and education. Health and education indicators are consistently low in these communities, when reliable data are available. They also have limited access to agricultural land suitable for growing paddy rice, being in hilly areas far from the plains, so they tend to prefer hill-rice cultivation. The relative productivity of upland and lowland rice-growing systems in Cambodia is a matter of some debate (Nesbitt 1997) and depends greatly on details of local soil and climate but it seems clear that it is difficult for a typical family in North-east Cambodia to achieve rice self-sufficiency by growing hill-rice. The effect this has on family welfare is usually offset by the free

access most have to extensive forests where they can collect wild foods or products for sale. For this reason, although their communities are poor, more extreme poverty can be found in those non-minority villages in densely-populated lowland areas where a large proportion of people are landless, and where no forest 'safety net' remains (Hean Sokhom pers. comm. 2002).

Cambodian Phnong live mainly in Mondulkiri with small numbers in Kratie and Ratanakiri Provinces. They apparently number in the thousands, but accurate figures are lacking. French estimates from 1942 suggested about 10,000 Phnong in Cambodia (M. Guerin pers. comm. 2002). ADB (2000), citing recent unpublished data from the Ministry of Information, list an official figure of 5,323 Phnong in Cambodia but this is felt to be a serious underestimate (Hean Sokhom pers. comm. 2002). In addition, several thousand Phnong live as coffee farmers just over the border in Vietnam, having fled there in the 1970s (Hang Mary pers. obs.).

Much of the description of the Mnong ethnic group by Lebar *et al.* (1964) is likely to apply to the Phnong The following notes are based on our own observations, especially those of Hang Mary who is ethnically Phnong and lives in the nearby commune of Bu Sra. Most Phnong live in small rural villages. Their traditional administration was based on tribal chiefs and respected elders within each village. This system has largely been superseded by the governmental system of village chiefs. Phnong communities apparently have little history of organisation between villages (for example military alliances, or acceptance of a supreme chief), but members of nearby villages are often related by birth and marriage and generally live on peaceful terms. Members of a village who break customary laws may be liable to fines or other sanctions, as decided by the village elders.

The Phnong are noted as skilful forest people and they have long hunted and collected forest foods and commodities to supplement their agriculture. Most Phnong families farm hill rice as their main form of agriculture, but in areas where paddy rice cultivation is feasible it is often adopted. The upland fields are typically managed through shifting cultivation and rice may be intercropped with a wide variety of other vegetables. The Phnong have a complex set of rituals for the various stages of shifting cultivation, from plot selection through to grain storage. These rituals form part of their animist religious beliefs. White (1996) also notes the existence of small sacred forest areas that are treated with great respect.

Generally a man is the head of the household but both male and female children typically inherit part of the family's wealth. As well as practical items, wealth is stored in various forms, in particular livestock, ceremonial gongs and large traditional wine jars. The traditional style of house (illustrated by Melville 2000, page 44) is built without legs and has a large thatched roof almost reaching the ground. This style has mostly been abandoned in the study area but a few remain in Ph. Roka Thmei (1).

2.2.4 The many names of the Phnong

The naming of the ethnic group that dominates in southern Mondulkiri is variable in the literature. For example, White (1996) and ADB (2000) call them the Phnong or Pnong whereas Melville (2000), describing the 1960 situation, maps the Biet Phnorr from this area and the Biet for northern Mondulkiri. He also mentions the Prea and Mnong from this province. The historian M. Guerin (pers. comm. 2002) states "Pnong does not mean anything. It is a Khmer word made from Bu Nong. The Khmer use it to call specifically the Bu Nong (Mnong group), the Rehong (Mnong group), the Biat (Mnong group) but also all the highlanders. The people who you will work with might be Bu Nong, Bu Rehong, Bu Biat or Stieng." To add to our confusion, a comprehensive survey of ethnic groups in South-east Asia in the 1960s (Lebar *et al.* 1964) lists no ethnic group for our area of interest other than the Stieng (who now occupy eastern Kratie Province) but does describe the Mnong from adjoining Vietnam. This group has been described by several different authors (cited in Lebar *et al.* 1964) each of whom names a different set of sub-groups, including the Bunor, Nong, Preh, Prong and Bu Dong. No subgroup is reported to be called Pnong but one of the languages spoken within the Mnong group is called Pnong (others include Biet, Preh, Nong and Rohor). It is beyond the scope of the present study to resolve this confusing nomenclatural situation.

2.3 Wildlife conservation values, threats and conservation activities

The wildlife conservation value of a site is often assessed according to the presence and abundance of species that are globally threatened with extinction (as listed by Birdlife International 2001 for birds and IUCN 2000 for other vertebrates). Initial surveys during 2000 (Walston *et al.* 2001) found internationally significant numbers of many such species, including Tiger *Panthera tigris*, Asian Elephant *Elephas maximus*, Banteng *Bos javanicus*, Gaur *Bos gaurus*, Yellow-cheeked Gibbon *Hylobates gabriellae*, Douc Langur *Pygathrix nemaeus*, Green Peafowl *Pavo muticus*, Germain's Peacock Pheasant *Polyplectron germainii*, Red-headed Vulture *Sarcogyps calvus* and Lesser Adjutant *Leptoptilos javanicus*. Subsequent surveys have revealed many other threatened species, including Marbled Cat *Pardofelis marmorata*, Asiatic Black Bear *Ursus thibetanus*, Giant Ibis *Pseudibis gigantea*, White-backed Vulture *Gyps bengalensis* and Orange-necked Partridge *Arborophila davidi* (J. Walston . Tan Setha and T. Clements pers. comm. 2002). The core area represents the most important (or only) site in Cambodia for some of these species. Some very vulnerable large mammals have apparently become extinct in the area through hunting (Javan Rhinoceros *Rhinoceros sondaicus*, Eld's Deer *Cervus eldii*, Hog Deer *Axis porcinus* and Kouprey *Bos sauvelii*) but otherwise the area supports an almost intact fauna, something that is now true for few sites in the region.

Some of the threatened species prefer mainly evergreen habitats and others prefer deciduous areas but it is often impossible to make this distinction, because many (e.g. ungulates, large carnivores, Green Peafowl) use different parts of the habitat mosaic on a daily or seasonal basis. The significance of the area stems from a combination of the high habitat quality, the large extent of habitat and the presumed low levels of hunting over recent decades relative to most other parts of Indochina. The habitat is continuous with even larger tracts of deciduous forest in Phnom Prich Wildlife Sanctuary to the north and smaller areas of evergreen forest types in Snuol Wildlife Sanctuary (Cambodia) and Bu Gia Map Nature Reserve (Vietnam) (Walston *et al.* 2001).

One aim of the wildlife surveys during 2002 was to identify the most important parts of the core area. An extensive system of transects was set up to record animal signs and sightings, allowing objective comparisons to be made. Clements (in prep.) discusses the results; our Figure 3 shows the areas that he identified as being of highest conservation significance. Note that most of the study area is in this class, as are areas between the study area and Vietnam. Sectors north, east and west of the study area are of lower relative significance, although still important.

Threats to wildlife were discussed in detail by Walston *et al.* (2001) and also considered by Clements (in prep.). They identified intensive logging as a major potential threat but suggested that well-managed concession-based logging on a sustainable basis might be a better alternative to the unregulated illegal logging that could replace it. This was especially true as some of the most important species in the concession were expected to be quite tolerant of the habitat changes caused by logging. Overall, they considered that the biggest threat was from hunting and the wildlife trade. The area of shifting cultivation was so small that this was not believed to be a serious conservation issue. Resin-tapping was also mentioned as an area of potential concern that needed further study, both because it was possible the trees were being harmed and because resin-tappers might hunt a lot whilst doing their rounds.

The absence of villages and so of hunting during the 1970s and 1980s is likely to have contributed to the high surviving wildlife populations but hunting during the 1990s was high and many species have entered rapid declines. In particular Tiger, Gaur and Banteng used to be seen in much larger numbers than is now the case, according to local reports. Through the 1990s guns were widely available and hunting by returning local communities was probably high. Once Samling began field operations the improved road access and large numbers of people living in the forest fostered even higher levels of hunting – for example one of us (HP) worked in a logging camp in the area for several months in 1997 and knows of at least ten Gaur, one Tiger, one bear and many Sambar and wild pigs killed by members of the camp during that time. Although logging is also expected to have caused some habitat damage for many species, it is generally the case in the tropics that the associated high hunting levels cause far more damage to threatened species (Putz *et al.* 2000).

In about 1998 the national gun confiscation campaign greatly reduced the availability of guns in the study area. Although aimed at improving civil security it is likely to have reduced hunting levels too, especially for species that cannot be caught by other means such as snaring. However, since many concession staff and all village police officers retained their weapons, hunting with guns continued.

The Samling concession suspended logging in 1999 as a result of nationwide increases in timber royalty rates. Although they were granted a felling permit for 2001 they chose not to log in that

year due to a temporary ban on felling tapped resin trees, their main target species (E. Galabru pers. com. 2002). In January 2002 a nationwide suspension on logging was declared pending development of better forest management plans and environmental/social impact assessments. This suspension remains in force at the time of writing, but decisions are expected by the start of 2003 for most concessions. Therefore, Samling have not been actively logging in the study area since early 1999.

Samling initially kept a strong field presence and hunting by their staff remained a serious concern. In June 2001 a collaborative agreement between WCS, DFW and Samling was set up that aimed to prevent concession staff from hunting, transporting or purchasing wild animals (WCS 2001). However, the Samling field presence continued declining so that only a tiny skeleton staff remained by mid 2002.

This combination of events has slowed damage to the habitat and greatly reduced one of the main sources of hunting pressure, but significant hunting by other groups continues, as does piecemeal logging. In response to this and other problems, joint law-enforcement patrols were begun in early 2002. These involve staff from the central and provincial offices of the Department of Forestry and Wildlife (DFW), provincial police and provincial army staff, with funding from WCS under the authority of DFW. These patrols continue at the time of writing and form the main means of combating hunting and illegal logging at present. Community-based activities aimed at forming co-operative agreements with Phnong communities are expected to start in the next few months.

3 Methods

3.1 Desk studies

These included a literature review, a review of relevant laws and discussions with various specialists. For the literature review a search was made of online databases available at Oxford University (Web of Science, TreeCD, Kew Record) whilst in Cambodia, Peter Swift and Andrew Cock shared their large collection of literature. The following legal documents were examined: existing Land Law and Forest Law, draft Forest Law, draft sub-decree on Community Forestry, several legal orders of lesser standing and three recent reviews of all of these documents (White and Case 1998, Sigaty *et al.* 2001, Global Witness 2002).

3.2 Fieldwork

We wished to gather clear, reliable information over a large number of families and several villages. To do this we used many of the techniques of Rapid Rural Appraisal (see e.g. Chambers 1994). Among these the most important were semi-structured key informant interviews, structured family questionnaires, and forest visits.

Questionnaires are the simplest and most popular way to produce data in this type of study but they can easily give inaccurate and misleading data unless they are designed and used critically (Gill 1993). To avoid this the questionnaire was developed with great care (see below). Our decision to use other methods as well not only increased the range of data we could collect but also allowed many of the results of the questionnaires to be cross-checked. The methods were mainly developed during a pilot phase of two weeks at the start of the fieldwork; further improvements were made throughout the survey period as our understanding of the local situation improved.

In addition to using these specific methods, we also lived and slept in each village for many days, talking informally with people there and observing day to day life. This gave good opportunities for rapport-building, for answering the villagers' questions about our work and for discussing in more detail interesting points that arose from the more formal surveys.

3.2.1 Semi-structured interviews with groups and key informants

A group discussion was conducted at the start of work in each village. These typically involved 10-20 people, mostly heads of households and mostly chosen by the village chief. These people discussed and answered questions on pre-prepared topics over 2-3 hours in an informal setting. In addition, the forest visits (see below) enabled us to hold extended informal discussions with resin-tappers. To collect information on trade, three individual interviews of c. 30 minutes each were also conducted with local resin traders in Keo Seimaa and Lapake.

3.2.2 Structured family interviews

These involved talking with the family member who was most familiar with the family's resin trees (typically the father). We aimed to interview every family present in the village during our stay; most interviews were done at the respondent's home in the mornings and evenings when people had more spare time. All questions were asked in the Khmer language by native speakers and after the pilot phase most interviews were conducted by a single Cambodian interviewer, to make the atmosphere as unthreatening as possible.

The questionnaire is given in Appendix 1. It usually took 15-30 minutes to complete, and it was deliberately kept this short and simple to increase the reliability of the answers. Informants (and researchers) often lose interest when answering long questionnaires, leading to answers being omitted or ill-considered (Gill 1993).

All the questions were pretested in group settings and during informal discussions before being finalised; all respondents were able to give quick, clear, confident answers to these questions. This was an essential step because many questionnaires ask poorly-designed questions that people find difficult to answer but feel obliged to answer anyway out of politeness (Gill 1993, Chambers 1994). An example might be to ask a woman how many frogs her family consumes in a year – it would be almost impossible for anyone to recollect this information with any precision.

Some minor changes were made to the questionnaire as the survey progressed, and where necessary some of the earlier families were partially re-interviewed to keep the data uniform.

Despite pre-testing, later cross-checking (Section 0) showed that answers were erratic and unreliable for one question used ("When did tapping begin in each group of trees?").

3.2.3 Forest visits

Groups of resin trees were visited to collect more precise information about them. After an initial period of pilot surveys a two-part sampling process was used.

1. **Mapping the extent of forest used by each village for tapping**. For this, the outermost group of trees in each direction was identified from interview data and subsequent discussions. This was done partly by estimating the general location from descriptions of nearby landmarks (using topographic maps), and partly by asking informants if they knew of other members of the village who tapped trees further out in that direction. From these outer groups we selected the minimum number that would let us map the boundary to within +/- 1-2 km accuracy (or often better) in all directions. These groups were then visited and mapped with a GPS. Enough points were mapped to show the extent and shape of the area but not the location of every tree.

2. **Random sampling of groups**. This is necessary to get statistically representative information. Once a list of all the groups of trees in the village had been compiled from the family questionnaires a 25% sample was chosen at random for detailed measurements. Each group was then visited and mapped in the same way as described in the previous paragraph. For each tree the following data were noted: species, size (girth at breast height, gbh), number of active resin taps, number of abandoned resin taps, damage score (for each hole, following Ankarfjard and Kegl 1998) and the number of years the tapper had been using the tree. Because of time constraints we were rarely able to make these measuring trips coincide with routine resin-collection trips, except during the initial pilot survey.

3.3 Survey timing, personnel and coverage

3.3.1 Timing

Fieldwork was conducted during February-June 2002, as shown in Table 2.

Table 2 Dates of main fieldwork in the study villages

Dates	Village
20-27 February; 11 March-6 April; 17-25 June	Ph. Kati
26 April-13 May	Ph. Roka Thmei
27 May-16 June	Ph. Andong Krolung
16-17 February; 26-30 June	Ph. Pu Char

3.3.2 Personnel

Table 3 shows the survey participants and their roles.

Table 3 Participants in the research

Name	Role	Abbreviation in text
Tom Evans	Survey design and data analysis, participant in fieldwork	TDE
Hout Piseth	Fieldwork team leader	HP
Phet Phaktra	Field researcher	PP
Hang Mary	Field researcher	HM

HP and PP acted as Khmer-English translators for TDE. HM is ethnically Phnong and acted as a Phnong-Khmer translator. Most fieldwork with men was conducted in Khmer, since almost all were happy to use this language. Supplementary discussions with women were mainly conducted by HM in Phnong.

3.3.3 Coverage

Of the c.30 Phnong-dominated settlements known to exist in or bordering the core area 14 were surveyed. For most of these settlements forest visits were also made to directly observe aspects of forest use. Together these areas form a large part of the southern half of the core area. There were no significant limitations to note.

4 Results

4.1 Overview of results

4.1.1 Demography

The description of livelihoods begins with an analysis of demographic patterns (Section 0) since these set the scene and partly dictate the trends for all other human activities.

4.1.2 Comparison of major livelihood options

Interview data are used to identify the most important livelihoods in the area, both in terms of the number of families practising them and the relative importance to those families. This begins with a discussion of rice farming (Section 0), which is the first choice for almost all families. It is followed by a review of additional occupations which people have to follow to compensate for the low levels of rice production (Section 0) . Some of these additional occupations are more significant than others; resin-tapping is by far the most important of these.

4.1.3 Detailed study of resin-tapping

Most of the remaining sections deal in detail with aspects of resin-tapping. These include a review of published information (Section 0) and the legal situation (Section 0), description of tapping practices and trade (Section 0) mapping of areas where trees are tapped (Section 0), estimation of the economic value of tapping (Section 0) and losses caused by logging (Section 0) and finally biological aspects such as damage to the trees and trends in productivity (Section 0).

4.1.4 Hunting and electrofishing

The final section of the results is devoted to hunting of wild animals and electrofishing (Section 0). Hunting is the principal threat to the survival of many key species in the area and it was essential for future management efforts that the involvement of Phnong communities in hunting was better understood. Electrofishing is a damaging practice that is causing immediate hardship for some families in the study area.

4.2 Village demography

4.2.1 Village sizes

The complexity of settlement names in the study area is discussed in the 'Conventions' section, above. The description of settlements is further confused by the fact that many families have houses in more than one place. For example, they may live in one of the larger settlements but also have a smaller house that is in a hamlet closer to the family's resin trees and is used one or two nights a week. Some other second houses are near to remote rice paddies and are occupied only in the wet season. A few people in Ph. Roka Thmei divide their time between this village and distant Memong. In this report, wherever possible, people have been treated as living at their main residence.

Each village chief held a list of families compiled in either 2000 or 2002 depending on the village. We modified this list on the basis of interview results and detailed discussions with the chief.

Table 4 describes key demographic facts for the four study villages.

Table 4 Key demographic data for the four study villages

Village	**All villages**	Ph. Pu Char	Ph. Kati	Ph. Andong Krolung	Ph. Roka Thmei
Number of settlements	**14**	2	3	6	3
No of families	**211**	49	40	85	37
No of individuals	**970**	230	180	390	170
No of families interviewed	**189**	48	38	71	32
% of families interviewed	**90**	97	95	84	86
Year established	**-**	pre 1960	1930	pre 1930	pre 1960[1]
Year re-founded	**-**	1984	1987	1989	1998

[1]Originally named Ph. Bang-rayay

The villages thus contain 40-85 families with 170-390 people, but the average settlement size is only 15 households or 70 people. Almost all inhabitants are ethnically Phnong, with only 1-3 families of Khmer or mixed ethnicity (Khmer-Phnong or Vietnamese-Phnong) in each larger settlement and none in the smaller settlements. These non-Phnong families are often those running the village store(s); they rarely collect resin from the forest.

4.2.2 Village history

The four villages have a similar history. All of the main settlements were founded before 1960 (Ph. Kati and Ph. Andong Krolung as long ago as 1930) although not always on exactly the same site as they now stand. For example, the settlements of Ph. Andong Krolung were scattered in the forest until the 1960s, when the government asked them all to move to be near the road.

As noted in Section 0, in 1969-1970 all of the study villages were forcibly moved to Koh Nyek district. After the Vietnamese invasion of 1979 it became possible for the survivors and their descendants to move away from Koh Nyek to places like Sen Monorom and Memong, but still they could not return to their old homes in the study area because of security problems. The first family eventually returned to Ph. Pu Char in 1984, but nobody joined them until 1988; the first people began returning to Ph. Kati and Ph. Andong Krolung about the same time, but Ph. Roka Thmei only became safe in 1998, four years ago. Thus the area was virtually uninhabited by Phnong people for almost 20 years, although there was presumably some military and logging activity by Khmer Rouge and Vietnamese forces. Current residents were able to provide us with almost no information about what happened in the area whilst they were absent.

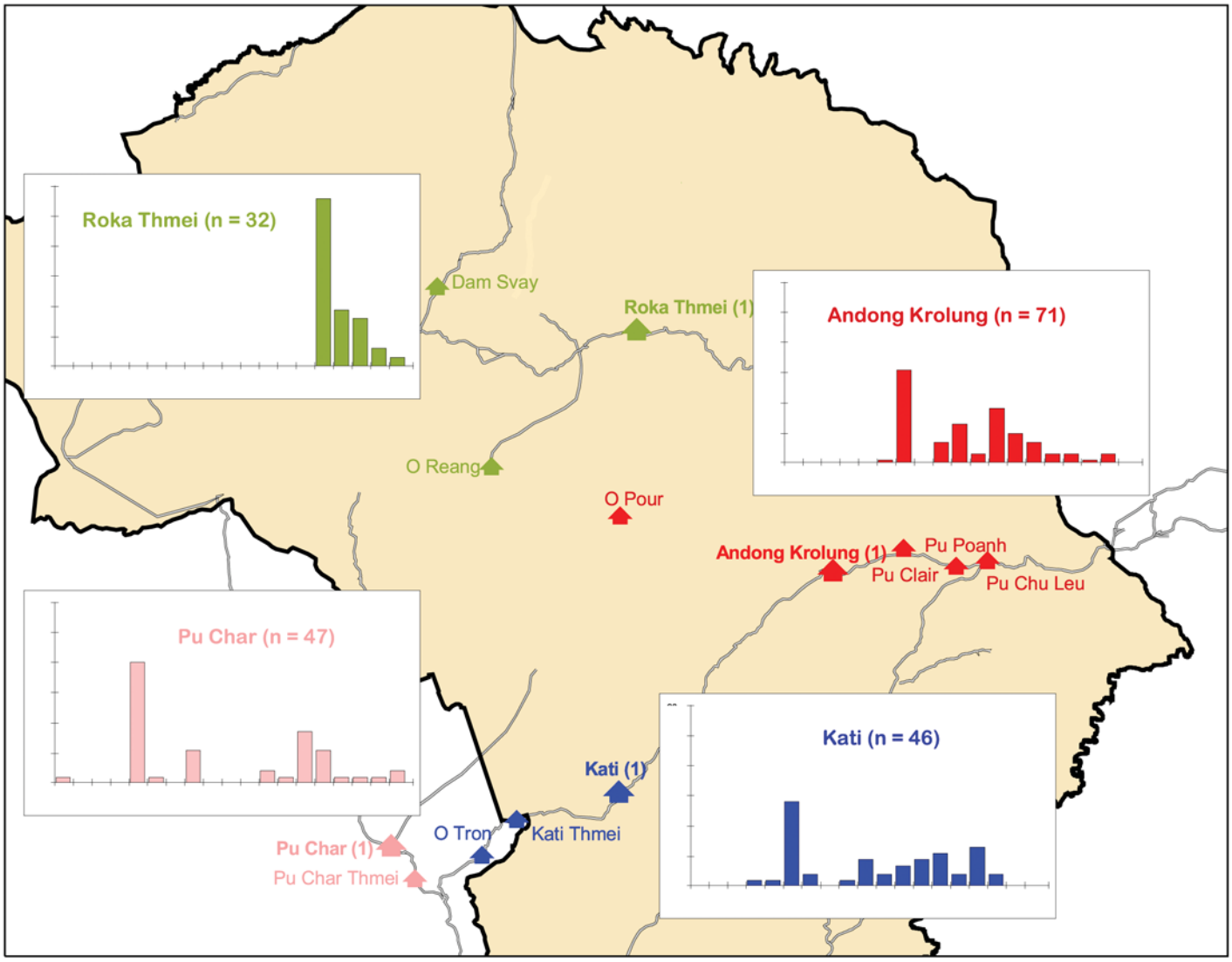
4.2.3 Immigration patterns

Figure 4 shows the approximate pattern of recent return migration by Phnong families. The charts show the number of currently resident households that arrived in each village in each year. Note that there are three limitations to the data:

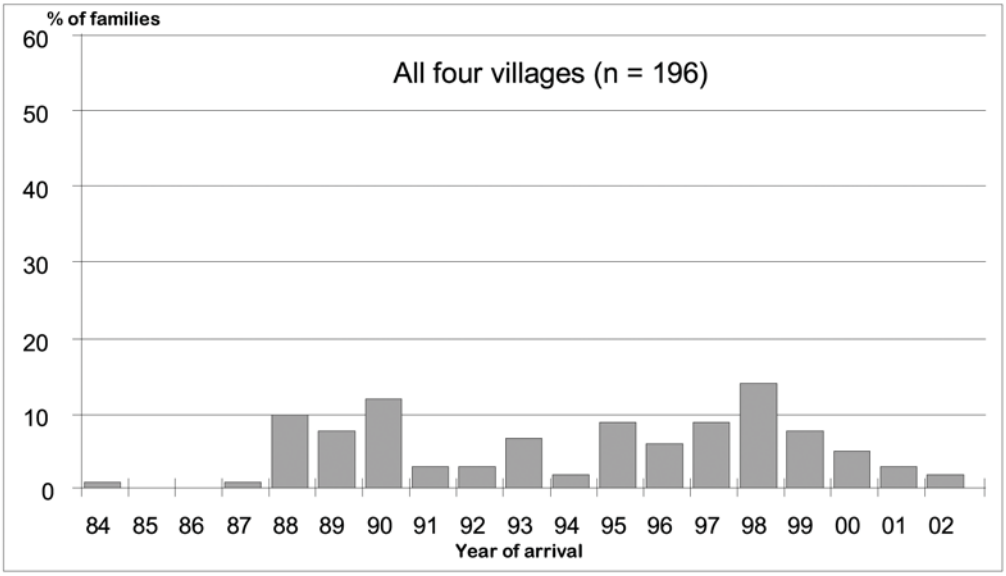
1. The number of individuals arriving in each year is not known, only the number of households.
2. Full data on families that have arrived and then left are not available but these are believed to be a fairly small percentage.
3. A few families moved between study villages and so the combined chart does not give an exact picture of when people first arrived in the study area.

Figure 4 Patterns of return immigration in four Phnong villages

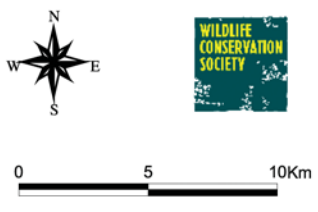
Fig. 4 Patterns of return immigration in four Pnong villages



NOTES :
i. Settlements with same colour are grouped administratively into a single village.
ii. Charts show % of current resident families arriving each year.
iii. Charts for individual villages have same axes as main chart (below).
iv. Households that have arrived then left could not be recorded, but they are few in number and, if included, would further emphasize the recent decline in immigration.



COORDINATE SYSTEM
- Projection : UTM
- Zone : 48N
- Horizontal Datum : Indian 1960
- Spheroid : Everest



Prepared by WCS Cambodia - GIS
Date : August 2002

However, these points are not thought to change the general patterns. The key feature is that in each village an initial surge of immigration (mostly by returning families) has gradually died away and the rate is now close to zero in all four cases. Small peaks following the main wave often show the establishment of new hamlets by later immigrants. In Ph. Kati only one family has arrived and six have left in the past two years, so the village is probably shrinking. In Ph. Roka Thmei equal numbers of families left and arrived, whilst in Ph. Pu Char three arrived but none left, so the village is growing slightly. Recent departures were not noted for Ph. Andong Krolung.

People appeared to return along two different routes. They returned via Sen Monorom to Ph. Kati, Ph. Pu Char and Ph. Andong Krolung, but via Memong to Ph. Roka Thmei. Almost all reports of expected future immigration were of people coming from Memong to Ph. Roka Thmei or areas further north.

This gradual return to natal areas is different from the traditional habit of the Phnong of shifting their villages frequently over short distances within a traditional village area as a response to death, disease or disaster. All those asked about this habit said it was a thing of the past since families now have too much invested in their well-built houses and prefer to stay put.

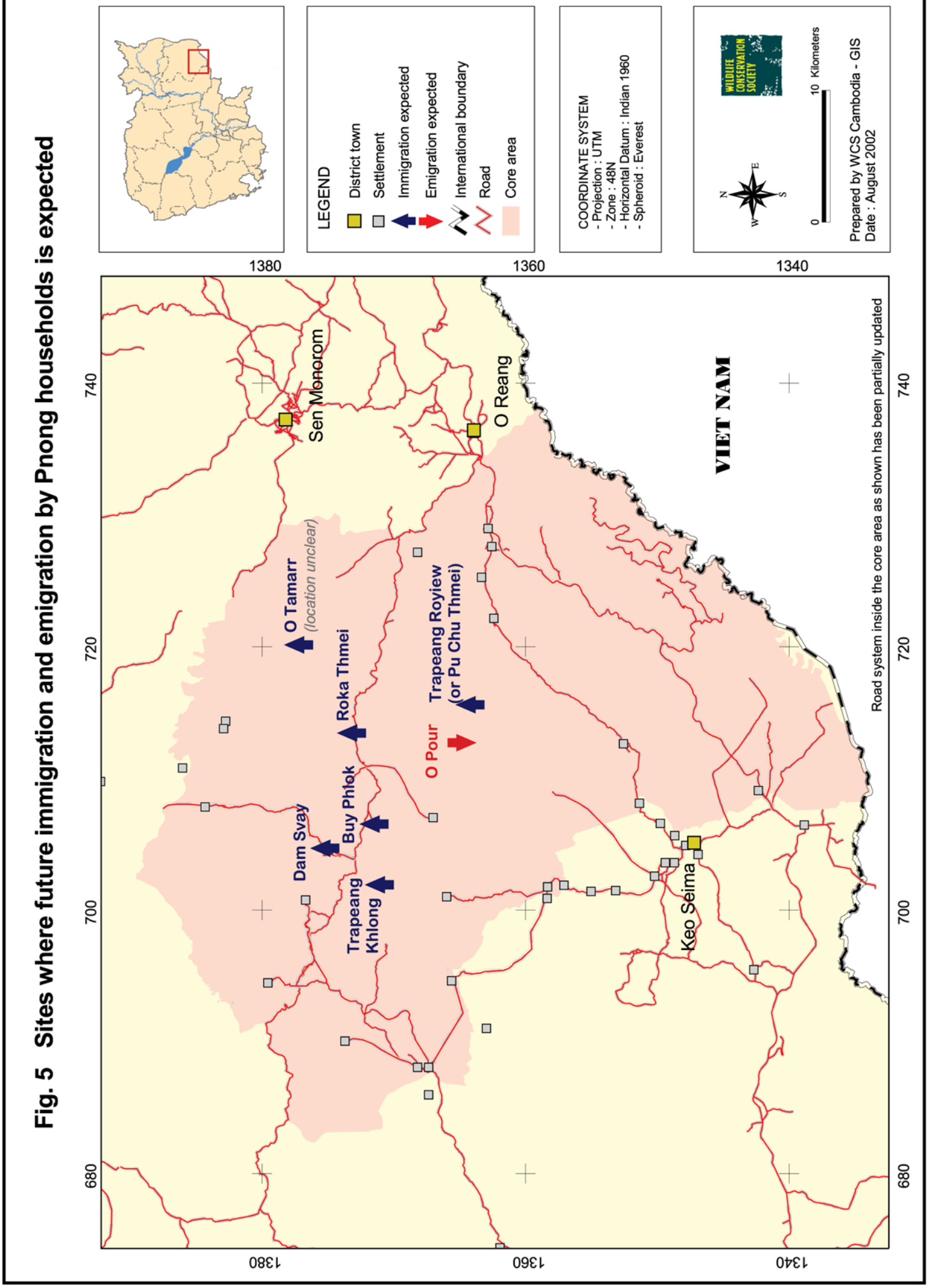
Population changes due to births and deaths were not examined by this study. Births are presumed to exceed deaths here as they do in most rural areas of Cambodia and so even without immigration the population is expected to continue growing. In the longer term this is likely to lead to increasing pressure on land and forest resources. However the rate of growth is unknown so it is not known how important this is as a conservation issue.

4.2.4 Future migration patterns

Interviews gave some information about planned population movements around Ph. Andong Krolung and Ph. Roka Thmei in the near future (Figure 5). Sites are listed in Appendix 2: some involve movements of families already in the core area, others probably involve fresh immigration. The Buy Phlok area has significant densities of wild cattle and other key wildlife species, as did the Trapeang Royaaw and Trapeang Khlong sites until settlement began there, so these movements are likely to cause conflicts with wildlife conservation.

Figure 5 Sites where future immigration and emigration by Phnong households is expected

Fig. 5 Sites where future immigration and emigration by Pnong households is expected



4.3 Comparison of livelihoods

4.3.1 Rice-growing

Almost all families in the study area are primarily subsistence rice-growers. They view other activities as additional to farming. Table 5 summarises some key statistics about rice-growing for each village.

Table 5 Agricultural indicators for each village

Indicator	**All villages**	Ph. Pu Char	Ph. Kati	Ph. Andong Krolung	Ph. Roka Thmei	Notes
% of families with rice paddies	**24**	65	22	1	16	Usually 0.5-1.5 ha.
% of families with shifting cultivation (chamkar)	**86**	61	91	99	91	Usually 0.5-1.5 ha. A few of these grow no rice, only vegetables.
% of families with rice paddy but not chamkar	**9**	31	3	0	0	
% of families with neither paddy nor chamkar	**5**	8	6	1	9	
Mean rice sufficiency per year (months of rice/family)	**4.6**	6.1	2.6	5.3	3.1	Mean across all families in village, including those planting no rice.

The villages are mostly very similar. In all four the cultivation of hill rice as part of the upland farming system called chamkar is very common – it is practiced by 91-99% of families in the three villages on hilly terrain. In the fourth village, Ph. Pu Char, chamkar is less popular and this is because the flatter terrain allows over 60% of families to grow rain-fed paddy rice, which is apparently more productive.

Chamkar practices are similar to those seen elsewhere in north-east Cambodia in almost all respects (White 1996, Javier 1997). They also match those observed in the northeast during the period 1959-1960 by Melville (2000). Field plots are small, often quite distant from the village and often including vegetables intercropped with rice. No fertiliser is used and fields are rotated, with a 2-3 year cultivation period followed by approximately ten years fallow in the study area. Old fallows are preferred for chamkar since the smaller trees are much easier to clear.

Annual rice sufficiency is low in all villages - on average most families run out of rice a few months after the harvest and have to buy rice for the rest of the year. Even in Ph. Pu Char, with its extensive paddies, yields only average six months' worth of rice per family, whilst in Ph. Kati and Ph. Roka Thmei yields are only half this. Rice sufficiency is much higher in Ph. Andong Krolung than in Ph. Roka Thmei despite the fact that families cultivate similar sized plots – this may be due to better rainfall, soils or some other factor.

In all villages crop depredation by wild animals (especially pigs and parakeets) was reported to be a significant problem; a big cat also killed several cattle in Ph. Kati in 2001.

Some fruit and vegetables are grown for food in the chamkar and others are collected from the forest around the village. Continued access to these wild sources of food is probably important to help people keep a balanced and healthy diet and to compensate for bad harvest years (E. Galabru pers. comm. 2002) but this subject was not examined in detail in the present study. The occasional sale of surplus produce is considered a minor, supplementary livelihood activity (Section 0).

Despite the low agricultural production most families are able to use incomes from additional livelihood activities to buy the extra rice they need. Most also have some leftover income for other purchases. To give three examples:

- about 42-56% of the families in each village own either a motorbike or an oxcart,
- many have cows (23% of families) or buffalos (31% of families, with a high of 71% in Ph. Pu Char, the richest of the four villages). One family owns an elephant.
- a moderate number of families have well-built wooden houses with metal roofs.

Ownership of giant ceremonial winde jars and the making of public sacrifices would also have been good indicators of relative family wealth but these were not recorded during the current study due to time constraints.

The level of income remaining after rice needs have been satisfied is discussed in more detail in Section 0.

Sources of dietary protein are discussed in Section 0.

4.3.2 Additional livelihood activities

Interviews allowed us to identify the various additional opportunities people have found, and to separate them into two broad classes.

- **Major sources of income** are those that potentially enable a family to satisfy the rice needs that are not met through farming, and perhaps to have enough left over from this to cover other necessities. The income may be cash, or people may be paid directly in rice.
- **Supplementary sources of income** are those that by themselves appear to make only small contributions to household needs.

Reported sources of income are shown in Table 6 (major activities) and Table 7 (supplementary activities).

Table 6 Number of families reporting various major sources of income

	All villages	Ph. Pu Char	Ph. Kati	Ph. Andong Krolung	Ph. Roka Thmei
Total interviews	***189***	***48***	***38***	***71***	***32***
Resin collection	**162**	37	36	61	28
Shopkeepers/resin middlemen	**7-8**	1	1-2	2	3
Wage labour	**14**	5	1	6	2
Police salary	**5**	1	3	1	1
Teacher	**2**	1		1	
Commune chief	**1**	1			
(Tiger Team Project patrols)	**(2)?**		?	(2)	(1, retired)
Hunting mammals for sale	**[4?]**	0?	[2?]	[2?]	0?

[ ] = activity not reported in family interviews but known to occur from other evidence

The clearest feature of this table is the overwhelming importance of resin-collection among the major livelihood activities. In view of its importance, this practice was studied in more depth and the results are given in Sections 0-0. Apart from this practice, or sometimes in addition, the following livelihoods are pursued by small numbers of people:

- shop keepers/small-scale traders. The shopkeepers were all Khmer or Vietnamese in the four study villages.
- paid jobs (police, teachers, commune chief). When finalised, the commune chief salary is expected to be $300/year, but police and teachers earn much less.
- daily wage labour, for example weeding other peoples' fields or working on road crews. One or two people in Ph. Roka Thmei collect resin for absentee tree owners and these have been included under the same heading. Some people reporting wage labour do it only as a supplementary activity.
- some scouts and observers were formerly paid $50/month by the national Tiger Team Conservation Project but this scheme has ceased to operate in the area.
- specialist hunters targeting large mammals. This livelihood is discussed in more detail in Section 4.11.

Table 7 Number of families reporting various supplementary sources of income

	All villages	Ph. Pu Char	Ph. Kati	Ph. Andong Krolung	Ph. Roka Thmei
Total interviews	***189***	***48***	***38***	***71***	***32***
a) Services					
Transport resin [1]	**[+]**	[+]	[+]	[+]	[+]
Village militia	**>5**	[+]	[+]	2	[+]
Headman's salary	**4**	1	1	1	1
Birth attendant	**1**	1			
b) NTFPs					
Lizards and turtles	**>40**	10	[+]	17	[>10]
Malva nuts	**22-37**	5	15-30?	2	
Hard resin	**17**				17
Electrofishing	**[3]**				[3]
Bamboo	**1+**	[2+]	1		
c) Handicrafts					
Basketry	**4?**	2		2	
Building ox-carts	**2**			1	1
Brewing	**1**				1
Making knives	**1**				1
d) Produce					
Plantation crops[2]	**15+?**		[>10]	4	+
Vegetables	**11**	1	1	8	1
Sell rice surplus	**2**	2			
Pig selling	**2**	1		1	

[ ] = activity not reported in family interviews but known to occur from other evidence
+ = total number of families unclear
[1] By motorbike, oxcart or, for one family, elephant.
[2] Cashews, fruit trees or beans.

There is a wide diversity of supplementary sources of income. Taken together they probably provide the villages with some valuable security against fluctuations in the resin market or increased family income needs. However, if the income from resin was lost it is very unlikely that most of these other sources of income could expand to replace it. The only exception in the long term may be agricultural produce, as discussed below.

Services

The only common practice in this category is transporting resin from small settlements to places that traders visit. Data on this were unclear since nobody apart from the one elephant owner mentioned it in the formal interviews. However, fees for transporting by motorbike or ox-cart were mentioned in other discussions.

Non-timber Forest Products (NTFPs)

Apart from liquid resin, a surprisingly low variety of NTFPs was reported to be sold. The main ones varied between villages.

- Dogs are used in all villages to find monitors, turtles and other small wildlife which are either eaten or sold. This common practice is discussed in more detail in Section 0.
- Malva nuts (probably from *Scaphium lychnophorum*) are collected around the O Ngeuy by almost every family in Ph. Kati, although in interviews only about half of the families reported the activity. Very few people reported this activity in other villages, although it seems likely that people from Ph. Andong Krolung are also able to travel to the collecting area quite easily, and they may have under-reported their involvement. Fruit is only available in large quantities every 3-4 years, most recently in 2002. Individual collectors search for fruiting trees and either collect fallen fruit or fell the trees. They are involved in a competitive scramble with many people visiting the area from elsewhere so there is wide variation in the success of individual collectors. Typical incomes reported in a good year were equivalent to only about 3 months of resin income - averaged over poor years as well this represents a limited contribution to total family or village income.

- Hard resin falls from the branches of *Shorea* trees in deciduous forests. Only people in Ph. Roka Thmei commonly reported collecting it. It is found in small quantities, fetches a low price and takes a long time to search for (1-5 kg/day, worth 500R/kg).
- Bamboo was reportedly a significant trade commodity in Ph. Pu Char in the past, but stocks are now low following a mass flowering and die-off of the species used.

Handicrafts

These are practised on a very small scale, mostly for consumption within the village.

Produce

Agricultural surpluses (vegetables, fruit, pigs, chickens, rice etc.) are sold on a very small scale within the villages. However, some families have begun to grow small plantations of commercial species and this has the potential to become a much larger activity. The commonest choice is cashew trees although some fruit trees and green beans are also being planted on old chamkar. Some families have a few cashew trees planted at the edges of their chamkar gardens whilst others have fields with up to 200 trees.

The fact that cashews are hard and non-perishable makes them a good cash-crop for such a remote area with such poor roads. Planting them is a recent development and both these planters and other families in the villages are watching closely to see how profitable the crop will be. If early success is maintained and markets remain strong it seems likely that the crop will be rapidly and widely adopted.

4.4 Resin tapping – review of published information

4.4.1 Product types and species involved

Many species of trees in the family Dipterocarpaceae across South-east Asia produce marketable resins, some collected as solids, others as liquids (Howes 1949, Ashton 1982, Shiva and Jantan 1998). Some solid resin is collected in Laos and Cambodia from *Shorea* species and is called *jor chong* in Khmer (Dy Phon 2000) or *kisi* in Lao (Foppes and Kethpanh 1997). However, compared to liquid resin it appears to be relatively insignificant in the economies of many villages so far visited in north-east Cambodia (e.g. Baird *et al.* 1996, Bann 1997, Forest Policy Reform Project 1998, So *et al.* 2001, Section 0 above).

Liquid resins are the main product of interest to us. Technically the product is an oleoresin, since it contains an essential oil (volatile) fraction, but in this report it is simply called resin, which is the name in everyday use. It is also often called wood oil or dammar, the latter being a Malay word that is sometimes confusingly restricted to solid resins. Liquid resins are called *chor tuk* in Khmer (Dy Phon 2000) and *nam man yang* in Lao (Foppes and Kethpanh 1997).

In mainland South-east Asia liquid resins come mainly from *Dipterocarpus* species. Little original research has been published on the biology, techniques or economics of tapping *Dipterocarpus* resins, presumably because it is a relatively low-value product. Much of the limited existing literature concerns *D. kerrii* growing in Peninsular Malaysia, and although this species also occurs in southern parts of Thailand, Vietnam and Burma it is not reported from Cambodia (Smitinand *et al.* 1980).

Smitinand *et al.* (1980) list nine species in the genus in Cambodia. At least six are tapped for resin in Cambodia (Dy Phon 2000) but their quality relative to *D. kerrii* is unclear. However Smitinand *et al.* (1980) state in passing that the resins of *D. alatus*, *D. turbinatus*, *D. intricatus* and *D. kerrii* are all of similar quality.

The evergreen species *D. alatus* is believed to be the main source of resin in both Laos (Ankarfjard and Kegl 1998, Foppes and Ketpanh 1997) and Cambodia (various informants, pers. comm. 2002), whilst both *D. alatus* and *D. turbinatus* are significant in Thailand (Smitinand *et al.* 1980). *D. alatus* is a widespread and often common species, occurring from Bangladesh to southern Vietnam and northern Peninsular Malaysia in lowland evergreen and semi-evergreen forests (Smitinand *et al.* 1980).

The Cambodian vernacular names for *Dipterocarpus* species are numerous and confusing. For example, Smitinand *et al.* (1980) list five Khmer language names for *D. alatus*, and two of these, plus a sixth, are used in the official DFW table of timber types and royalty classes. Most other species also have several recorded names, many of them using the generic Khmer term *chhouteal* plus various classifiers. Given this variability it is probably unsafe to determine the species being used in a given

area on the basis of names reported in interviews; direct observation of the trees is needed, together with botanical assistance. Appendix 3 discusses local names used in the study area.

4.4.2 End uses

The raw resin has long been used for illumination and waterproofing boats in rural Laos and Cambodia. Some part of the oleoresin is also used in paints, lacquers and varnishes (Gianno and Kochumenni 1981, Ankarfjard and Kegl 1998 and many other authors). According to Gianno and Kochumenni (1981), Gianno (1986) and Shiva and Jantan (1998) the volatile fraction (gurjun balsam) of *D. kerrii* can be used in perfume manufacture and its widespread adoption for this use after 1974 led to a great increase in the demand for international trade and a parallel leap in the price of resin. It is thought that this new high value end use also applies to the Cambodian species, since Foppes and Kethpanh (1997) report that most Lao *D. alatus* resin was exported via Thailand to India and that some is destined for perfume manufacture in the Arab world. However, we have not found confirmation of this key fact from other sources.

The wood of *Dipterocarpus* species is commercially valuable, although not of the highest quality (Dy Phon 2000, Gardner *et al.* 2000). It is classed as Grade 2 by the DFW in Cambodia. It is highly sought after by most Cambodian timber concessions, in part because it is ideal for the plywood factories that these companies have invested in (E. Galabru pers. comm. 2002).

4.4.3 Productivity and sustainability

The trees release resin in response to injury. Tappers cut a backward sloping hole in the trunk where resin can pool and then briefly light a fire to stimulate better flow. A few days later the resin can be scooped out, a new fire set and the process repeated (Ankarfjard and Kegl 1998 and pers. obs.). Data on the long-term effects are scarce, but anecdotal reports based on interviews suggest that most trees can continue yielding resin for decades (e.g. Gianno 1986, Ankarfjard and Kegl 1998, Enfield *et al.* 1998, Foppes and Kethpanh 2000). This may depend on the intensity of tapping – but it is rarely clear whether the trees have been tapped continuously over many years, and how frequently tapping took place. Gianno (1986) explicitly notes that periods of unrest or low prices allowed trees at her Malaysian study site to rest during some earlier decades and this also seems likely to have been the case in many parts of Cambodia.

It seems likely that the abnormally high levels of resin production may cause the tapped trees to divert some resources from growth, survival or reproduction but this remains speculation and no relevant studies have been conducted (Soerianegara and Lemmens 1993). A study of over 300 trees in Laos found very limited, surface damage on the great majority of trees examined (Ankarfjard and Kegl 1998) but was not able to study other aspects of sustainability.

Ibrahim *et al.* (1987 and 1990) tested the use of 10% sulphuric acid solution on shallow bark scratches to stimulate resin flow in *D. kerrii.* They found that it gave initial yields comparable to the traditional pit and fire techniques used by Malaysian ethnic minority groups. However, we have traced no subsequent published report of this technique being used commercially.

4.4.4 Trade patterns

Judging from official archives, resin has been traded in Cambodia since at least French colonial times (A. Cock pers. comm. 2002). The official *Code Forestière* (Department des Eaux, Forêts et Chasse, Phnom Penh) dating from 1930 contains a detailed Annex describing resin-tapping procedures and regulations. There is also a published reference from the 1880s of the 'Phnongs' owing the Cambodian king a tribute of four tonnes of resin every three years (M. Guerin pers. comm. 2002). It is not clear whether this source refers to the Phnong of southern Mondulkiri or the Phnong as an umbrella term, but it is still a remarkable indication that resin trade from some parts of the north-east has been taking place on a large scale for over 100 years.

Trade from Mondulkiri appears to flow into Vietnam (Nhiel and Be 1996, Walston *et al.* 2001, this study). Trade flows from other parts of Cambodia remain unclear in the literature, but information from Mr Ly Jubiang indicates that resin from Ratanakiri passes directly to Vietnam, from Stung Treng passes into Laos and from Preah Vihear, Kompong Thom etc. passes through Kompong Cham or Phnom Penh to Vietnam. Recent exports from Laos mostly flowed into Thailand and then to other countries such as India (Foppes and Kethpanh 1997, 2000) until 1996 when (for unknown reasons) the Lao government banned trade other than the re-export of imports from Cambodia (Enfield *et al.* 1998, Foppes and Kethpanh 2000).

As discussed in Section 0, tapping for trade did not take place in the villages of the study area before 1970; it was reportedly only after villagers returned in the late 1980s that traders came looking for resin in the area. Whether this was due to an improving road network, loss of trees in other areas or the apparent increase in demand during the 1970s remains unclear.

Village resin-tappers in both Laos and Cambodia usually sell the raw resin. The Cambodian and Lao traders refine it by crude filtration but further processing (e.g. distillation of the essential oil) is done after export, at least in Laos (e.g. Ankarfjard and Kegl 1998).

4.4.5 Socio-economic significance of resin-tapping

Recent observations suggest that resin-tapping is a widespread and often dominant livelihood activity throughout northern and northeastern Cambodia (A. Cock, P. Swift, E. Galabru, Uck Kim Nary, J. Walston and Hean Sokhom pers. comm. 2002, authors pers. obs.). A national review of the situation is in preparation (A. Cock and P. Swift pers. comm. 2002). Tapped resin trees are commonly logged, both legally and illegally (e.g. Global Witness 2002) and this is likely to be having significant detrimental effects on the livelihoods of tappers. Following loss of resin trees there are anecdotal reports of increases in shifting cultivation, hunting and illegal logging to replace lost income, but published studies are lacking.

Resin-tapping seems to be a rare and declining activity in some neighbouring countries. For example, 20 years ago Smitinand *et al.* (1980) could already say 'tapping was once a big home industry that kept tens of thousands of Thai rural inhabitants employed'. Takeda *et al.* (1996) report that it is still an important activity for some people in Northeast Thailand, but has 'declined drastically'. Whether this is due to better employment alternatives or felling of resin trees for timber is unclear. Similarly, speaking of Malaysia and Indonesia, Ashton (1982) said 'the oleoresin of *Dipterocarpus* .. is still used locally for caulking and varnish, being formerly an export commodity'. Gianno (1986) noted that tapping had declined in Malaysia, largely due to the logging of suitable trees, and despite price rises during the 1970s.

4.5 Resin-tapping – the current legal situation

4.5.1 Legal controls on tapping and trade

To the best of our understanding the tapping of resin trees is fully legal and there are no restrictions upon it. However, some concessionaires dispute the right of people to use trees that were first tapped after the concession was granted.

There are some legal controls on the transportation of resin but a full review was outside the scope of this study. According to Ly Jubiang (pers. comm. 2002), no permits are required from central government but provincial permits must be obtained. For example, traders taking resin through Sen Monorom town and exporting at Dak Dam border crossing have to obtain a permit for each shipment, and pay a tax of 300,000 Riel per tonne to the Provincial DFW office (HM, pers. obs.). Traders passing through Keo Seimaa are believed to require a different set of permits and pay a different set of fees. An ongoing study of resin trade issues is likely to provide some clarification on this subject.

There have been large seizures of illegally traded resin during 2002 and this together with other evidence suggests that government control of the sector is beginning to tighten significantly (E. Galabru pers. comm. 2002). For example, one reading of the upcoming new Forestry Law is that all collection of resin for sale is likely to require permits (e.g. Articles 24-27, see Appendix 4), which could result in a dramatic change in the freedom of rural families to practise this livelihood (E. Galabru pers. comm. 2002).

4.5.2 Legal controls on felling of tapped trees

At the time of writing the new Forestry Law was close to being passed. This will govern future disputes over resin trees but has no bearing on past events. Forestry practice over the past ten years has been governed by a wide variety of laws, decrees and official orders This is considered 'an incomplete and antiquated patchwork that provides numerous loopholes for the commission of forest crimes' (Global Witness 2002). White and Case (1998) went further and stated that 'In spite of general prohibitions on certain harvesting activities, the laws appear to allow practically any harvesting activity...so long as relevant authorities can be persuaded to issue the proper permits'. The laws rarely specify what the 'proper permits' are, leaving a great deal of discretion in the hands of senior officials.

Both the cited reviews state that the Forest Practice Rules (Kret no. 35, June 25 1988) form the principal law governing forestry activities. The Rules exemplify the problems noted above. In particular, Article 17(g) states that '[It] shall be forbidden …g. to fell the trees that people have tapped for resin…' whereas Article 18 states that '…the felling of resin trees, shall be permitted only if there is authorization from the Ministry of Agriculture', suggesting that such authorization can be given, in an unspecified way and by unspecified parties.

A subsequent set of Instructions on the Implementation of Kret no. 35 (8 November 1988) tried to clarify the issue by offering seemingly contradictory advice, specifying that tapped trees larger than 1.20 m in diameter 'are to be considered too old and must be exploited and removed.' These trees may be felled without consulting the tapper. For trees smaller than this it is necessary to 'mediate' with the villagers who tapped them. This 1.20 m threshold is repeated in the Log Book of regulations issued with each annual felling permit (Global Witness 2002). The need to 'mediate' with the tapper is presumably the legal provision that allows tappers to demand (and sometimes receive) compensation for felled trees.

A number of legal documents relating to resin trees have been issued since the review of White and Case (1998). Most significantly there was a series of three official letters on 26 April, 29 May and an uncertain date in July 2001 all ordering a moratorium on the felling of tapped trees until the economic impacts on tappers could be studied and prevented. These orders remain in force at the time of writing. Since all concessions are currently preparing revised management plans and environmental/social impact assessments there is a more general reason why no logging of resin trees (or any other species) should be occurring during 2002. Nonetheless, extensive illegal logging of resin trees has gone on in many parts of the country since April 2001 (Global Witness 2002).

The draft Forestry Law establishes protection and responsibilities for resin-tappers. The protection appears to be quite strong for resin trees in active use, as shown by Appendix 4. However, some key aspects do not appear to be fully defined and may be used to restrict the activities of resin-tappers in the future. In particular these are:

- how much sale or barter is allowed before the harvest ceases to be at a customary subsistence level (e.g. Articles 40 C5, 44b, 25b).
- how long does a practice have to have been carried out before it becomes treated as traditional/customary?
- what is the situation in a concession that has already been granted – will the new law remove any contractual rights the concessionaire may have been granted to fell resin trees?

There are also responsibilities for both the community and the Forest Administration to ensure sustainability of harvest (Appendix 4). The mechanism for ensuring this is not clear in the case of customary use rights since no management plans or monitoring are required.

A second new set of laws, the forthcoming Sub-decree on Community Forestry, is less well-advanced and is also less immediately relevant to the situation in southern Mondulkiri. It will only cover sites that are the subject of formal forest management agreements between local communities and the authorities. Such agreements are probably several years in the future for this area so the law is not analysed here, but it may have a significant role to play in long term management there.

4.6 The resin collection system in the study area

4.6.1 Tapping practices

Tapping practices were very similar between the four studied villages. They are also very similar in at least some other parts of Mondulkiri (e.g. the Bu Sra area, HM pers. obs.) and match closely with descriptions from elsewhere (e.g. in Malaysia, Gianno 1986, Laos, Ankarfjard and Kegl 1998 and India/Burma, Shiva and Jantan 1998). The key points noted for the study area are detailed below.

History of tapping

- resin-tapping before 1970 in the study area involved only 1-2 trees per family, since there was no commercial trade in this area. At that time tapping provided oil for making torches to light the family home and individual trees were tapped les often than they are today.
- when the villagers began to reoccupy the villages after 1989 large-scale tapping expanded rapidly since a strong market already existed.

Target species

- most tapped trees are *Dipterocarpus alatus* (local name *chhouteal tuk*). A smaller proportion are *D. intricatus* (*traich*) and a very small number are *D. turbinatus* (probably *chhouteal masao*). See Appendix 3 for notes on the identification and biology of these species and Section 0 for details of tree numbers.
- the resin from these three species is of similar quality and is mixed together during collecting trips.
- trees over 40-50 cm diameter are preferred; bigger trees give more resin.
- all healthy trees of suitable size in these species are tapped – the differing proportions reflect differences in the natural abundance and sizes of the three species.

Ownership

- the first person to find and mark a tree is considered by village custom to be the owner of that tree. The owner typically starts tapping the tree straight away, but he doesn't have to. Other people may tap it only with permission of the owner.
- this ownership does not have a clear basis in national law but it is recognized by other village members and makes it possible for trees to be sold, bought, given or inherited within or between the villages.
- people from neighbouring villages also respect customary ownership. We were not told of any disputes over tree ownership, although there is a small amount of opportunistic theft of resin by other forest users.
- the trees grow in more or less well-defined groups, separated by areas of apparently suitable habitat where few, if any, grow. All the trees in one group tend to be found by the same person and so the group of trees is the natural unit to talk about when discussing tree locations.
- a family usually owns 1-5 groups of trees, often in widely separated areas that have to be visited on different days.
- almost 80% of groups of trees are tapped by the family that first found them, 11% are tapped by people who have bought the trees and the remainder by people who inherited the trees or were given them by relatives.
- the owner of a group of trees is also considered to own those trees in the group which are not being actively tapped, either because they are too young or they are being held in reserve. Exhausted resin trees are also owned in the sense that other people may not tap them, but the owner is also unlikely to use them again.
- other species mixed with the resin trees are not owned under this customary law.
- other forest products occurring amongst the resin trees are not owned by the owner of the trees – anybody is free to e.g. hunt, fish or collect rattan amongst the resin trees.
- a few groups are owned jointly between two families (because they found them jointly). They may take turns to visit the trees or go together and share the resin.
- trees are usually tapped by their owners in most parts of the study area, but the owner may occasionally let another person tap his trees, for example to pay off a debt, or to help a relative in need of extra cash. In Ph. Roka Thmei one or two tree owners actually live in Memong and employ a relative to tap the trees in return for a share of the resin.
- the trees in one area near Ph. Roka Thmei (1) are shared between six families. Each of these families has other groups of trees elsewhere which they own exclusively. Tapping of trees in the shared area is decided informally and is usually done by the family most in need of extra income that week.

Tapping techniques

- a backwards-sloping pit about 20-30 cm deep is cut in the tree at about waist height to collect the resin.
- the yield is reportedly best if the pit is directly below one of the tree's major boughs; pits on the underside of sloping trees are also preferred, because they collect less rain.
- the resin floats on water so if rainwater fills the pit, the resin is lost. Some tappers put roofs of bark above holes that are likely to collect water, but the majority do not, for reasons that are not clear.
- not all trees of suitable size produce resin when first tapped. Sometimes this is because the tree is sick or has a hole in the centre; at other times there is no obvious reason.
- trees are usually visited about once a week but the cycle may range from 5 days to 2 weeks.

- at each visit resin is scooped from the pit and then a fire is briefly set in the pit to stimulate further resin flow. This fire is put out before the tapper moves on to the next tree.
- usually a team of two people does the resin collecting – one to scoop and one (often a child) to put out the fires and help with minor tasks.
- the owner sometimes keeps the base of the tree free of fallen leaves, to reduce the risk that passing forest fires will damage its productivity
- individual pits may eventually stop giving resin but it is usually possible to start a fresh tap on another side of the same trunk. This can be done more than once.
- one man stated that he was able to revive exhausted holes by enlarging them, instead of starting a new hole. He wasn't sure why no-one else used this technique.

Current yields and seasonality

- trees are tapped year-round except when persistent heavy rain or flooding streams prevent access.
- wet season yields are reportedly higher than in the dry season but prices are lower. The reason for lower prices was said by the villagers to be reduced quality, but traders also hinted at seasonal changes further up the marketing chain.
- in very broad terms most families have 10-100 trees which reportedly yield around 0.5-1.0 l/tree/weekly visit and very approximately 30-40 litres per year per tree. This is discussed in more detail in Section 0.
- the reported months of high and low prices and high and low yields differed widely between villages. This is discussed in more detail in Section 0.
- long terms trends are discussed in Section 0.

4.6.2 Resin trade

The collectors carry out no processing of the resin – they sell it all to traders in its crude state. Marketing opportunities vary depending on a collector's access to transport and whether or not traders visit the village.

Some people sell their resin to a trader resident in their village; these are often people without their own transport. They are often in debt to the trader, having borrowed money or rice on credit. They are trapped in a relationship with a single buyer, placing them in a weak bargaining position.

Other people have some form of transport and are able to take their resin to a larger village where they can choose between several different traders. These people rarely have debt problems and can shop around for the best price each week.

In some settlements several traders visit each week. This enables the sellers to find a good price without having to own a vehicle.

The first-stage traders vary between villages. In Ph. Kati they only take resin as far as Keo Seimaa and they only have a small mark-up. In Ph. Roka Thmei there are two traders (one serving Ph Roka Thmei/O Reang, the other Dam Sway and Ph. O Khtong) and both have a larger mark-up since they carry resin all the way to Sen Monorom town.

Table 8 summarises marketing behaviour in the study area.

Table 8 Resin marketing in the four study villages

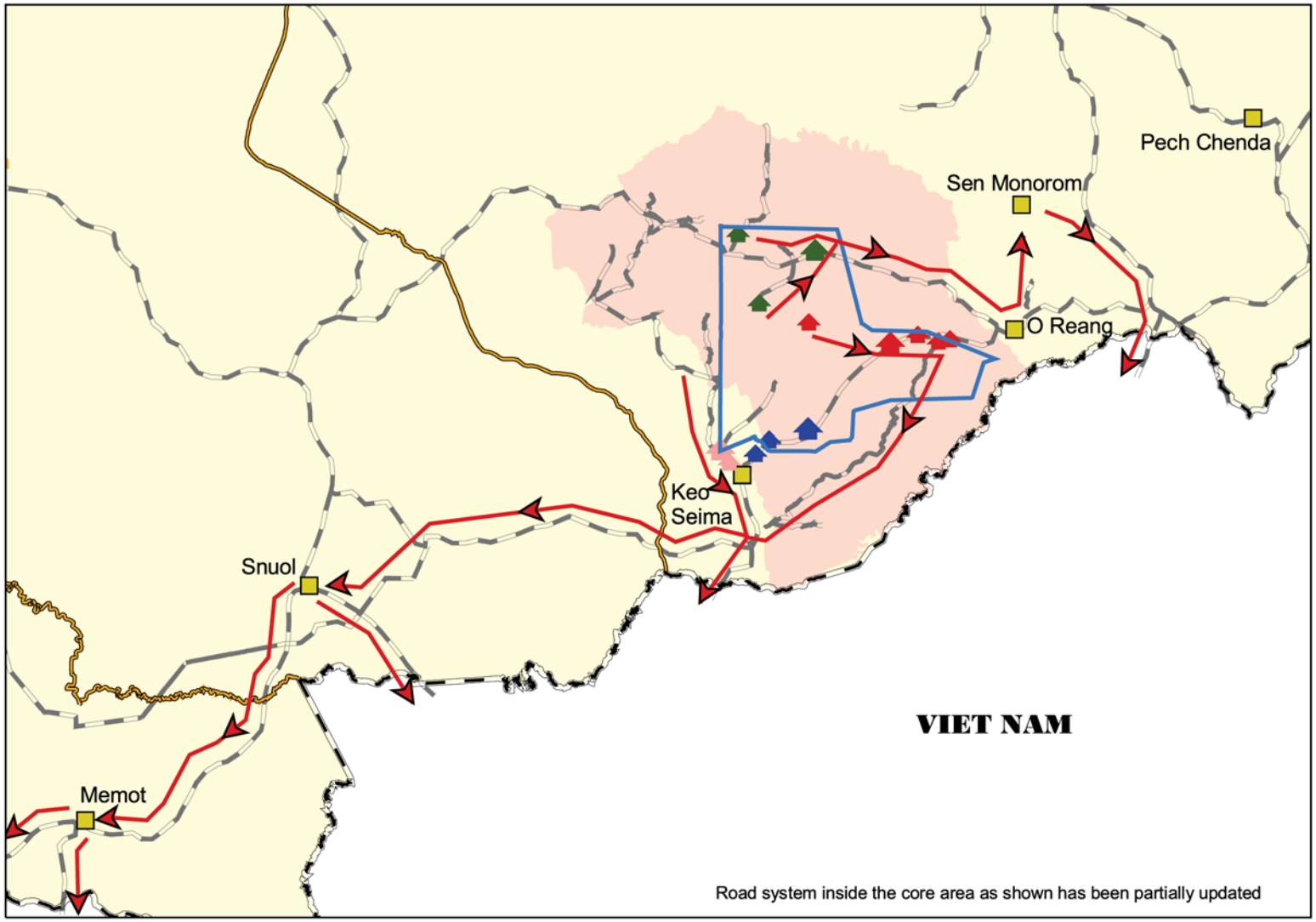
Seller type	**All villages**	Ph. Pu Char	Ph. Kati	Ph. Andong Krolung	Ph. Roka Thmei
No vehicle, sell to resident trader, debt problems common	**some**	few	some (10 families?)	0?	many
Vehicle, travel to sell in other settlements, debt problems rare	**many**	most	most	some?	few
Vehicle not needed, several traders come to settlement, debt problems rare	**some**	-	-	most?	-

Ph. Roka Thmei is thought to be the village with the largest impact from low access to traders and high debt problems.

Resin from the study area is traded in two directions (Figure 6) – east towards the Dak Dam border post beyond Sen Monorom and west towards various border crossings near to Snuol, Memot and possibly elsewhere. Trade from Ph. Roka Thmei goes east and from the other three villagers west.

Figure 6 General trade routes for resin collected in the study villages

Fig. 6 General trade routes for resin collected in the study villages



LEGEND
- Studied settlement
- Main town
- International boundary
- Provincial boundary
- Main road
- Resin trade road
- Study area
- Core area

COORDINATE SYSTEM
- Projection : UTM
- Zone : 48N
- Horizontal Datum : Indian 1960
- Spheroid : Everest

N W E S

WILDLIFE CONSERVATION SOCIETY

0 10 20 Kilometers

Prepared by WCS Cambodia - GIS
Date : August 2002

The westward trade route through Keo Seimaa and Labake is used by a wide variety of traders. We had reports of at least ten operating in this area, two on a larger scale and the others on a smaller scale. To get a general idea of the situation we interviewed both larger traders and one of the smaller traders. The main points from these interviews are as follows:

- the three market along different routes – one sells at the Vietnamese border directly south of Lapake, one is visited by a buyer from Snuol and the third drives his resin to Memot District.
- all filter the resin with simple sieves but do no other processing.
- there are high export taxes and some additional costs at internal checkpoints.
- the price they receive for high quality resin was reported to increase in the rainy season (1 person), decrease in the rainy season (1 person) or remain steady except for decreases in February and April (1 person).
- villagers tend to supply poorer quality resin in the rainy season due to contamination of poorly protected taps by rainwater. In at least two (and probably all three) cases the traders do not attempt to remove this water before selling on. The water makes the resin cloudy.
- typical prices paid to villagers are 21-27,000 R/30 litre container for high quality/dry season resin and 19-22,000 R/30 litre container for lower quality/wet season resin. These were slightly higher ranges than those reported to us in the relevant villages (Table 10).
- all the resin is apparently destined for Vietnam and possibly third countries after that. All three traders knew that one end-use was waterproofing boats, one reported other uses for low grade parts of the heavy fraction but none knew of end-uses for the lighter fraction of the resin.

Reportedly, 2-3 years ago one trader from Snuol bought monopoly rights from the Keo Seimaa district authorities to buy resin there. This monopoly did not survive, apparently because of protests by the villagers and their representatives over the lower prices they received for their resin; protests from other traders may also have played a part.

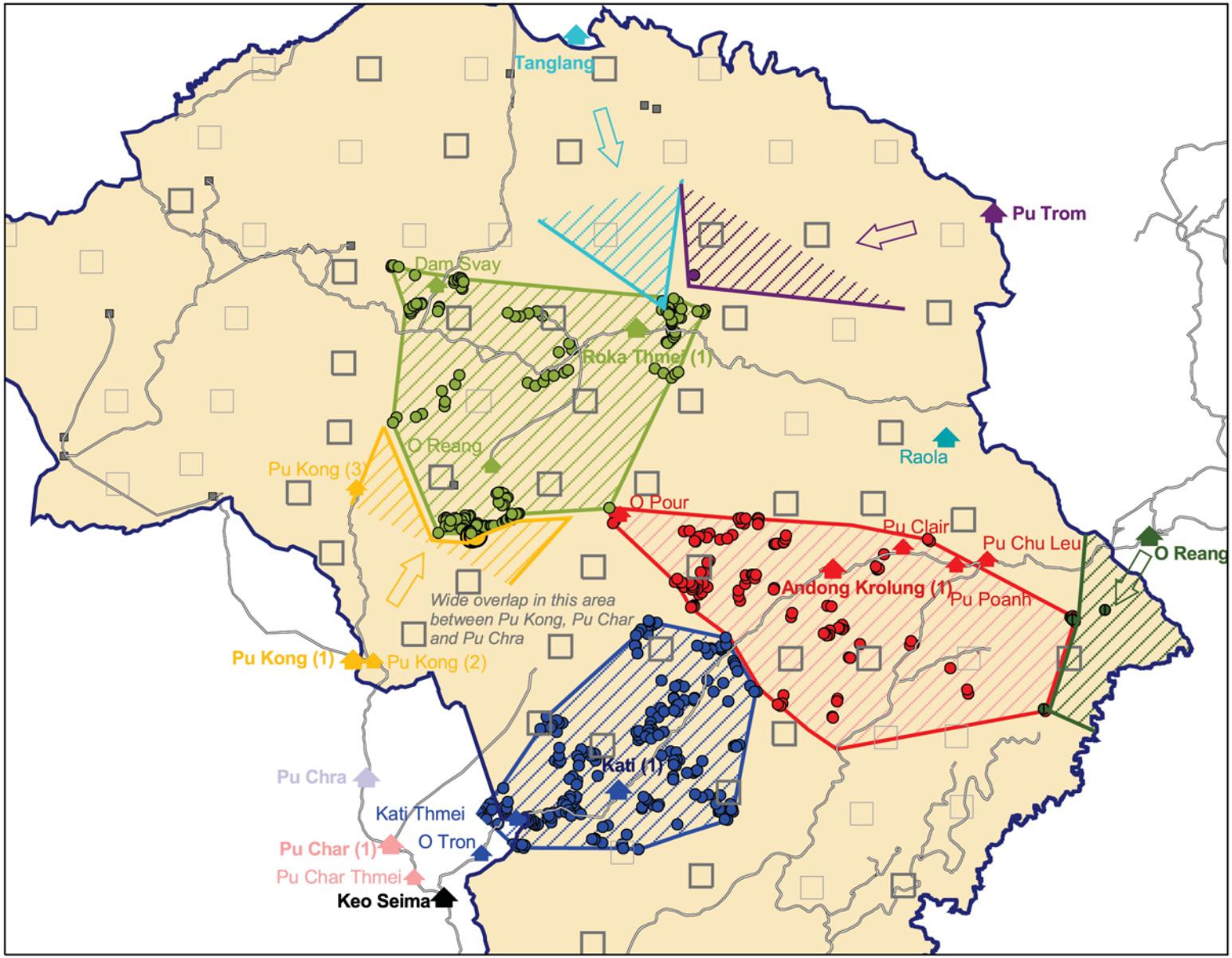
4.7 Resin-collecting areas

4.7.1 Shape and boundaries of resin use areas

Figure 7 shows a set of data collected throughout the core area as part of a wildlife survey and another set collected during the current study. For the wildlife survey 80 randomly placed, square, 4 km transects were surveyed; in each of these a note was taken of human activities visible at the four corners of the plot and additional records of human use were taken whenever wildlife was seen (see Clements in prep. for detailed methodology). Any transect where tapped resin trees were noted is highlighted on Figure 7.

Figure 7 Resin-tapping areas used by the study villages and their neighbours

Fig. 7 Resin tapping areas used by the study villages and their neighbours



LEGEND

- Settlement for which resin area mapped (some or all)
- Other settlement
- Mapped location of resin tree (see text for explanation)
- Main road or concession road
- Core area
- Area containing resin trees tapped by a known settlement
- Transient with resin trees observed
- Transect without resin trees observed

DATA SOURCE
- Resin tree locations recorded by GPS

COORDINATE SYSTEM
- Projection : UTM
- Zone : 48N
- Horizontal Datum : Indian 1960
- Spheroid : Everest

N
W E
S

WILDLIFE CONSERVATION SOCIETY

0 5 10 Km

Prepared by WCS Cambodia - GIS
Date : August 2002

It can be seen that the study area (coloured hatching) covers a large part of the main resin-tapping area but tapping also occurs in most neighbouring areas. South and west of the Ph. Roka Thmei area the forest is extensively tapped by people from P. Pu Kong, Ph. Pu Char and Ph. Pu Chra. North of Ph. Andong Krolung there is extensive tapping which we suspect is conducted by people from Ph. Raola and the district town of Ph. O Reang, but this is unconfirmed. In the northern third of the core area resin-tapping is much more patchy, as suitable forest types are scarcer. Ph. O Khtong is known to produce a lot of resin, and other villages also do some tapping.

Little resin collection takes place in the southern quarter of the core area, between the study area and the Vietnamese border. Although this area was once rich in resin trees these have now been almost entirely logged. The few tappers who still have trees in this area are thought to travel in by motorbike from the Lapake area.

To provide a better understanding of tapping patterns, resin-collecting areas were mapped in detail during the current study for three villages and some information was gathered on the collecting areas of six of the neighbouring villages (Figure 7). Note that the figure does not show every group of trees in each village; it shows a random sample of groups plus additional groups selected specifically because they were at the outside edge of the area used by the village (Section 0). This level of detail is enough to make the following general points:

1) **People travel moderately large distances from their homes to collect resin**.
   Many families have trees up to 6 km from their homes, and in an extreme case people from Ph. Tanglang travel south >12 km by elephant to tap resin close to Ph. Roka Thmei. In interviews about 10% of groups of trees were said to require overnight trips to harvest them, the rest can be done as daytrips.
2) **Resin collection areas do not overlap significantly in many cases**.
   In the three villages studied thoroughly the overlap is small. There is a little overlap between Ph. Andong Krolung and Ph. O Reang and this may be slightly larger than shown because systematic surveys were not done in Ph. O Reang. Furthermore, two or more families based in Keo Seimaa town have trees within the Ph. Kati collecting area (not mapped), forming a second example of minor overlap.
3) **Non-overlapping resin-collection areas usually meet each other – there are no gaps**.
   For example, the Ph. Roka Thmei collection area was found to meet those of at least four other villages. The implication of this, supported by villagers' reports, is that few or no stands of untapped trees are likely to remain between current tapping areas.
4) **Resin collection areas of some other villages are reported to overlap much more**.
   This is especially true of Ph. Pu Char, Ph. Pu Chrar and Ph. Pu Kong which apparently have a wide area of overlap in the area north-east of these three villages. This is partly due to people moving house to neighbouring villages after finding their resin trees, and partly due to the position of the three villages close together but outside the area supporting most of the resin trees.

The way these patterns have developed, and their implications for community perceptions of forest tenure, are discussed in more detail in Section 0.

4.7.2 Habitats where resin trees occur

Some general remarks can be made, based on the broad habitat classes recognised throughout southern Indochina (Rundel in prep.). Resin trees of all species were very rare or absent in areas of Deciduous Dipterocarp Forest. In the study area *Dipterocarpus alatus* occurs mainly in areas of mature Semi-evergreen or Evergreen Forest, characterised by a closed canopy with many evergreen tree species, a diverse shady understorey of evergreen woody plants and very limited amounts of bamboo or grass. It also occurs in a more open formation, with a higher proportion of deciduous canopy trees and a much more open and fire-prone understorey with small bamboos, patches of grass and, along seasonal watercourses, belts of evergreen shrubs. This habitat might be considered a transitional type between Mixed Deciduous and Semi-evergreen Forest, the presence of evergreen *D. alatus* being one of the key features setting it apart from pure Mixed Deciduous Forest.

This transitional habitat also supports many of the *D. intricatus* individuals large enough to tap, although some also occurred in Semi-evergreen Forest and in purer Mixed Deciduous forest. *D. turbinatus* was only found in Evergreen/Semi-evergreen Forest, but too few were seen to assess habitat preferences confidently.

4.8 Economics of resin-tapping at the village level

4.8.1 Resin tree ownership

Table 9 presents key figures describing resin-tapping in each village.

Table 9 Comparison of resin-tapping statistics between villages

Measure	**All villages**	Ph. Pu Char	Ph. Kati	Ph. Andong Krolung	Ph. Roka Thmei
% of families owning resin trees	**86**	78	95	86	86
Average number of trees per family[1]	**77**	60	52	76	135
Average number of groups of trees per family[1]	**1.5**	1.4	1.6	1.5	1.2
Average number of trees per group	**53**	44	32	52	106
% of trees of species *D. alatus* reported	**92**	87	93	95	92
Estimated total number of trees used by village	**17000**	2900	4200[5]	5600	4300
Estimated size of resin collection area (ha)[2,3]	**32100**[4]	-	7800	12600	11700
Estimated density of actively harvested resin trees (trees/ha) [2]	**0.44**[4]	-	0.54	0.44	0.37

[1] Excludes families with no trees.
[2] Ignoring small areas of overlap between villages.
[3] Calculated from Figure 7 in ArcView using the extension 'Points to Polygon Version 1.2'.
[4] Covers three villages, not four.
[5] Excludes two groups of trees in the area owned by people from other villagers; including these is estimated to increase the number of trees and the density by about 2.5%.

The table shows great similarities between the four villages. Ph. Roka Thmei is slightly unusual in having fewer, but much larger groups of resin trees per family, resulting in a much higher total ownership of trees per head. Interestingly this is cancelled out by lower resin prices so that family incomes are much more similar (Table 11).

The great majority of trees tapped are *Dipterocarpus alatus*; reports suggest about 92%. However, direct tree counts from randomly selected groups of trees suggest that the other main species, *D. intricatus,* was heavily over-reported in interviews (189 reported, 83 counted), making the likely true percentage of *D. alatus* even higher (Table 13).

A large total number of trees is in use by each village. However, these are spread over great areas of land, so that on average there are only 0.44 tapped trees/ha. Note that this includes large areas of Deciduous Dipterocarp Forest with almost no resin trees so densities in more evergreen forests are markedly higher than this figure.

The forest visits allow a cross-check on the accuracy of tree counts reported in interviews. Across 55 randomly selected groups of trees the difference between the number of trees reported and the number of trees counted was only 1%, indicating that the interviews give very good information overall. However, analysis of individual reports shows that these were often unreliable, with errors increasing rapidly in size as the number of trees increased. For groups of more than 70, errors were especially large, and a mixture of both under- and over-estimates. Therefore data for individual groups or families should be treated very carefully.

The forest visits also allow a partial cross-check on the dates of first tapping reported in formal interviews. Forest visits were often carried out several days after the interview covering the same group of trees. In 63% of cases the informant gave a different estimate of year of first tapping, in 32% of cases the difference was more than two years in either direction and in 7% of cases (four groups) the difference was +/-8-10 years! The mean date from formal interviews was almost one year earlier than reported during forest visits. Clearly one or both sets of data are unreliable. We consider that the answers provided on forest visits are more reliable, because the informant had much more time to consider his answer and he was less likely to feel under pressure than during the formal interview. Therefore we reject the larger dataset from interviews as being too inaccurate for useful analysis and

suggest that other workers treat estimates of tapping duration from formal interviews with similar caution. Clearly it is possible that our estimates from the forest visits are also in error, and so any analysis involving duration of tapping as a variable should be interpreted cautiously.

4.8.2 Income from resin trees

Table 10 shows the prices reported during interviews in each village.

Table 10 Seasonal variation in reported prices (Riel) for a standard 30 litre resin container

	Dry season		Wet season	
Village	Duration	Price	Duration	Price
Ph. Pu Char	January-March	23,000	April-December	8,000-18,000
Ph. Kati	November-June	21,000	July-October	15,000-18,000
Ph. Andong Krolung	December-May	22,000	June-November	18,000
Ph. Roka Thmei	November-February March-April	9,000-10,000 13,000	May-October	9,000-10,000

Rainy season prices are lower, probably due to lower resin quality and poor road conditions, but there is a complicated pattern of variation. For example, the period of high prices ranges from 2 to 8 months amongst these four villages. The prices achieved also vary widely between villages at a given season. One reason is probably differing transport costs (e.g. Ph. Roka Thmei is more remote and people there achieve much lower prices) but levels of formal and informal taxation may also differ depending on the trader and trade route involved. A third point is that in Ph. Roka Thmei many people are in debt to the traders after receiving credit in the form of rice; this may also lower their ability to bargain for a fair price.

Reported average dry season yields were cross-checked in Ph. Kati by observing the yield from single visits to 12 groups of trees. The total expected from reports was 320 litres; the total observed was 332.5 litres, a difference of less than 4%. Therefore the reported yields are believed to be an accurate reflection of the true figures, at least for the dry season. None of the wet season forest visits coincided with resin collection days so there is no independent cross check of the reported figures

Many people report slightly increased resin yields during the rainy season. However, for the 55 randomly selected groups of trees average reported yields per counted tree only rose from 0.72 litres/visit in the dry season to 0.74 litres/visit in the wet season. This seems to be a negligible increase, but may be an underestimate of the difference in output by the trees because some rainy season resin is lost through tap flooding and so not counted and several groups of trees are not tapped at all when rivers are swollen.

Combining reported median price, season length, frequency of collection and average yield allows the annual income to be estimated for each family (means in Table 11). The calculations here do not take account of the slightly lower prices earned by tappers who are not able to transport their own resin out of the village to market, nor of the 'hidden income' that results from traders deducting money from the selling price to take account of the sellers' debts.

Table 11 Mean estimated incomes from resin in the four study villages

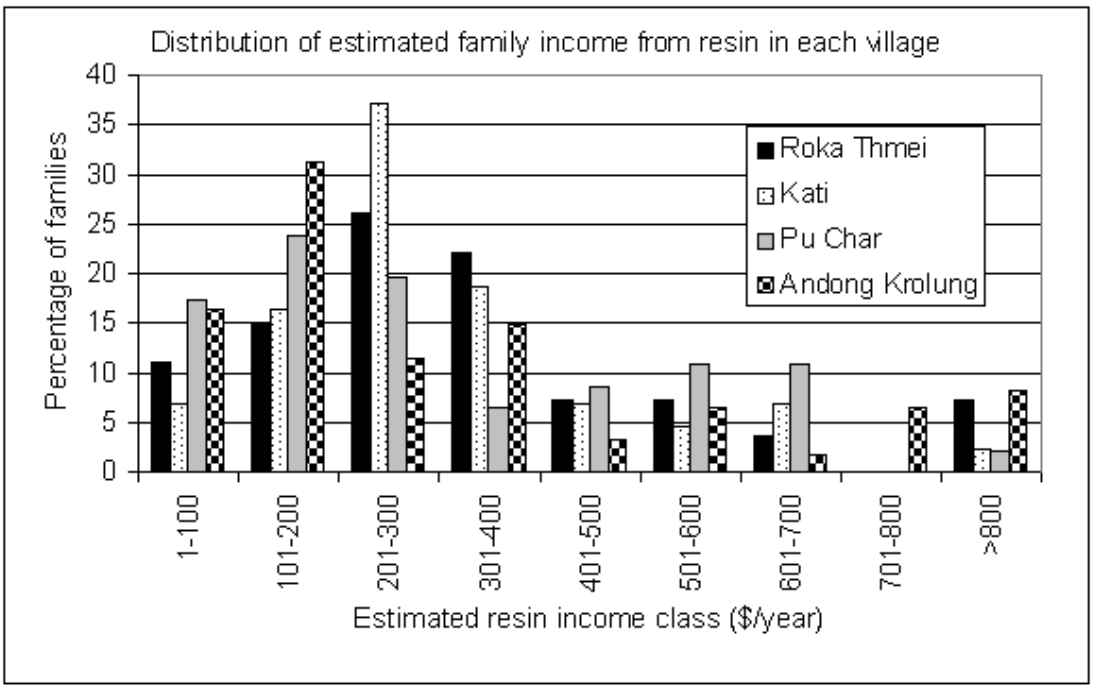
	All villages	Ph. Pu Char	Ph. Kati	Ph. Andong Krolung	Ph. Roka Thmei
Number of tapping families[1]	**181**	38	38	73	32
Mean income per family that taps resin ($/year)	**338**	299	314	377	329
Total village income from resin ($/year)[1]	**61200**	11300	11900	27500	10500
Mean income from resin per area ($/ha/year) [1,2]	**1.9**[3]	-	1.5[4]	2.2	0.9
Mean income from resin per tree ($/tree/year)	**3.6**	3.9	2.8	4.9	2.4
Mean income from resin per tree (Riel/tree/year)	**14000**	15000	11000	19000	9000

[1] Includes an estimate for families not interviewed, assuming they are uniform with those interviewed.
[2]Areas (from Table 11) include significant areas of deciduous forest unsuitable for resin trees.
[3]Covers three villages, not four.
[4] Excludes the two groups owned by outsiders; these would add approximately 2.5% to the income/ha.

The mean income per family is markedly similar from village to village. However, the mean annual income per tree and per hectare vary more, with the highest rates in Ph. Andong Krolung and the lowest in Ph. Roka Thmei. This is because Ph. Andong Krolung reports the highest yields, medium densities and high prices per litre.

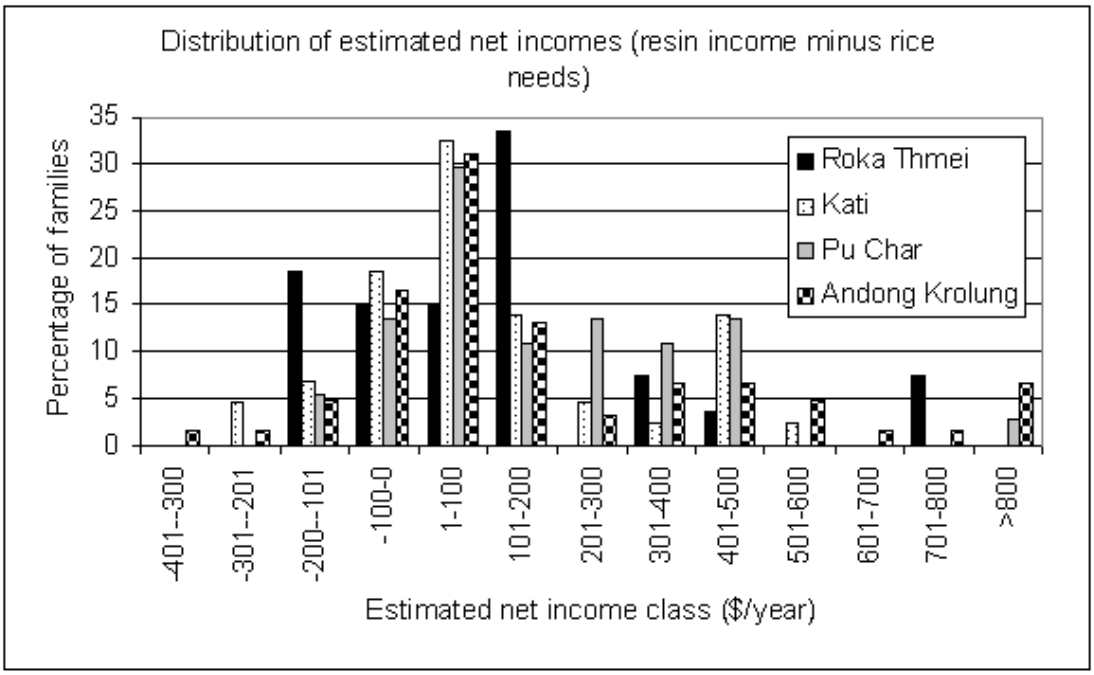
The income per tree per year should not be compared directly to the timber value of the tree for several reasons. Firstly the resin income can be obtained for many years, whilst the timber income is a one-off. Secondly, the income from felling a tree would mainly be received by already-rich outsiders, whereas the resin income is received by rural people with few other sources of income. Thirdly, the cash income from timber takes no account of the significant losses society incurs due to environmental damage; by contrast the resin collection appears to have almost no environmental cost (Section 0).

Figure 8 Distribution of estimated family income from resin in each village



The distribution of incomes in $100 classes (Figure 8) is similar in shape in each village, with most of the families clustered from $100-$400 and a long, low tail of families with much higher earnings (more than $2000 in one or two cases).
These figures could only be directly cross-checked by long term income diary methods. However, one partial cross-check can be made with existing data, because much of the gross income listed here has to be spent directly on rice. Rice needs can be calculated since family sizes and the reported average annual rice deficit for each family are known. Helmers (1997), citing an unspecified MAFF study, suggests a national average consumption of over 250 kilos of unmilled rice per person; since in our study site diet is less diverse and physical demands are greater than average we have used an estimate of 300 kg. With rice priced locally at $10/50 kg bag this gives a cost of $5/person/month of rice bought. The distribution of estimated net incomes (i.e. resin-rice, before other costs) is shown in Figure 9

Figure 9 Distribution of net incomes (resin income minus rice needs)



Most families are estimated to have a net income of $1-200 from resin-tapping after allowing for their family rice requirements. Many families also have some additional minor sources of income (see Table 7) whose cash value cannot be calculated with the available data. This level of wealth is more or less consistent with the current conditions in the study villages. The fact that a significant minority are estimated to have deficits may indicate that the method is not very accurate, or that these families depend heavily on other types of income, credit or support from relatives to break even.

4.9 The effects of logging

4.9.1 Locations and scale of logging

Large *Dipterocarpus* trees are among those favoured by loggers, and this often includes trees actively tapped for resin. Felling stops resin production and the trees do not resprout. Felling of resin trees was widely reported in three of the study villages, the great majority occurring in 1998-99. Appendix 5 lists the main areas where felling was reported; descriptions in interviews were quite general and field visits were not made to check exact locations. The whole area falls within the Samling International concession but some of the logging was reported to be done by other parties, not always identified. In 1998-99 the only part of the study area where the concessionaire could legally fell timber was Coupes 2a and 3 (for Coupe boundaries see Figure 10); reports suggest that logging by various parties also occurred widely in Coupe 5.

Figure 10 Logging coupe boundaries

Fig.10 Logging coupes boundaries

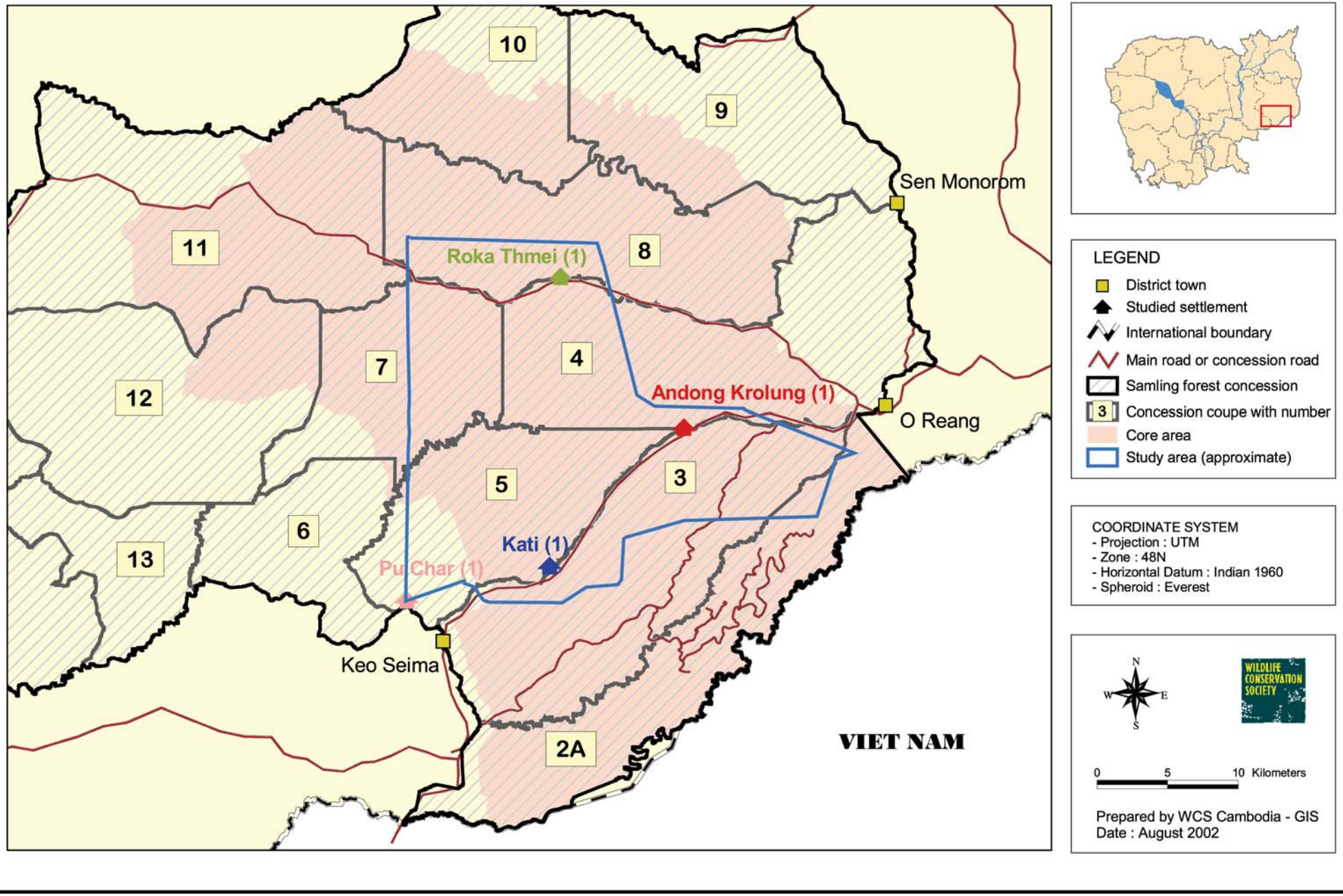


Table 12 shows the reported amount of logging of resin trees since the reoccupation of the villages.

Table 12 Reports of recent logging, and replacement trees found since logging took place

	All villages	Ph. Pu Char	Ph. Kati	Ph. Andong Krolung	Ph. Roka Thmei
Number of interviews	***189***	***48***	***38***	***71***	***32***
Number of families reporting loss of some trees	**69**	24	18	27	0
Estimated total number of families losing some trees[1]	**82**	31	19	32	0
Range of number of trees lost (trees/family)	**2-300**	2-70	2-200	7-300	-
Total number of resin trees reported felled	**3073**	547	692	1834	-
Mean loss among resin-tapping families (trees/per family)	**23**	15	19	30	-
Percentage loss of trees active in 1998[2,3]	**27**	20	26	30	-
Number of trees marked for felling but then not cut	**195**	0	155	0	40
New trees tapped since time of felling[3]	**1029**	232	0	797	-

[1] Assuming non-interviewed families are uniform with those interviewed.
[2] Covers three villages, not four.
[3] The number of trees estimated to be in use in 1998 is calculated as (number of trees in use in 2002 + corrected number of trees felled in 1998 – number of trees for which tapping reportedly started after 1998). The corrected number of trees felled takes into account the possibility that reports of felled trees included some trees that had already ceased resin production. The percentages of such trees in 2002 in each village were used to estimate the percentage of felled trees likely to have been in the same category. This is likely to underestimate the true number and percentage of actively tapped trees that were felled.
[3] These trees were often reported to be much smaller than those felled.

Three of the villages experienced substantial losses, but Ph. Roka Thmei has so far escaped logging of resin trees. The impact on individual families varies widely; some families lost no trees, other lost a few and some lost very many. The average current income from a standing tree is shown in Table 11 but this may be a slight underestimate of the average value of felled trees. This is because the minimum felling limit for these trees is 60 cm dbh, somewhat larger than the size at which resin-tapping starts (Section 0) and so smaller trees will make up a larger proportion of the post-logging population. On average smaller trees are less productive than bigger ones (Section 0).

4.9.2 Defence of trees by villagers

Although the law appears to protect tapped trees it was not possible for tappers to prevent the felling of their trees in these three villages, since the loggers had extensive paperwork supporting their activities. One point sometimes mentioned to villagers was the regulations allowing tapped trees to be felled as long as compensation was paid. Several people reported being told that their trees would be felled anyway, so they may as well accept some compensation; low levels of compensation were offered (5000-10000 Riel/tree) and reportedly even this was sometimes not paid.

There was widespread unhappiness about the felling and related loss of income but the people had little political strength with which to defend their rights. Despite the risks to their safety, one man reported taking off the pre-felling tags fixed to his trees, members of another village wrote a formal letter of complaint to the district authorities and several villages sent delegations to the concessionaire's office. However, these attempts were unsuccessful, except that they helped more people to get offers of compensation.

4.9.3 Livelihood changes in response to logging

When faced with the loss of an average 20-30% of their resin income (and up to 100% for some families) people had few alternatives sources of income to turn to. Section 0 shows the limited range of livelihood options available in the study villages. No other quantified information was collected on this subject but extensive discussions were held, especially in Andong Krolung where tree losses were worst. The two main responses that people described were to increase the area of chamkar under cultivation and to seek casual wage labour. Some families that previously had no chamkar took it up; many others increased the area of land that they had under active cultivation although we were not able to quanitfy the increases. The increase only replaced a small part of the lost income, since labour is the main limiting factor to the area under cultivation. With fewer resin trees to visit, more time was available for agriculture, but typically only 1-2 extra days per week by one adult plus one child per family, because resin collection doesn't take up much time. This means that the proportional increase in labour available for agriculture was quite small, especially in view of the low productivity of farmland in the area.

Wage labour was also limited; few opportunities exist and they are seasonal and poorly paid. There was formerly some work as guides or manual labourers with the logging crews but this kind of work has not been available since logging stopped in 1999. There were no reports of families or individuals moving away from the area to look for better incomes elsewhere. This would be seen as an extreme act of last resort by most interviewees because most members of the Phnong ethnic minority are inexperienced in urban life and have no support network of friends and relatives there.

It might have been expected that harvesting of other forest products would increase and this is probably true in a limited way. However, few local products currently have markets so the scope for expansion was limited. One exception is hunting. Commercial hunting of large mammals would probably have increased were it not for the mass confiscation of guns which coincidentally happened at about the same time, greatly reducing opportunities for hunting. Small-scale commercial hunting of smaller species with dogs is reported to have increased somewhat, despite declines in dog numbers due to disease; those families that do have dogs reportedly spend more time hunting now than they did before logging took place.

There were no consistent reports of major effects on the health or education status of the communities following logging, but these subjects were not examined in detail. The main effect of reduced income reported by people in the villages was greater difficulty in getting enough food. Many more families now have to supplement their diets with low quality foods such as forest tubers and bananas. The tubers, in particular, are very laborious to collect. They were reportedly a mainstay of the local diet in the years before 1970 when no resin was traded.

4.10 Biological aspects of resin-tapping

4.10.1 Characteristics of tapped trees

Table 13 shows the characteristics of the randomly selected groups of trees studied in each village.

Table 13 Characteristics of the randomly selected groups of trees studied in each village

	All villages	Ph. Pu Char	Ph. Kati	Ph. Andong Krolung	Ph. Roka Thmei
Number of groups studied	**55**	-	21	21	13
Total number of trees	**2555**	-	722	867	966
Total number of actively tapped trees	**2347**	-	702	782	863
Percentage of *D. alatus*	**96**	-	97	95	97
Mean dbh of trees (cm)	**82**	-	81	83	83
Mean basal area of trees (m^2) [1]	**0.59**	-	0.58	0.61	0.59

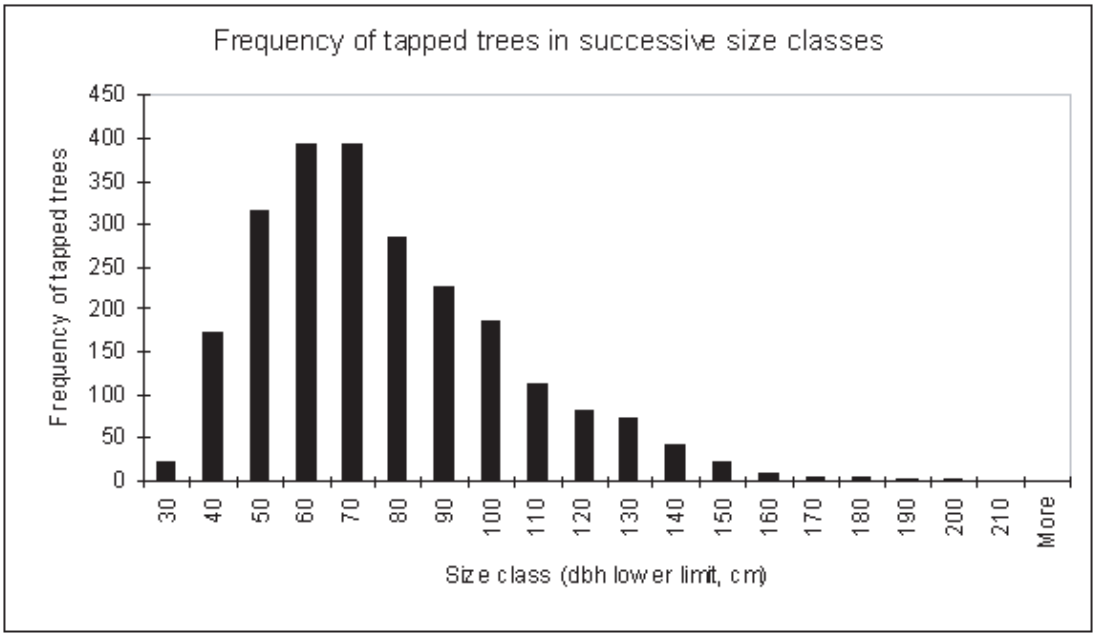
[1] Cross-sectional area of trunk at breast height; this is often a better guide than dbh to total tree size and other characteristics dependent on tree size, such as timber volume and fruit production.

It is notable in the table above that the species composition and mean tree size (using two measures) are very similar in all three villages. In fact, no substantial differences were found between villages in any of the following analyses.

Average tree size (using basal area, square-root transformed to ensure normality) also showed no statistically significant trend in relation to the year trees were first tapped. We might expect that the big trees would be found first and groups of smaller trees tapped later when the best trees were taken, but this was not so. People did report that the few groups of trees found and tapped after the intensive logging in 1998-1999 were made up of small trees since most big trees were cut in logged areas. There were too few groups in the sample from this period, so this cannot be tested with our data.

Figure 11 shows the distribution of trees amongst various size classes. The very smallest tapped tree was 33 cm dbh but very few (3.5%) were smaller than 45 cm dbh. About 78% were larger than 60 cm dbh.

Figure 11 Frequency of tapped trees in successive size classes



From 70 cm dbh upwards the number of trees tapped in successive classes gets smaller, even though these are the preferred trees because of their high yields. This is likely to be because all suitable trees in these classes are being tapped and the availability of larger trees is naturally lower. Declining densities in successively larger size classes are typical of many forest tree species, although recent logging has probably exaggerated this effect.

The declining numbers in successively smaller size classes below 70 cm requires some explanation, since the number of trees present in the forest is likely to be larger in these classes. Possibly the density is depressed in these classes, due to some past mortality or recruitment failure, or possibly a smaller proportion of trees in this class are judged to be suitable for tapping.

The usual practice is for a tree to have one active tap at a time. Trees larger than 70 cm dbh occasionally have two and trees larger than 95 cm dbh occasionally have three, four or even (once) five active taps. As a given tap ceases to yield it is usually replaced by a new hole. Abandoned taps gradually form new bark, at least round the edges, but they do not fill in much, so trees gradually accumulate holes. Table 14 show the number of trees with different numbers of active and exhausted taps

Table 14 Frequency (%) of trees with different numbers of taps

	Number of exhausted taps				
Number of active taps	0	1	2	3	Grand Total
1	76.5	10.0	1.3	0.2	87.9
2	10.0	0.7	0.2	0	11.0
3	0.8	0.2	0	0	1.0
4	<0.1	0	0	0	<0.1
5	<0.1	0	0	0	<0.1
Grand Total	87.4	11.0	1.4	0.2	100.0

Tapping intensity is generally low. The mean number of active taps per tree is 1.14. In total 87.9% of trees have 1 active hole and 0-3 previous abandoned holes (usually 0). A further 11% have 2 active holes and 0-2 exhausted ones, leaving only 1% with more holes in either class. Usually only big trees (<70 cm dbh) have more than one hole and only very big trees (<100 cm) have more than two. There is no relationship between the number of active holes and the mean duration of tapping in that group. Mean duration is used because different trees in the group began to be tapped at different times.

Although the total number of taps in a tree (active plus exhausted) logically must increase over time this appears to be a slow and variable process. There is no statistically significant relationship at all between duration of tapping and total number of taps in our large data set.

4.10.2 Trees ceasing to yield resin

In some cases a tree will not provide usable quantities of resin, no matter how many taps are cut. This can happen in two ways. Some trees do produce resin from the first one or two taps but when this eventually runs dry none can be got from new taps. We call this an *exhausted* tree. Other trees never give resin in usable quantities, even from the first tap cut. We call these trees *non-starters*. Table 15 show the proportions of trees in these two categories.

Table 15 The proportion of trees observed that are exhausted or never started giving resin

	All villages	Ph. Pu Char	Ph. Kati	Ph. Andong Krolung	Ph. Roka Thmei
Total number of trees observed	**2555**	-	722	867	966
Total number of non-starter trees	**62**	-	3	36	23
Total number of exhausted trees	**146**	-	17	49	80
Percentage of exhausted trees	**6**	-	2	6	8
Percentage of non-starter trees	**2**	-	<1	4	2

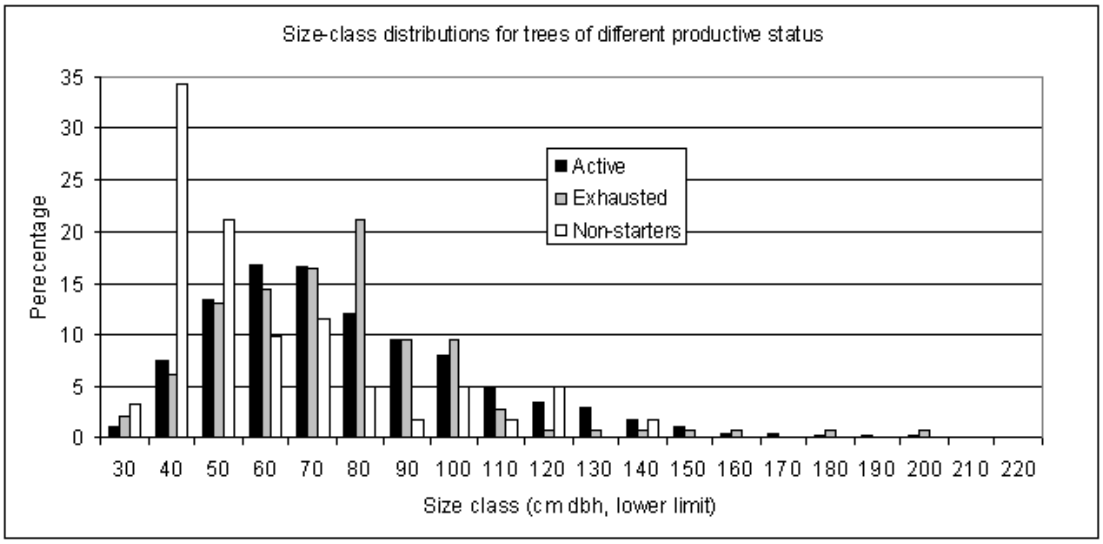
The percentages in these two categories are low. For example, only 6% of trees have become exhausted over the first 5-10 years, and so this process is not a major current management concern for tappers. However, there is no information from trees tapped for longer than about ten years, since this is when most tapping began in the area. It cannot be assumed that the trends observed in the first decade will continue unchanged over the next ten years; the rates of exhaustion might rise or fall.

Therefore, it would be helpful to understand the processes that cause trees to cease giving resin if we wish to predict long term trends in resin production. Full statistical analysis of the data collected were beyond the scope of this report, but some preliminary conclusions are given here.

For non-starter trees a clear cause for the lack of resin is sometimes visible, invariably the fact that when the tap is cut the tree is found to be hollow. For other non-starters there is no obvious reason. For exhausted trees, nobody was able to suggest why some apparently healthy individuals became exhausted quickly whilst others continued giving resin for many years. Neither was any cause obvious to us when we inspected the trees, since they almost all appeared healthy. There was absolutely no evidence that these trees had become sick or badly damaged as a result of tapping and so ceased to produce resin. This point is discussed in more detail in the next section.

The proportions of exhausted and non-starter trees in each group of trees are highly variable. Many groups have none in either category, some have quite large numbers in one or both. Figure 12 shows the proportions of trees in each size class for each productive category. The use of percentages makes comparisons easy, but remember that the actual number of trees in the 'active' class is much greater than in the other two. The size distribution among exhausted trees is similar to that of active trees, suggesting that size is not a major factor influencing the likelihood of becoming exhausted. However, non-starter trees are mainly in the smaller size classes (30-60 cm), suggesting that many non-starter were simply too small to be tapped. The wide variation in non-starter rates between tappers suggests that men vary widely in their ability to judge the potential of a small tree.

Figure 12 Size-class distributions for trees with different productive status



Too few *D. intricatus* trees were recorded to make a clear comparison between rates of exhaustion in the two species.

4.10.3 Damage to trees

Signs of direct damage were recorded for each tree. The four-point scale is given in Table 16.

Table 16 Damage classes used to assess direct damage to trees

Damage class	Criteria
1	Wood and bark fairly intact above tapping hole
2	Bark burnt above tapping hole but wood fairly intact
3	Wood burnt above tapping hole/dead branches above hole
4	Tree dying

Severe damage was very rarely recorded – in fact no trees were recorded in Class 4 and none of those in Class 3 had dead branches above the tap. Furthermore only four trees were seen that had formerly been tapped for resin but had since died. For two there was no obvious cause, but two had fallen over after forest fires weakened the base of the tree. A forest fire would be unlikely to harm an untapped tree. The deaths were probably due to the resin in an unattended tap catching light and burning for a long period. This can occasionally happen if leaves and twigs have accumulated at the base of the tree, something that careful tappers avoid by periodically clearing the debris away.

Minor damage was recorded more often (Table 17). On trees with more than one active tap we used the score for the most severely damaged active hole.

Table 17 Proportion of trees showing each damage class

Damage score	Percentage of trees
1	78
2	15
3	7
Total	100

The great majority of trees (93%) show only minor damage, classes 1 and 2. This included scorching at the mouth of the hole and, for class 2, some charring of the bark in an area 20-50 cm above the tap. There is also a large, unsightly sooty area on the surface of the bark but this should not be mistaken for damage to the tree.

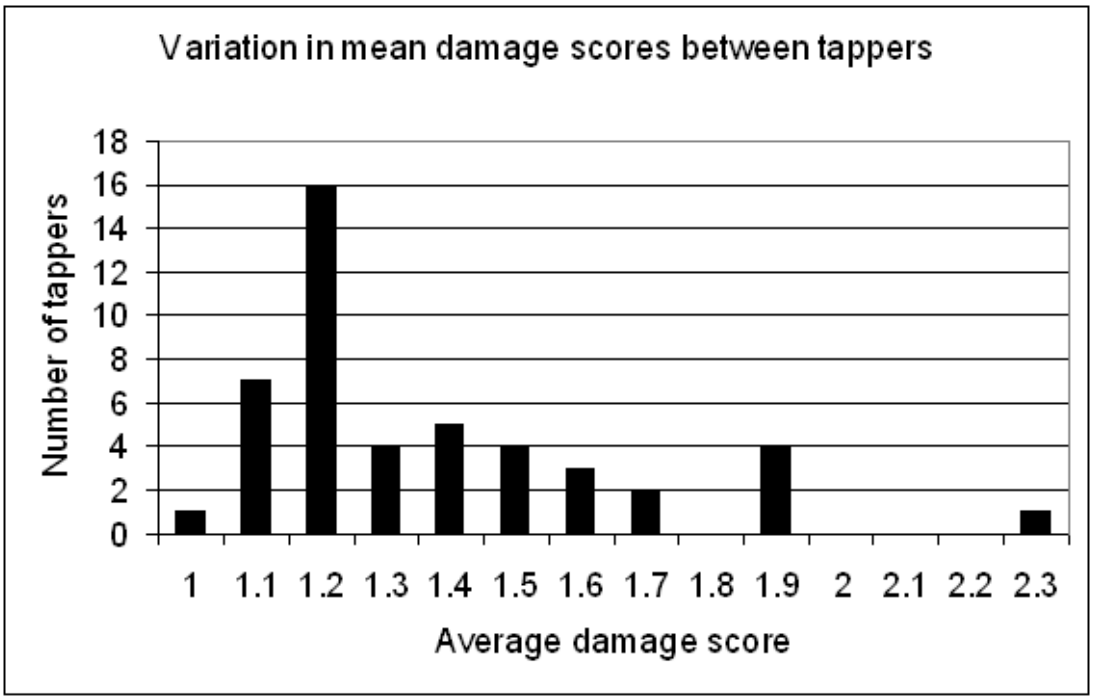
Only 7% of tapped trees showed signs of slightly more serious damage, with an area of bark totally burnt through and the underlying wood becoming charred. This was usually confined to an area of only 10-30 cm wide and 5-30 cm high and can still be considered minor damage. Only on a tiny

handful of trees was extensive damage to the wood seen that extended more than 50 cm above the tap; this was probably caused by full taps catching light during forest fires, as mentioned above. Even these trees were clearly vigorous and able to fruit copiously during the study period

There is no statistically significant correlation between the mean number of years of tapping and the mean damage score. The data suggest a very weak progressive increase in damage score may take place, but this only represents a change in average damage score from 1.27 to 1.28 over ten years – a trivial change even if it could be proven. The fact that some groups of trees have relatively high damage scores is probably due to a factor other than the length of time they have been tapped, probably including the skill of the tapper.

Tappers appear to vary a little in the level of damage they cause to trees**.** A chart of the average damage score for each tapper (Figure) shows that most are grouped at the lower end of the range, with mean scores of 1-1.5. For these tappers typically the majority of trees score 1 and few (at most 50%) score 2. Only one tapper had a mean score of more than 2 – many of his trees scored 3 suggesting he was unusually careless.

Figure 13 Variation in mean damage scores between tappers

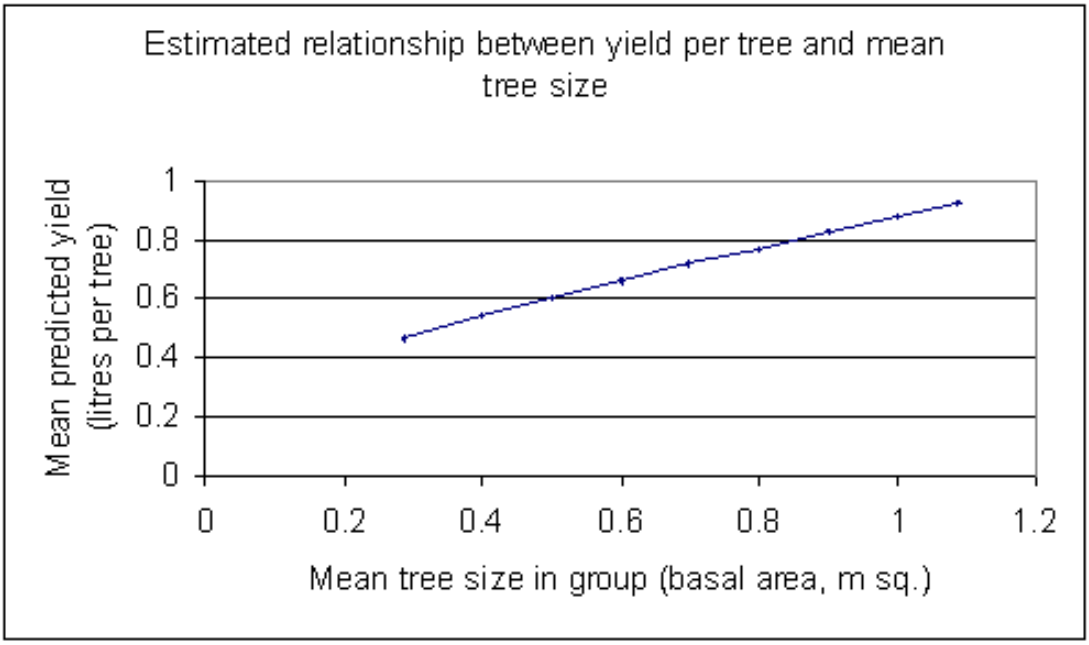


4.10.4 Factors affecting yield

Many factors seem likely to affect the yield of a tree, including its size, tapping duration, skill of tapper, environment, health, genetic factors and annual or seasonal climatic effects. We are able to estimate the effect of the first two aspects using our data. We analyse data at a group level rather than an individual tree level because this is the level that reported yields were provided, and because lack of independence for trees within a group makes random sampling of individuals difficult.

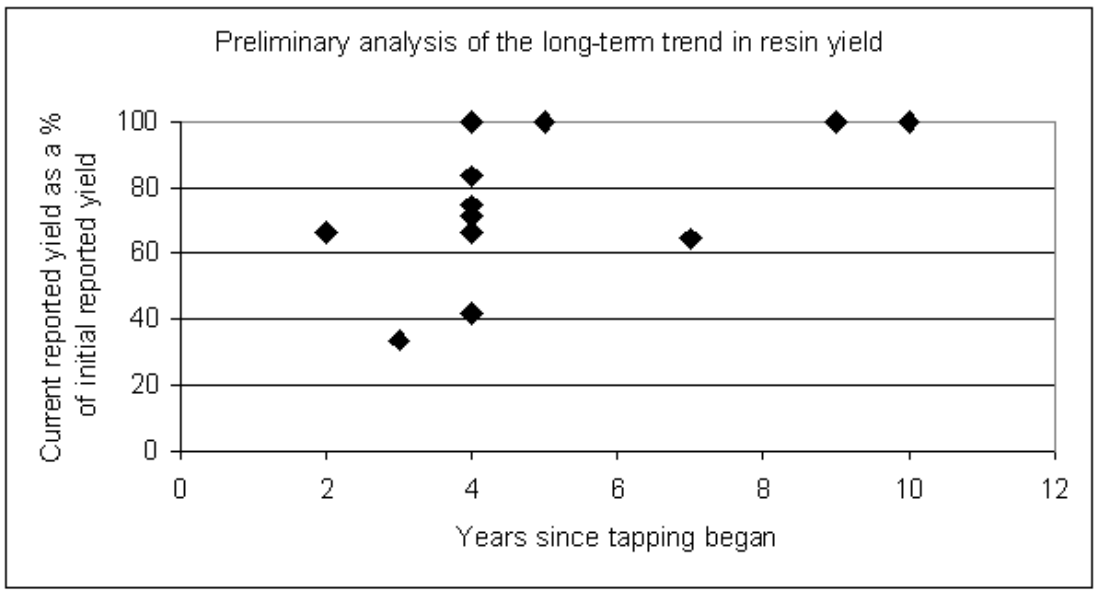
Mean reported dry season yield per visit per observed tree (square root transformed to improve normality) was taken as the dependent variable and a General Linear Model was fitted, using mean basal area (square root transformed) and duration of tapping as covariates and village as a random effect. There were no significant interactions in the fully or partially crossed models so a reduced model was fitted using only main effects. Mean basal area was a significant predictor of yield (root mean yield = 0.384+0.554 root mean basal area, p=0.02) but village and duration of tapping were not. Figure show this estimated relationship between yield and mean tree size. It is a steep relationship – sampled groups range from 0.29 to 1.09 m^2 average basal area and the predicted average yield rises from 0.47 to 0.93 litres per tree over this range. However note that the observations show a great deal of scatter around this average relationship, suggesting that many other causes of variation are also important.

Figure 14 Relationship between yield per tree and average tree size



Although duration of tapping was not shown to be an important factor by this test, this may be because the test was not accurate enough. Tappers usually report declining overall yields since they first tapped the trees, but it is not clear if these declines level off or will continue until every tree is exhausted. It is impossible to use most of the reports to analyse declines in yield because the number of trees being tapped in a group varies over the years due to logging, exhaustion and the delayed start to tapping some 'reserve' trees. Fourteen of the 55 groups of trees suffer from none of these problems and a preliminary analysis based on these groups (Figure) shows some decline in almost every case but no evidence of an inevitable long term decline.

Figure 15 Preliminary analysis of the long term trend in resin yields



Some of the groups give only 35-65% of their initial reported yield, but others are doing better. Most notably, rather than yields dropping off towards zero with time they appear to be maintained or even partially recovered, after an initial drop. Increases are not impossible, since trees

may respond to continuous tapping by increasing their defensive resin production at the expense of other activities, such as growth or fruiting. However, great caution is needed here for two reasons:

- the analysed sample has selectively excluded groups where reserve trees have been used – but these are probably the very groups where yields have declined most strongly
- tappers' memories of the initial yield may become less reliable with time, so the reports from longer ago may be biased in some way (e.g. reporting the yield a year or two after tapping began, after declines had occurred).

For these reasons further study of this key question is necessary. Interview data are unlikely to be suitable for this purpose, unless tapping dates can be determined more reliably.

4.11 Hunting practices

Information collected on hunting was mostly anecdotal and so it is difficult to quantify the following conclusions. They are discussed here under two headings, followed by notes on electrofishing. Most data on hunting were collected during informal discussions, since it is widely known to be illegal and it might thus have distracted attention from resin-tapping during formal interviews, or changed interviewees' willingness to talk openly.

4.11.1 Hunting of large-bodied mammals by specialist hunters

This category has high impacts on threatened species, is economically important to only a few members of the community and has a high involvement by outsiders.

Hunted species include muntjacs, Sambar, Gaur, Banteng, bears and Tiger, with at least the first four of these still occurring in significant numbers around the study villages. Total volumes hunted are probably not very high, but they are thought to be very significant in comparison to the already reduced populations of some of these species. The balance of hunting pressure between locals and outsiders is not clear, but both are believed to be significant threats. To give an indication of general levels of hunting, in most areas gunshots are heard in the forest much less than daily during 2002 (from discussions with WCS field teams). Several hundred snares were confiscated by two patrol teams in their first three months of operation and snaring is believed to be on the increase (Men Soriyun 2002).

Some outsiders visit the study area to set traps and snares or hunt with guns. Often they are soldiers or policemen from towns such as Keo Seimaa, Snuol, Sen Monorom, Memong and Kompong Cham and they may either camp in the forest or stay in villages whilst hunting. Most instances of hunting and snaring by outsiders that have been detected by patrol teams during 2002 have been in Coupes 2a and 3 (Men Soriyun 2002, Clements 2002, see Figure 10 for coupe boundaries). This is likely to be a real pattern, reflecting ease of access for hunters, but patrols in other area have been less intensive and so significant hunting in other coupes could also be occurring. Significant instances of hunting in areas north of Coupe 3 have been noted by Walston *et al.* (2001), Clements (in prep.) and the present survey (Appendix 6).

Amongst local residents, guns are only legally held by members of the police (1-2 living in each village), military police (a guard post in Ph. Andong Krolung) and the regular army (varying activity in the area, currently not in areas close to the four study villages). These people may hunt directly but more often loan their guns to other local people to hunt on their behalf. Large ungulate meat is mostly sold, either locally or in the surrounding towns, and trophies are also sold if they are suitable. Meat and income from a kill are shared between hunter and gun owner, with some occasionally being shared with other people in the village. Due to the great skill involved, only a small number of local men are reported to take part in this kind of hunting, representing only 0-2 families per village, and their activities are well known to other members of the community.

Hunting of pangolins in the study area requires special searches for scratches that indicate occupied trees or burrows. Pangolins were caught more in the past but are now very scarce and this is not a significant livelihood for anybody in the study area. However, the price of a single adult (over $50) is 15-20% of the average family's annual resin income and so even occasional finds are valued.

Hunting trips by local residents are mostly done with that as the main purpose. Guns, bows and crossbows are very rarely carried on routine resin-tapping trips, according to our interviews, our observations in the field and discussions with other WCS field staff. The resin containers are bulky (and soon become heavy) so it would be inconvenient and inefficient to try to combine the two activities. We also saw very little evidence that resin-tapping was combined with the checking of snare lines.

One possible way that resin-tapping may contribute to increased hunting of large mammals is that it ensures regular observation of animal activity in remote areas, making it easier for hunters to find information on promising areas to search. A second way is that the minority of tree groups requiring overnight stays in the forest give the tapper more opportunity to hunt in remote areas.

4.11.2 Hunting of small and large-bodied animals by non-specialist hunters

This category mostly involves lower conservation impacts, is economically significant to more families and is mainly conducted by local residents.

Hunting of smaller species is conducted much less intensively than TDE has observed in many areas of Lao PDR. For example, ricefield rats and squirrels are rarely taken for food. However, there is targeted hunting of some animal groups. Much of this is for local consumption. HM spent much time in each village talking with adult women about the types of food they prepare and based on this work she has drawn the following general comparisons.

Fish is the only common form of animal protein eaten, mainly in the form of small quantities of *prahoc* (fermented fish). Fresh fish is eaten less than daily. Fish greatly outweighs the various types of animal meat, all of which are eaten irregularly.

Wild pig meat is probably the most important type of animal meat. It comes from animals snared occasionally around the chamkar fields and then shared out between neighbouring families.

Wild monitors and occasional turtles or porcupines are caught with the help of dogs whilst walking in the forest. Many families report hunting monitors and turtles with dogs (Table 7) and those that have dogs always take them on resin-tapping trips. This is a significant link between tapping and one type of hunting. However, people also hunt with dogs when tapping is not being done, and reports suggest that this type of hunting actually increases after resin trees are logged (Section 0). Monitors are mostly caught during April-May, when they are easiest to find - a family may get several during this time and on one of our forest visits we observed three being caught by one man in a day. Population trends in these species were not discussed during the interview surveys but turtles at least are known to be highly vulnerable to harvesting due to their low reproductive rate. Some Brao communities in Ratanakiri report that their harvesting is causing declines amongst both monitors and turtles (I. Baird pers. comm. 2002).

The least significant source of meat is domestic animals (pigs, chickens, cows) which are only eaten very occasionally, almost always at festivals or when important guests are present. Importantly they also function as stores of wealth which can be sold quickly in case of need (P. Swift, pers. comm. 2002).

The sale value of monitors and turtles is probably more significant than their food value. Although some are eaten a larger proportion is sent for sale as meat in nearby towns. The total income from this is likely to be moderate (e.g. a 5 kg monitor is worth about 15000 Riel or $3-4) but still significant to some families.

Extensive snaring of groundbirds and medium-sized mammals is not common in areas we visited. Only two brush-fence snarelines were seen, one active one near Ph. Kati (1) and one abandoned one near Ph. Roka Thmei (1). The Ph. Kati (1) site probably involved a Vietnamese man who has recently started to visit the village to snare jointly with some residents there.

Despite extensive discussions, little evidence was found of traditional controls on hunting either for resource management or religious reasons. The exception was that some families have taboos on eating particular types of animals, e.g. one family may avoid porcupine, another rabbits or softshell turtles. These taboos are hereditary and result from some ancestor of the family having a severe bad dream about this type of animal. By themselves, these taboos probably have little scope for development into more formalised protection measures.

4.11.3 Electrofishing

A brief note is needed here on fishing practices. These were not studied in detail, but in general most families catch small and medium sized fish from the various small streams in the area. These are usually caught with small-scale gear and eaten in the family, where they form an important part of the diet. Most people report no conflict over fish supplies – there is enough for everybody and it is fine for people from one village to visit the area of another village for fishing. However, commercial electrofishing is significant in two villages. In Ph. Pu Char this is conducted by people from Keo Seimaa and is causing significant hardship for people in the village. In Ph. Roka Thmei this is done by three of the richer families in the village; it did not appear to be a significant worry for other people in the village.

5 Discussion

5.1 Interview methodology

Unless used carefully, interviews can generate meaningless numerical data that appear detailed and accurate. Interviews were central to the present study, but many of the results could be cross-checked with other pieces of data. A brief discussion of the results may be helpful to others planning similar surveys.

Most of the interview data had adequate reliability for the purposes intended, but close examination revealed significant limits to the accuracy of the data. The main problem was that individual responses seemed to have a fairly high degree of random error. When these responses are aggregated the data closely approach the 'true' figure – for example the total reported number of trees across many groups of trees was very similar to the actual number (Section 0) and the total reported yield across many groups was very close to the actual observed yield (Section 0). However, for tree counts the responses for individual families were often different from the observed values by a large margin. This means that decisions or conclusions drawn from the unaggregated data have a high chance of being wrong. This does not imply a bias in responses, merely imprecision.

Estimates of total income seemed to give plausible results and a fairly reasonable distribution of values (Section 0), supporting our confidence in the various questionnaire answers that went into the estimate. Likewise, allowing for rice deficits gave a reasonable range of estimates for net income (Section 0). However, we would not be confident in using the estimates for individual families for making important individual-level decisions without additional cross-checking.

Forest visit information on dates that tapping began suggested that the answers from formal questionnaires were highly imprecise, and slightly biased, perhaps because they were less carefully considered (Section 0) so most of these data were discarded. Even the carefully-considered dates we do use are probably slightly imprecise, but fortunately this can be handled as just another source of error in statistical analyses.

5.2 Demographic trends

Trends amongst Phnong and non-Phnong communities are best treated separately. Very few non-Phnong people live in the study area and their numbers are hardly growing. They mainly work as traders, soldiers or policemen. However, there is a major influx taking place just west of the study area, both along the main road and near the main district towns. This influx was not examined by the present study but is known to represent a potentially very great threat to habitats and wildlife if it spreads to the core area. It also has the potential to harm the Phnong communities if it results in land grabs, forest clearance, competition for forest products and felling of resin trees.

By contrast the Phnong communities in the study area appear to be at the end of a period of rapid growth (Section 0). This has been due to return migration into ancestral territories after the forced emigration of 1970-1988. Centres of population have shifted slightly, with fewer villages along the road through Ph. Kati and around Buy Phlok than in the 1960s. Current population density is about 2.3 persons/km^2 over an area of 320 km^2 around three of the studied villages (comparing Table 4 and Table 9). This suggests at most a modest increase in density from the 1 person/km^2 recorded in the same general area in the 1940s (Section 0). However, if we include the rapidly increasing populations just west of the study area, and the improved access, it seems fair to suggest that total human pressure on the resources of the study area is markedly higher now than at any time in the past century.

Population growth by birth seems likely to accelerate and this will be a significant management problem in the medium to long term, although high infant mortality rates are currently thought to be keeping this growth fairly low (M. Guerin pers. comm. 2002). It seems unlikely that any of the presently established Phnong settlements will grow much by immigration over the next few years. Immigration to established villages has tailed off to very low levels in all cases (Figure 4), and although there are some who still wish to return to the area there are limited economic opportunities for newly arrived families. Some new settlements are likely to be established in the future (Figure 5) and these will be the focal points for any immigration that does occur. Where they occupy critical wildlife habitats these new settlements will cause conservation impacts.

The availability of resin trees made it much easier for the families returning before about 2000 to make a living. But this opportunity no longer exists – almost all suitable trees have been claimed and

incomers now have to buy resin trees if they want to become tappers. Future immigration is likely to depend much more on other economic activities. As far as we can understand, the main attraction for Phnong incomers at the moment is the availability of land suitable for paddy rice. This is quite limited in area because of the hilly landscape. Many of the suitable sites are already in use, but others exist and may be occupied in the future. These include the Srer Pleng wetlands, the plateau at Buy Phlok, the Trapeang Khlong area, and perhaps the trapeangs north of Ph. Roka Thmei.

Once the available paddy land is occupied, further immigrants will need to find other types of income. If this occurs it is likely to involve some kind of cash-crop agriculture on upland sites, something that will attract both Phnong and non-Phnong families. If land policies permit it, rapid adoption of cashew cultivation or some other cash crop may take place in the next few years. This is likely to make a new wave of immigration possible, as well as causing direct damage to large areas of habitat. The uncertain future for the Samling concession suggests that opportunities for land-grabbing of this kind may rapidly become available in the near future.

5.3 The significance of resin-tapping in the village economy

Rice production has a central role in village life, despite the fact that 'additional' activities often provide for a greater share of the family's needs, mathematically speaking. For most families of this socio-economic status, the daily challenge is to achieve basic sufficiency in rice, the staple food. Agriculture addresses this need directly, and, although harvests are low and erratic, they are still more dependable, year after year, than most other types of income. To abandon farming for, e.g. wage labour, is to abandon a key element of food security.

Poor soils, erratic rainfall and low-input agricultural methods lead to remarkably low yields of hill rice among most families (Table 5). The situation is somewhat better amongst paddy rice farmers, some 25% of whom have abandoned hill rice entirely in favour of paddy, but they still have large annual rice deficits (Table 5).

To earn money to cover rice deficits most farmers have other livelihoods too, by far the most important being resin-tapping (Table 6). Mean incomes for tapping families are in the range $300-380 per family per year depending on the village (Figure 8) and this is expected to cover the rice deficit with some to spare in most families (Figure9). Various supplementary incomes exist too, although hardly any have the potential to replace incomes that would be lost if resin-tapping stopped (Section 4.3.2 If that happened, people in the villages would experience a sharp decline in their standard of living.

People have subsistence requirements other than rice and many of these are also gathered from the forest. These include protein (especially fish, but also wild animals), fruit, green vegetables, bamboo, rattan and some medicines. Overall this way of life is providing a moderate and dependable standard of living and although none of the villages can be described as wealthy, they are also less poor than many remote rural Cambodian villages (P. Swift and Hean Sokhom pers. comm. 2002).

Resin-tapping represents quite a low-intensity form of land-use – across the study area about 0.44 trees/ha are tapped (including areas of unsuitable deciduous forest), yielding $1.9/ha/year (Table 11). While adequate at present, the resin-tapping way of life has little potential for expansion or intensification to cater for larger populations, forest loss or increased material aspirations. Almost all suitable trees are being tapped and although no data exist, few tappers consider that the trees could be tapped much more intensively than they are now. Improved incomes are most likely to come from improved marketing systems (B. McKenney pers. comm. 2002) or from increased on-site processing, as currently happens amongst some Thai tapping communities (I. Baird pers. comm. 2002).

5.4 Sustainability of resin-tapping

5.4.1 Sustaining the yield

Future yield trends are hard to predict because past trends are unclear (Section 0). Gradual declines over the past few years are often reported, and if genuine these might continue.

The trend for individual taps is to give high initial yields which decline over a few years to the point where the tap is not viable and a new tap is made. The new tap again gives high yields, perhaps as high and for as long as the previous tap, but this has never been quantified. When a group of trees is first tapped every hole is fresh and yields are impressive, but thereafter the tapper has a mix of fresh and aging holes and the average yield might never regain that initial level. However, if successive holes

are as good as the first, a steady yield should be possible for many years. If the first hole has rested long enough to be tapped again by the time the tapper has gone right around the tree, tapping should be able to continue indefinitely.

Experience of high intensity tapping in Mondulkiri only goes back 8-12 years and so tappers have little idea what to expect during the second or third decades of tapping. Experiences from pre-Pol Pot times are not really relevant, since the intensity of tapping was so much lower. Data from elsewhere are not very helpful. Anecdotal reports from Laos (e.g. Enfield *et al.* 1998, Ankarfjard and Kegl 1998, J. Foppes and R. Dechaineux pers. comm. 2000) and Malaysia (Gianno 1986) suggest that trees can yield well for decades (figures of up to 80 years have been quoted), but the intensity and continuity of tapping is never known. A study is needed from an area of Cambodia where tapping has been carried out commercially and continuously since the early 1980s, or even earlier.

5.4.2 Maintaining tree health

Tapped trees show little sign of harm and we conclude that the practice of resin-tapping has had negligible effects on the size and health of the tree population at the study site. The taps or taps are relatively shallow and do not invite infection because of the coating of resin. The weekly burning to stimulate resin flow tends to cause very minor and localised damage, with only 7% of trees showing even minor burning of the wood below the bark (Section 0). A very small number of trees show more serious damage, with burnt wood up to a metre above the tap. This is probably caused by ignition of a full tap by a stray forest fire (Section 0). The more careful tappers carefully remove leaf litter from the foot of the tree to prevent this from happening. There is some variation in the levels of damage caused by different individuals but most cause low average levels of damage (Section 0). Some Brao communities in Ratanakiri have supported the idea of community-designed tapping rules to reduce the impacts of poor tapping (I Baird pers. comm. 2002) and this may be an appropriate measure for our study area too.

Among over 2500 trees examined, death of tapped trees was only observed four times and only two these cases could be attributed directly to tapping (Section 0). Even if tapping is causing occasional weakening or death of trees, the percentage of the tree population affected after about ten years of tapping is so low that it can be ignored. Published mortality rates for untapped wild adult dipterocarps at Pasoh in Malaysia are typically 0.5-2.2 % per year for trees >5 cm dbh (Manokaran *et al.* 1992). The figures for tapped trees in the study site are much lower than this, but this is not surprising since tappers select only the healthy trees in the population so the trees they tap would be expected to show a lower mortality rate anyway.

It is sometimes suggested that resin-tapping contributes to forest fires but this seems very unlikely to us. The weekly burning of the tree is carefully controlled and there is little chance for the fire to escape. Forest fires are commonly set by people in the study area for many other reasons (e.g. to clear paths, to improve hunting or grazing, or by accident) but a tapper would always avoid setting a fire near to his trees, for fear of damaging them.

5.4.3 Commercial and political sustainability

Over the past few years tapping has provided a much more steady and predictable source of income than rice harvests, which fluctuate depending on the weather and only occur annually. Tapping has been the key element in the economies of hundreds of families in the study area, and this seems likely to remain true in coming years.

However, resin-tappers are always going to be vulnerable to changes in the world market for their product. It has not been reported to fluctuate much in recent years but volatility is the norm for most raw materials of this kind and changes must be anticipated in the future. For example, continuing forest clearance elsewhere may reduce supply and increase demand; alternatively cheaper synthetic substitutes could be found and the market would then collapse. In the long term, tapping communities would be wise to diversify their economies.

Prices are also affected by the national situation, especially policy and permit requirements. There are conceivable ways that policy could help tappers (e.g. by freeing the trade chain from unnecessary fees at checkpoints, B. McKenney pers. comm. 2002) but harmful policies may also be implemented. Officially sanctioned buyers' monopolies are found in parts of Cambodia (e.g. Stung Treng, E. Galabru pers. comm.) and these usually result in lowered prices for the supplier. Likewise, aspects of the upcoming Forestry Law may be used to suppress tapping. This might be done by those wishing to use the trees for timber, or even by well-meaning foresters who believe they are preventing a damaging activity.

5.5 Logging impacts

Logging during 1998-99 is reported to have caused major losses in three villages, ranging from 20 to 30% of trees then in use and probably an even higher percentage of income, due to the disproportionate loss of larger trees (Section 0). If concession logging had proceeded as planned all trees >60 cm diameter would probably have been cut. This would leave only the smallest, least productive 22% of the current stock of resin trees (Section 0).

Table 12 suggests that although over 3000 trees were felled, new tapping has begun in groups totalling more than 1000 trees since logging. This has partially offset the losses. However, in terms of income these newer trees were poor replacements for those lost, since they are reportedly mainly smaller trees that produce smaller amounts of resin. This was also a one-time safety net since few trees remain untapped to compensate for any future losses.

Some direct compensation was also paid for some of the felled trees, although the amounts offered were small. A sum of 10000 Riel per tree is equivalent to only 6-12 months worth of resin income, depending on the trade price of resin in each village (Table 11); many people received only 5000 Riel per tree.

Losses of resin income incurred so far are likely to have had significant effects on village prosperity, and various impacts have been reported. These include increased clearing of forest for shifting cultivation and increased hunting with dogs (Section 0). Declines in income amongst resin-tappers are also likely to have depressed other parts of the village economy such as resin transportation and sales of produce and handicrafts. Four years after the logging occurred, peoples' efforts to find replacement income have not been very successful and incomes are generally said to be at a markedly lower level than they were before logging.

Changed availability of other forest resources (e.g. fish, fruit, rattan) due to logging was not examined by this study.

5.6 Interactions between hunting and resin-tapping

Although some resin-tappers hunt, hunting is not an integral part of resin-tapping. A relatively small proportion of resin-tapping trips involves overnight stays in the forest, so there is only limited pressure to live off the land whilst tapping. Guns, crossbows and bows are rarely carried by tappers during their collecting trips. This is partly because guns are not readily available. Very few tappers appear to have snare lines that are visited as part of the tapping routine. Dogs are taken on a high proportion of trips to use for hunting of monitors, turtles and some other species, and this is a long-term conservation concern. However, hunting of the largest mammals, the type of hunting of most immediate conservation concern, is not directly connected to tapping. It is mostly done by specialists on dedicated hunting trips. Overall it seems feasible to stop or reduce hunting of vulnerable species whilst allowing resin-tapping to continue unaltered.

If resin-tapping was reduced it seems likely that hunting might increase, in an attempt to find substitute income.

5.7 Tenure issues

5.7.1 Tree and chamkar tenure

Resin tree tenure is universally recognised by customary law in the study area, and it seems to be a simple, elegant and effective system. The situation in national law is currently much less in the tapper's favour, since this customary ownership is not recognised. Once the right to fell has been granted to another party, the tapper can hope for nothing more than a little compensation.

The customary tenure does not extend to the land the trees stand on, nor to other forest products present in the area. Old fallows traditionally belong to the family that previously cultivated them, and they usually have the right to go back and recultivate them when they are ready. The ownership of resources growing on old fallows was not discussed.

5.7.2 Forest tenure

Figure 7 suggests a neat division of the forest into exclusive use areas for each village, but this is misleading for three reasons.

1) Some other villages where mapping was not done were reported to have tapping areas that overlap widely with their neighbours (Section 0).

2) The observed patterns have developed without planning. They occur as a result of the haphazard way that trees were found and taken into ownership. The apparent 'boundaries' between village resin-collecting areas are not really boundaries at all. There was no decision on the part of any of the villages to stake a claim to a particular area of forest and exclude people from other villages. Instead people newly settled in an area began finding and tapping resin trees, first near to the settlement, later in more distant forest areas. Smaller outlying settlements were later established to allow exploitation of even more remote groups of trees (for example Ph. Pu Kong (3), Ph. O Reang and Ph. O Pour). However, eventually these searches would bring people to an area where members of another village had already found and tapped the trees, and the apparent boundary would accidentally have come into being.

3) People tend to concentrate their other activities inside their own village's resin use area but this is because most activities are naturally done close to home, not because there is a defined 'village use area'. Phnong people in the study area do not consider themselves in any way confined to the village's resin-collecting area for other forest-related activities such as fishing, hunting or rattan cutting, nor do they have a tradition of excluding people from other villages.

Each village has a traditional range within which it has historically shifted from time to time, and which contains the main chamkar areas. Other villages would be expected not to build on or cultivate within this area, but given the large areas of land between villages in the study area there have probably been few occasions when this rule was seriously tested. Some new settlements in the customary use area of the village (e.g. by relatives) are probably welcomed, as long as they do not infringe on sacred sites.

The only exception to this laissez-faire situation might be if there were attempts by non-Phnong outsiders to establish new agricultural land, or settlements or extractive activities in the use area of the village. However, since this has yet to start happening it is impossible to say what the reaction of the communities will be.

This pattern of land-use and tenure has a number of implications for any formal community-based natural resource management activities that may be tried in the future. There are not defined village areas, but for practical purposes it is often easy to delineate an area that covers most of a village's activities and where other villages require only occasional visiting rights. The most important forest resources are resin and fallow land and it seems that tenure issues for these have already been settled at the local level between villages; disputes over other resources such as fish are apparently few and minor, possibly because most are not currently in limited supply.

We also suggest that the history of easy co-existence and plentiful forest land has left the study villages ill-prepared to deal with land grabs by outsiders or large scale colonisation by non-Phnong. They do not have the experience, procedures or institutions to face this novel threat (as has also been the case for many ethnic groups in Ratanakiri, e.g. White 1996, ADB 2000) and it may have a large impact on them before they learn to tackle it successfully.

5.8 Opportunities for co-operation, and divergent interests

The interests of the resident communities partly overlap with the objectives of wildlife conservation, which provides opportunities for co-operation. However, there are also areas where these interests are divergent, and where compromises need to be found. It is essential to recognise honestly that while the resident communities have ancestral connection to this land and a good understanding of the forest this does not make them automatic conservationists.

5.8.1 Co-operation

Opportunities for co-operation exist because the Phnong are present at low densities and most of their current livelihood activities appear to have low or zero environmental impacts. Resin-tapping, for example, is having no detectable, significant harmful effect on the forest or its wildlife, either direct or indirect. It is sure to be having effects of some sort, but all the evidence suggests that these are of no conservation concern. In fact, the dependence of the Phnong on forest resources makes them potential

allies for forest conservation at present, as they have a strong motivation to resist land claims and forest destruction by outsiders.

5.8.2 Divergent interests

Areas where interests diverge include the following:

Hunting
Hunting of large mammals by these communities was common in the recent past. It is at a low level now only because guns are in short supply, but this happy situation seems unlikely to change in the near future. The fact that it is now done by relatively few families suggests that it can be phased out entirely without serious livelihood losses.

Hunting of smaller animals is a much more widespread activity which is also probably having impacts on vulnerable groups (e.g. turtles). It has a role as both a supplementary dietary protein source and a supplementary source of income, although further work is needed to determine its exact significance. Negotiating a solution with communities on this issue will be necessary in the future.

Population change
Population changes of two kinds are expected among Phnong communities. Firstly, moderate levels of immigration by returning families will continue, and these have immediate impacts on critical wildlife habitats such as wetlands. Secondly, in the longer term Phnong populations will probably grow rapidly by birth, as is the case for most sectors of Cambodian society. This will have more widespread impacts. These two types of increase are probably both welcomed by existing communities, since they often involve friends, relatives or new children, and land is not currently perceived to be in short supply. Increased population density also brings benefits because larger markets attract more and cheaper services. Since stabilising the population at close to its current level is an important objective for conservation in the area, a negotiated compromise is also needed here.

Developing new economic activities
The resin-tapping lifestyle is providing a reasonable standard of living for current communities but has very limited scope for expansion, unless there is an unexpected rise in market prices. To satisfy increasing populations and increasing material aspirations, people will need to increase other activities that may be much more harmful to conservation aims. The current expansion of paddy land is one example; adoption of plantation cash crops is also expected. As well as leading to forest clearance, plantations are likely to stimulate immigration by migrant workers, increasing hunting, firewood collection etc. The challenge is to support economic activities that do not cause conservation problems, and to prevent adoption of harmful ones.

6 Recommendations

6.1 Management recommendations

These recommendations assume that most ongoing activities of the joint conservation team in the core area will continue, so they are not discussed in detail here. These activities include wildlife survey and monitoring work, regular patrols (currently targeting hunters and loggers not resident in the area), liaison with district and higher authorities, and investigation of the extent of immigration and land claims in the Keo Seimaa-Labake area. There are plans to expand many of these activities over the next few months and the urgent need for this is supported by the current study.

6.1.1 Specific, urgent management problems

A) Minimise or stop immigration and paddy expansion at critical sites (Figure 5 and Appendix 2)

Liaise with the District governor with the aim of delaying, preventing or redirecting the establishment of a new village at Buy Phlok.

Investigate the best way to slow, prevent or even reverse the establishment of new paddies at Trapeang Khlong and Trapeang Royiaw.

Conduct research to find out when the old village of Ph. O Tamarr may be re-occupied, and exactly where it is.

Try to clarify the future of Ph. O Pour, which the District authorities are apparently planning to move.

Conduct rapid demographic surveys of the remaining unstudied villages in the core area to

- identify which are currently growing
- collect reports of plans to establish other villages

B) Investigate and act on reports of hunting by outsiders in the Ph. Roka Thmei area

This reportedly involves regular visits by soldiers or policemen from Memong. Investigation can be done by the area patrol teams.

C) Investigate and act on reports of electrofishing in Ph. Pu Char and Ph. Roka Thmei

This reportedly being done by outsiders in Ph. Pu Char and by local residents in Ph. Roka Thmei (1). Investigation can be done by the area patrol teams.

A fourth recommendation will only be relevant if commercial logging by any party resumes in the area:

D) Prevent or mitigate fully the impacts of commercial logging on local livelihoods and wildlife

The key issue for local livelihoods will be loss of income from resin trees. Possible ways to reduce or mitigate this might include felling no resin trees, felling only some resin trees, creating genuine alternative livelihoods or providing adequate financial compensation. An assessment of and compensation for changed availability of other resources such as fish, fruit and clean water would also be needed.

Impacts on wildlife would include direct damage to habitat, hunting by logging staff, improved access for other hunters/settlers and increased hunting/clearance by local communities deprived of resin income. These impacts would each require different preventative action.

6.1.2 Longer-term community-based work

It is proposed to start a range of activities in Phnong communities, aimed at developing a constructive long-term working relationship with them. The Phnong are likely to remain a permanent presence in

the area but there are overlaps and divergence between the goals of the communities and the objectives of long-term conservation (Section 0), so negotiated compromises will be needed. The exact approach will depend on the results of the introductory stages, but a general strategy is outlined below.

The first step should be for the current team to review successes and failures by other groups working in this field. Much grey literature is available, but the team should also meet as many people as possible and visit some field sites, particularly in parts of the northeast where comparable ethnic minorities are present.

Most initial field activities should be at the village level, starting with one village to develop experience before expanding to more. Early activities should concentrate on confidence-building. Introductory meetings are required to present the conservation objectives the area and to learn about the communal and individual goals/problems of the people in the villages. A range of participatory techniques should be used to make sure that these meetings are not dominated by narrow sections of the village. These meetings should also help the team to learn about political realities in the village, and to form personal relationships.

One or two problems that the conservation team may be able to assist with should be identified at this stage. The problems should be significant to the villagers but small enough that with the help of the team they can be resolved within a few weeks or months. Early positive results are essential in establishing confidence. These problems will be identified mainly by the villagers, but illustrative examples based on recent survey work include: destructive electrofishing by outsiders (Section 0); family debt problems (see Table 8); low resin prices due to a lack of access to a choice of traders (Table 8); livestock disease; and helping villages to establish a code of good practice to minimse damage to tapped trees.

At the same stage there is the opportunity for the community to begin co-operating with conservation objectives in a modest way. One of the easiest and most valuable forms of help might be developing an information network to help reduce illegal hunting by outsiders. Joint monitoring of wildlife movements and numbers may also be worthwhile, both for the information it provides and as a starting place for building on whatever innate respect or love for wildlife exists in the community.

Later stages after this would aim to resolve progressively more serious concerns on both sides – on the side of the villagers this might include help establishing defensible tenure or use rights over parts of their ancestral lands, maintaining their current standard of living in the face of pressure from outside and perhaps diversifying their economy to reduce dependence on resin. On the side of conservation this might include reducing hunting by villagers, minimising damage to wetlands and saltlicks and addressing the issue of population growth.

Throughout the work it will be important to collaborate with Satrey Santepheap Daoembei Parethan (Women's Peace Organisation for the Environment, SSDP), the other NGO active in forestry in the same region. They have different approaches, resources and objectives but there is much common ground between the two organisations.

6.2 Further research

The following topics would be useful to research in parallel with future practical conservation activities. The various questions will be need to be answered for management planning at some stage in the foreseeable future.

6.2.1 Resin-tapping

Is there any way that resin quality can be improved, and thus prices?

This requires research amongst traders to determine which aspects of quality are important for pricing, and work with tappers to find ways to improve that quality. Keeping rainwater out of taps with simple roofs may be a valuable step, but some research needs to be done to see why so few people are currently doing this.

What are the long term trends in resin yield from tapped trees?

One-time interviews are unable to answer this question clearly, yet if yields decline in future this will have great impacts on the village economies. Selected families should be invited to keep tapping diaries that will reveal trends over several years. In the shorter term this method will provide a cross-check on estimates of yield and income from the current study.

What are the opportunities for village-level processing to improve prices?

What are the trade routes and marketing constraints?

Survey work is currently underway on this subject in Mondulkiri, conducted by the Cambodian Development Research Institute. Hopefully this will identify interventions needed, or further research questions.

6.2.2 Hunting

What roles do wild meat and fish play in the diets of Phnong communities?

Building on the preliminary findings here (Section 0), more in-depth studies could be conducted. These would need to target both women (who prepare most food) and men (who catch much of it). Fisheries, wild animals and livestock should be included in the questions. To get reliable information group discussions, questionnaires and diary techniques will probably be needed.

What are the cultural and medicinal roles of wild animals in Phnong culture?

Important uses of some animals may not be dictated by sale value or protein supply, and it would be helpful to understand these aspects.

6.2.3 Agronomy

What is the agricultural potential of the area?

An understanding of the potential of the area for various cash crops would help in predicting likely future pressures for forest clearance. It may also identify ways to improve rice yields from existing farmland.

6.2.4 Forest fire

What is the environmental impact of current forest fire regimes?

Some fire is probably beneficial in maintaining a habitat mosaic open grassy areas suitable for large ungulates, but excessive fires reduce biodiversity value. A study would need to clarify past fire histories, current patterns, trends and the effects of different groups of species.

7 References

ADB (2000) *Health and education needs of ethnic minorities in the Greater Mekong Subregion. Cambodia Country Report*. Asian Development Bank, Phnom Penh.

Ankarfjard, R. and Kegl, M. (1998) Tapping oleoresin from *Dipterocarpus alatus* (Dipterocarpaceae) in a Lao village. *Economic Botany* 52: 7-14.

Ashton, P. S. (1982) Dipterocarpaceae. *Flora Malesiana* Series 1, vol. 9 part 2: 237-290. [introductory section only].

Baird, I. G., Kaneungnit, T. and Baird, M. (1996) *The Kravet and the Kreung: observations of livelihoods and natural resources in two highlander villages in the Districts of Veun Say and Ta Veng, Ratanakiri Province, Cambodia.* Novib and Oxfam (UK and Ireland).

Bann, C. (1997) *An economic analysis of tropical forest land use options, Ratanakiri Province, Cambodia.* EEPSEA, Singapore.

Chambers, R. (1994) The origins and practice of participatory rural appraisal. *World Development* 22(7): 953–969.

Clements, T. J. (in prep.) *Establishing a biological baseline and monitoring in Samling Concession, Mondulkiri*. Wildlife Conservation Society, Phnom Penh.

Collar, N. J., Andreev, A. V., Chan, S., Crosby, M. J., Subramanya, S. and Tobias, J. A. (eds) (2001) *Threatened Birds of Asia. The BirdLife International Red Data Book*. Birdlife International, Cambridge, UK.

Dy Phon, P. (2000) *Dictionaire des plantes utilisées au Cambodge*. Imprimerie Olympique, Phnom Penh.

Enfield, N., Ramangkoun, B. and Vongkhamsao, V. (1998) *Case study on constraints in marketing of Non-Timber Forest Products in Champasak Province, Lao PDR*. IUCN-NTFP Project, Vientiane.

Evans, T. (2002) *Resin-tapping in southern Mondulkiri Province, Cambodia – first interim report*. Wildlife Conservation Society, Phnom Penh.

Evans, T., Houth Piseth, Phet Phaktra and Hang Mary (2002) *Resin-tapping in southern Mondulkiri Province, Cambodia - second interim report*. Wildlife Conservation Society, Phnom Penh.

Foppes, J. and Kethpanh, S. (1997) *The use of Non-Timber Forest Products in Lao PDR*. Paper presented at the Workshop on Sustainable Management of Non-Wood Forest Products, Serdang, Selangor, Malaysia, 14-17 October 1997.

Foppes, J. and Kethpanh, S. (2000) *Forest extraction or cultivation? Local solutions from Lao PDR*. Paper presented at the Workshop on the Evolution and Sustainability of "Intermediate Systems" of Forest Management, FOREASIA, June-July 2000, Lofoten, Norway.

Forest Policy Reform Project (1998) *The study of effects of forests on rural livelihoods in Kampong Thom Province, Cambodia*. Team of Chea Sam Ang, Department of Forestry and Wildlife, Phnom Penh.

Gardner, S., Sidisunthorn, P. and Anusarnsunthorn, V. (2000) *A field guide to the forest trees of northern Thailand*. Kobfai Publishing, Bangkok.

Gianno, R. and Kochummeni, K. M. (1981) Notes on some minor forest products. *Malaysian Forester* 44(4): 566-568.

Gill, G.J. (1993) *O.K., the data's lousy, but it's all we've got (being a critique of conventional methods).* GATEKEEPER series No.38, International Institute for Environment and Development (IIED), Sustainable Agriculture Programme, London.

Helmers, K. (1997) Rice in the Cambodian economy; past and present. pp 1-14 in Nesbitt, H. J. (ed.) *Rice production in Cambodia*. Cambodia-IRRI-Australia Project, Phnom Penh.

Howes, F. N. (1949) *Vegetable gums and resins*. The Chronica Botanica Company, Waltham, Mass., USA.

IUCN (2000) *2000 IUCN Red List of threatened species.* IUCN–The World Conservation Union, Gland, Switzerland.

Jantan, I., Said Ahmad, A. and Rashid Ahmad, A. (1987 and 1990) Tapping of oleoresin from *Dipterocarpus kerrii*. *Malaysian Forester* 50(4): 343-353 and *Journal of Tropical Forest Science* 3(4): 348-355. [duplicate papers]

Javier, E. L. (1997) Rice ecosystems and varieties. pp 39-81 in Nesbitt, H. J. (ed.) *Rice production in Cambodia*. Cambodia-IRRI-Australia Project, Phnom Penh.

Lebar, F. M., Hickey, G. C. and Musgrave, J. K. (eds) (1964) *Ethnic groups of mainland Southeast Asia*. Human Relations Area Files Press, New Haven, USA.

Manokaran, N., Kassim, A. R., Hassan, A., Quah, E. S. and Chong, P. F. (1992) Short-term population dynamics of dipterocarp trees in a lowland rain forest in Peninsular Malaysia. *Journal of Tropical Forest Science* 5(1): 97-112.

Melville, R. A. (2000) *A Northeast forest*. Private publication, Hallowell, Maine, USA.

Men Soriyun (2002) *Activity reports, January, February, March 2002*. Report for Southern Mondulkiri Biodiversity Conservation Project, Department of Forestry and Wildllife/Wildlife Conservation Scoeity, Phnom Penh.

Meyer, C. (1979) Les nouvelles provinces Ratanakiri - Mondolkiri. *Mondes en* Developpment 28: 682-690.

Nhiel, T. and Be, S. L. (1996) *Socio-economic and ecological survey in Snoul Wildlife Sanctuary*. Department of Nature Conservation and Protection, Ministry of Environment, Phnom Penh.

Putz, F. E., Redford, K. H., Robinson, J. G., Fimbel, R. and Blate, G. M. (2000) *Biodiversity Conservation in the Context of Tropical Forest Management*. World Bank Environment Department, Washington DC.

Rundel, P. W. (in prep.) *Forest habitats and flora in Lao PDR, Cambodia and Vietnam*. World Wide Fund for Nature, Indochina Programme, Hanoi.

Shiva, M. P. and Jantan, I. (1998) Non-timber forest products from dipterocarps. pp 187-197 *in* Appanah, S. and Turnbull, J. M. (eds) *A review of dipterocarps: taxonomy, ecology and silviculture*. Centre for International Forestry Research, Bogor, Indonesia.

Sigaty, T. and RraPP/CBNRM Team (2001) *Draft training materials: resource rights and responsibilities of local communities regarding natural resources management and conservation*. WWF, Phnom Penh.

Smitinand, T., Santisuk, T. and Phengklai, C. (1980) The manual of Dipterocarpaceae of mainland South-east Asia. *Thai Forest Bulletin* 12: 1-133.

So Srey Mom, Cheam Mony, Son Bora., Em Tray and Samrang Dy Vicheth (2001) *Economic valuation of livelihood activities in Pourapet village of Mondulkiri Province*. WWF, Phnom Penh.

Soerianegara I. and Lemmens R.H.M.J. (eds.) (1993) *Timber trees: major commercial timbers.* PROSEA 5(1). PROSEA Foundation, Wageningen, The Netherlands.

Takeda, S., Watanabe, H., Khemnark, C., Sahunalu, P. and Khamyong, S. (1996) Structure and management of *Dipterocarpus alatus* forest and production of yaang oil in Northeast Thailand. pp 380-385 in *Proceedings of the Fifth Round Table Conference on Dipterocarps, Chiang Mai, Thailand, 7-10 April 1994*. Forest Research Institute Malaysia, Kuala Lumpur.

Walston, J., Davidson, P. and Men Soriyun (2001) *A wildlife survey in southern Mondulkiri Province, Cambodia*. Wildlife Conservation Society, Phnom Penh.

Wharton, C. H. (1996) Man, fire and wild cattle in north Cambodia. *Proc. Ann. Tall Timbers Fire Ecology Conference* 5: 23-65.

White, J. (1996) The indigenous highlanders of the northeast: an uncertain future. pp 333-374 in *Interdisciplinary Research on Ethnic Groups in Cambodia*. Papers prepared for the National Symposium on Ethnic Groups in Cambodia. Centre for Advanced Studies, Phnom Penh.

White and Case (1998) *Analysis of Cambodian Law and Forest Concession Contracts*. Forest Policy Reform Project, Phnom Penh.

Wildlife Conservation Society (2001) *Workshop on biodiversity conservation in concession forests in Cambodia, Phnom Penh, June 15, 2001*. Wildlife Conservation Society, Phnom Penh.

Zimmermann, J. and Clements, T. J. (in prep.) *Preliminary study of the species composition of forest types in southern Mondulkiri, Cambodia*. Wildlife Conservation Society, Phnom Penh.

8 Appendices

Appendix 1 Family questionnaire used

Village name: Head of household name: Age:
Code number of family: Informant name: Family size:
Year arrived in village:
Amount of paddy field: Amount of chamkar: Typical rice production (in months):
Number of cows: buffalo: motorbikes:

Resin collecting areas

Name of area				
Time to travel there				
Number of days to collect resin				
Frequency of visits				
Number of *choteal tuk* trees				
Number of *traich* trees				
Dry season resin yield				
Wet season resin yield				
How did you get the trees?				
What year did you get the trees				
How many trees have ceased to yield?				
What was the yield from these trees in the first year? (only asked in some families)				

Number of your resin trees cut down: species: when: where:
who by:

Number of your resin trees marked for future felling: species: where:

Other sources of income?
examples
- malva nuts
- rattan
- bamboo
- wage labour
- sale of vegetables or rice
- other

Appendix 2 Sites where immigration or emigration by Phnong households is expected

See Section 0 and Figure 5.

1. Ph. Andong Krolung
    - At Trapeang Royaaw two houses have been built and rice paddies have been planted, starting in 2000. These people have come from Ph. Pu Clair. If the paddies are successful they will stay and other families are likely to join them – some coming from outside the study area, others moving from within Andong Krolung.
    - At Ph. O Pour about six families have settled since 1998. They have been ordered by the District governor to move back to Ph. Pu Clair, because he wants to encourage people to live in larger villages where policing and provision of services is easier. So far they have not moved, but they may do so in the future.

2. Ph. Roka Thmei
    - In Ph. Roka Thmei (1) a few more families (maybe 4-10) were said to be considering the move from Memong over the next few years.
    - At Dam Sway village seven families have returned from Memong over the past few years. They say that a few more families are considering doing the same thing. This village site held about 25 families before the Pol Pot era. In addition, existing families are planning to expand the rice paddies recently begun at Trapeang Khlong (c. 5 km south of the village).
    - In Dam Sway it was also reported that 2-3 families currently in Memong are thinking of settling at Buy Phlok in 2003. This was the provincial capital in the 1960s and had many houses plus an airstrip, but the area has now reverted to forest. The immigrants would plant paddy rice in the flat areas nearby, and if successful would probably be followed by other families.

3. Ph. Puparr
    - Some families in Memong are reportedly planning to re-establish Ph. Puparr, a village somewhere half a days' walk east of Ph. Roka Thmei at the source of the O Toi. The exact site could not be confirmed. Ten families once lived there but since only 3 now survive they may choose to settle in a larger village elsewhere.

Appendix 3 Notes on the species of resin tree tapped in the study area

Taps were found in three species of tree, as follows. Identification in the field was based on Smininand *et al.* (1980) and Gardner *et al.* (2001) and later confirmed from specimens by J. F. Maxwell. Specimens have been lodged with the Ministry of the Environment in Phnom Penh (contact person Khou Eanghourt) and duplicates have been placed at Chiang Mai University herbarium.

Species 1 – *Dipterocarpus alatus* Roxb. ex G. Don
This is the commonest species tapped. Identification on bark characteristics is quite easy once familiar with the tree; the presence of fallen fruits under most trees seen during March-May was also very helpful. The local name *chhouteal tuk* (or *chhou tuk*) appeared to be consistently and exclusively used for this species by all tappers in the study area. Voucher specimen *T. Evans* 82.

Species 2 – *Dipterocarpus intricatus* Dyer
This species was also widely observed. As one of the few deciduous *Dipterocarpus* species identification was easy; the bark is also quite different from *D. alatus*. The local name *traich* appears to be consistently and exclusively used for this species by all tappers in the study area. Voucher specimen *T. Evans* 81.

Species 3 – *Dipterocarpus turbinatus* Gaertn. f.
This species was only observed very occasionally. The dark brown, glossy fallen leaves are a distinctive feature. One tapped individual was seen near Ph. Roka Thmei (1) and a fruit was found in a stream near Ph. Pu Chu. In interviews people reported a tiny number of trees of a third species, *chhouteal masao* and it seems likely this is the local name for *D. turbinatus*. Unfortunately, the tree was not seen in the company of local informants so the local name could not be confirmed. Voucher specimen *T. Evans* 87.

One other species of *Dipterocarpus* was commonly seen in the study area, the deciduous species *D. tuberculatus* Roxb. var *tuberculatus*, which is not tapped. The local name *khlong* is used for this species. One or two trees beside Ph. Pu Char had small taps in but these were said to be made by small boys, for fun and for practice. Voucher specimen *T. Evans* 80.

Appendix 4 Provisions of the draft Forestry Law relevant to resin-tapping

i) Articles providing protection to resin-tappers and their trees

Article	Content
2c	Consistent with other laws, the State ensures customary user rights of timber products and NTFPs for local communities and as further provided in this Law.
4b/c	b. Consistent with the Environmental Protection and Natural Resources Law, a Social and Environmental Impact Assessment ("SEIA") shall be prepared for any major forest ecosystem related activity or decision that may cause significant adverse social and environmental impact. A copy of the SEIA shall be made available for public comment. c. All final decisions by the Royal Government of Cambodia ("RGC") on major forest ecosystem related activities must consider the recommendations of the final SEIA and comments thereto and shall be publicly noticed. [note – given the high dependence of villages on resin, these provisions should in theory ensure that the social impact of resin-tree felling is addressed]
15	Each concessionaire shall have the right to manage and conduct harvesting operations within the concession, while ensuring that the operation does not interfere with…..2. Customary access and user rights practiced by a community residing within, or adjacent to a forest concession.
24b	Any individual, legal entity or community that intends to harvest timber products and NTFPs for commercial purposes must possess a harvest permit issued by the Forest Administration. A permit shall not be required for members of a local community harvesting an amount of timber products and/or NTFPs equal to or below customary subsistence use defined in Chapter 9 of this Law [article 40, below].
29	Unless authorized by MAFF for specific exceptions (e.g. a weather emergency or trees removed for previously authorized forest feeder roads or other conditions proposed by the Forest Administration), it shall be prohibited to harvest the following anywhere within the Permanent Forest Estate…. 3. Trees within a species that local communities have tapped to extract resin for customary use….
40 b/c	b. For communities living within or near the Permanent Forest Reserve that do not own land by community title, the State shall recognize and ensure their customary user rights for the purpose of traditions, customs, religious and subsistence use as defined in this Law. c. The customary user rights of a local community for timber products and NTFPs shall not require a permit and include the following: 1. The collection and use of dead wood, wild fruit, products from bee hive or comb, resin, and other NTFPs; ….. 5. The ability to barter or sell NTFPs to a third party where the means or amount is consistent with customary community practice. [this point seems to be crucial for the concept of customary use – it shows that customary use is not synonymous with household use, since sale is permitted]
44b	[In areas with Community Forest Agreements] The customary user rights shall include the right to barter or sell NTFPs without a permit provided such sale does not threaten the sustainability of the community forest.
53b	MAFF shall waive the royalties for any timber products or NTFPs or premiums collected from the State forest by local communities under customary user rights as defined in Chapter 9 of this Law.

ii) Articles providing responsibilities

Article	Responsibility
7(1,2)	the Forest Administration shall perform the following duties: …Issue regulations governing forest activities to ensure the sustainable management of the Permanent Forest Estate. Collect data on all forests regarding scientific, economic, social and environmental factors in order to set a sustainable production level….
9 (part)	[the National Forestry Management Plan shall] develop programs to:… assist stakeholders in management and use of the Permanent Forest Estate.
40d	…customary user rights shall… respect the natural balance and sustainability of forest resources
44b (repeated)	The customary user rights shall include the right to barter or sell NTFPs without a permit provided such sale does not threaten the sustainability of the community forest. [here specifically in a Community Forest, but presumably this is a more general requirement too]

Appendix 5 Sites where logging of resin trees was reported to have occurred around the study villages

Village	Sites reported
Ph. Pu Char	Near the village North of the village West of the village Mount Chout O Chrar O Kamong O Kao O Mhoach O Pour O Tear Sre Tonsay Toul Krek
Ph. Kati	O Chlong O Chra O Khnong O Piup O Rlok O Tron Trapeang Tlang
Ph. Andong Krolung	km 150[1] km 170 O Chlong O Houch O Kor O Ngeuy O Pam

[1]a notable but real outlier from the rest of the areas used by the village

Appendix 6 Instances of hunting of large mammals observed by or reported to the survey team

Specific instances are listed; village residents who are 'known hunters' are not detailed here. Hunting observations by patrol and wildlife survey teams are not given here

Ph. Pu Char

None.

Ph. Kati

Antlers from recently killed Sambar drying outside a house.
Meat from two other Sambar offered to team whilst conducting survey.
Meat said to be from a Gaur killed by people from Ph. Kati seen being transported through Ph. Andong Krolung.

Ph. Andong Kralung

Members of the Military police post said to hunt muntjacs quite often.

Ph. Roka Thmei

Drying rack and a large bone found in the forest south of Ph. O Reang said to be used by people from Ph. Pu Kong to prepare meat from a Gaur they killed in 2001.

Police and soldiers from Memong said to visit quite frequently to hunt around the village.

អង្គការសមាគមអភិរក្សសត្វព្រៃ (WCS) គឺជាអង្គការមួយដែលការពារសត្វព្រៃនៅលើដែនដីដ៏ធំបំផុតនៅលើពិភពលោក។ វាត្រូវបានបង្កើតឡើងនៅក្នុងឆ្នាំ១៨៩៥ ដោយសារសត្តវិទូនៅក្នុងទីក្រុងញ៉ូយ៉ក។ អង្គការសមាគមអភិរក្សសត្វព្រៃ គឺជាអង្គការដែលប្តូជាថ្វាយ និងថែរក្សាសត្វព្រៃនៅលើផែនដី ដោយបានគង់វង្សជូនពិភពលោក និងប្រពន្ធអេក្វឡូស៊ី។ វាបានឆ្លងកាត់វិទ្យាសាស្ត្រទូទៅ និង ការឆ្លើយតបនៃការផ្លាស់ប្តូរថ្មីៗ នៅក្នុងវិទ្យាសាស្ត្រ និងពីងផ្អែកលើ បញ្ហាដំណោះស្រាយយ៉ាងសំខាន់។ ឥឡូវនេះអង្គការសមាគមអភិរក្សសត្វព្រៃបានពង្រីកទីតាំងរបស់ខ្លួនរហូតដល់ចំនួនលើពី ៣២០កន្លែង នៃបណ្តាប្រទេសជាង ៥២ នៅក្នុងពិភពលោក។ អង្គការសមាគមអភិរក្សសត្វព្រៃ បំពើការនៅក្នុងប្រទេសកម្ពុជាដោយមានការព្រមព្រៀងជាមួយរដ្ឋាភិបាលខ្មែរក្នុងរយៈពេល ៥ឆ្នាំម្តង ហើយនឹងបានចុះហត្ថលេខាពីក្រសួងកសិកម្ម រក្ខា-ប្រមាញ់ និងនេសាទ, និងពីក្រសួងបរិស្ថាននៅថ្ងៃទី១៣ ខែធ្នូ ឆ្នាំ១៩៩៩។

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