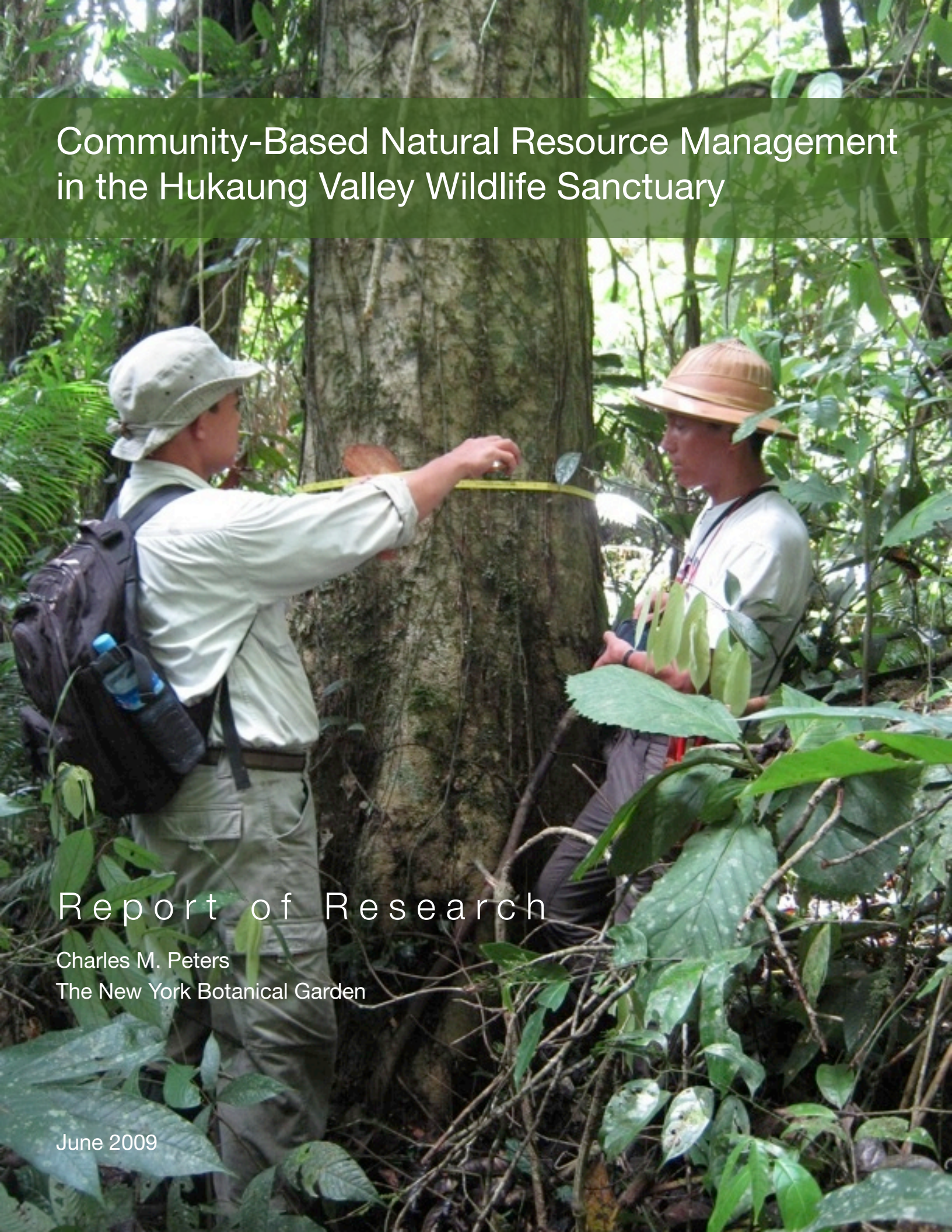
Community-Based Natural Resource Management in the Hukaung Valley Wildlife Sanctuary



Report of Research

Charles M. Peters
The New York Botanical Garden

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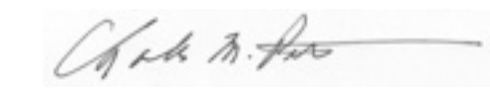
Acknowledgments

Warm thanks to everyone for making the recent fieldwork in the Hukaung Valley Wildlife Sanctuary (HVWS) so successful and rewarding. There is great potential - and a great need - for community forestry within the wildlife sanctuary, and hopefully the work reported herein will help to move things in this direction. The forests of the HVWS provide many things to many different people, and with careful management, they can continue to provide these goods and services for a long, long time.

I would especially like to thank the Ministry of Forestry and the Myanmar Forest Department for granting the necessary permissions to conduct the research. The Wildlife Conservation Society played a key role in developing and organizing the community forestry work in the Hukaung Valley, and I gratefully acknowledge their continued support. In the WCS Yangon office, U Than Myint was instrumental in putting together the original proposal and skillfully guiding it through the process. Colin Poole from the WCS New York office provided invaluable advice about community-based resource management and the practicalities of doing fieldwork in Myanmar, and helped secure the funding for the research. Thanks to Dr. Alan Rabinowitz of Panthera for his continued support of plant science and community forestry in the HVWS.

None of the fieldwork would have been possible without the hard work, enthusiasm, and good humor of the scientific team, the local program staff, the forest guards, and innumerable villagers from Shinlonga, Lajarbon, and Takhet. I could not have selected a more pleasant group of people to work with. Finally, I would like to thank the Blue Moon Fund for their financial support (and patience). Palms together in gratitude to all...



Charles M. Peters

Executive Summary

From May 23 to June 2, 2009, field research on community forestry was conducted in three villages within the Hukaung Valley Wildlife Sanctuary, i.e. Shinlonga, Lajarbon, and Takhet. The main objective of the work was to provide a preliminary estimate of the existing supply of and current demand for different forest resources important to local livelihoods to serve as the basis for future management planning activities.

Building on WCS's previous work on community-based resource management in the area, a "short-list" of 30 important forest resources was first compiled. Resource Needs Assessment (RNA) interviews were then conducted with selected villagers to estimate the actual quantities of different resources that were needed each year for construction, farming, and health care. Finally, quantitative inventories were conducted in different forest habitats in Shinlonga to assess the density and size-class distribution of useful plant taxa

Roofing material, bamboo, and structural timbers were found to be the most important forest resources in the households interviewed. There was a general consensus that: (1) good timber is getting harder and harder to find, (2) there is no easily accessible source of palm thatch, and (3) certain species of bamboo and rattan are being over-exploited. Although local communities, especially the Kachin, have traditionally planted bamboo and palms around their wet rice fields, the uncertainty of the current political situation has caused most families to stop doing this.

The forest inventories reinforced the findings from the household interviews. Most of the important plant resources still grow in the forest, but at relatively low densities, and the size-class distributions of many species suggest that they are not actively regenerating. For some resources, e.g. rattan, there is abundant regeneration but many of the merchantable stems have been removed through commercial harvesting.

To insure a continual flow of forest resources, it is recommended that the traditional Kachin practice of planting bamboo and palms for thatch around rice fields be facilitated and reinstated, and that a relatively small, 100 hectare, community management area be established to supply the timber, rattan, and medicinal plant needs of the community. The existing village nurseries should be expanded to produce the tree seedlings and bamboo cuttings needed for enrichment planting and reforestation.

Introduction

WCS and the Myanmar Forestry Department have been working to develop community forestry in the Hukaung Valley Wildlife Sanctuary for several years. Starting in 2006, detailed village consultations (VCP) have been conducted in 40 villages to document the pattern and intensity of resource use, and land-use mapping and the delineation of Village Development Zones (VDZ) have been initiated in 22 villages. Building on this important work, the next phase in the community-based natural resource management (CBNRM) project in the Hukaung Valley is the development of specific management plans for selected resources. Depending on the resource, these management recommendations may involve: (1) the sustainable exploitation of wild populations in the forest, or, in the case of species that occur naturally at lower densities, (2) *ex-situ* propagation in more accessible sites.

This report presents the first baseline data about the supply and demand of natural resources at the village level in the Hukaung Valley Wildlife Sanctuary. Descriptions of the survey team and the sample villages are first presented, followed by an annotated listing of the most important local timber, bamboo, rattan, and medicinal plant resources. The data collection procedures used to assess the village demand for these resources, as well as their current supply in the forest, are then outlined and the results from the Resources Needs Assessments (RSA) and quantitative forest inventories are summarized. Several notable patterns in the use and supply of plant resources are highlighted. A final section discusses the potential of community forestry in the Hukaung Valley Wildlife Sanctuary and offers several specific recommendations for achieving this objective.

Inventory transect through Production Forest at Shinlonga.

Survey Team

The survey team was composed of an inter-disciplinary team of scientists from several different institutions, together with WSC Myanmar Program staff, HVWS Forest Guards, and local villagers. The science staff included:

U Sein Aung Min is Staff Officer in the Nature and Wildlife Conservation Division of the Myanmar Forest Department. U Sein Aung Min helped with the village interviews and did an outstanding job running compass on all of the transects. U Sein Aung Min was the main reason that we ran straight lines through the forest.

U Saw Htun is the Coordinator of the Northern Forest Complex for the WCS Myanmar Program. U Saw Htun organized most of the logistics for the trip, conducted and translated the interviews, did the village presentations, and took care of counting and measuring all of the plants on the right side of the transects. U Saw Htun played a critical role in almost every aspect of the survey.

Dr. Charles Peters is the Kate E. Tode Curator of Botany at the New York Botanical Garden. Dr. Peters is a plant ecologist and a forester specializing in the ecology, use, and management of tropical forest resources and he has written extensively on various aspects of community forestry.

Rob Tizard, wildlife biologist, community development worker, and accomplished photographer, is Technical Advisor to the WCS Myanmar Program. Mr. Tizard provided invaluable assistance with logistics, identified all the animals, and counted and measured the sample plants on the left side of the transects.

Measuring the diameter of a sagawa tree (Michelia champaca Linn.) in transect 2.

Study Villages

The community forestry research in the Hukaung Valley Wildlife Sanctuary was conducted in three villages: Shinlonga, Lajarbon, and Takhet. The villages vary in size, ethnicity, organization, and potential for successful community forestry activities.

Shinlonga

Shinlonga (26.52028°N, 96.6263°E) is a Kachin village with 42 households and about 200 inhabitants. The village has received support from the UNDP Remote Township Project to build a clinic and is very interested in developing community-based management activities to produce a more regular supply of important subsistence resources.

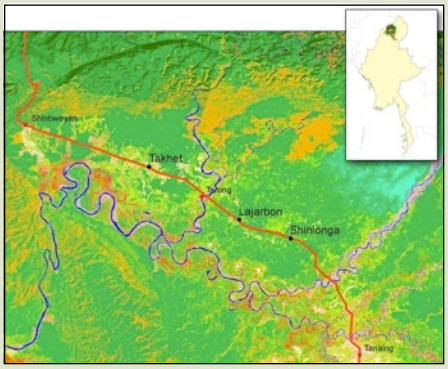
Village consultations (VCP) have been completed in Shinlonga, as have various phases of the Village Development Zonation (VDZ) process, including sketch mapping, boundary survey, and the creation of a preliminary land-use plan for the village. Because of its proximity to Tanai, more community forestry work has been done in Shinlonga than in the other two villages.

Lajarbon

Lajarbon (26.54946°N, 96.53997°E) is a mixed Lisu/Naga village with 64 households and 288 residents. The village headman is Lisu. Preliminary village consultations (VCP) and development zoning (VDZ) have taken place in Lajarbon, and a detailed map of different land-use areas has also been developed. The results from these activities suggest that although there is substantial local interest in community forestry, Lajarbon is also linked to a certain degree of market-based hunting, gold mining, and land clearance which could complicate further engagement with this village.

Takhet

Takhet (26.63321°N, 96.39984°E), a predominantly Naga community, is the largest study village with 97 households and 456 inhabitants. The residents are primarily shifting cultivators, and the large amount of land clearing required each year for agriculture is a chronic impediment to the development of sustainable community forestry in this village. Fallow times in Takhet are currently only six to eight years.



Location of study villages in the Hukaung Valley.

Plant Resources

A list of the important forest resources used by each village was compiled in the initial Village Consultation Process (VCP). Although there were differences from one village to the next, the overall suite of plant resources used by communities in the Hukaung Valley is surprisingly similar. To guide subsequent data collection activities in the area, a prioritized short list of 30 forest resources was developed. This list was organized into six basic resource groups: 1) timber, 2) palm thatch, 3) bamboo, 4), forest fruits, 5) rattan, and 6) medicinal plants. A selective representation of some of the most important taxa in each group is presented below.

All taxonomic designations should be viewed as tentative. It is very important that replicate herbarium specimens be collected of all important forest resources in the wildlife sanctuary, and WCS staff were trained how to make a plant press and shown how to collect, dry, and annotate specimens. A standardized collection label was also designed for the CBNRM project. Clearly, a critical first step in the development of any viable program of community forestry is a clear understanding of the taxonomic identity of all the resources involved.

Timber

Sagawa (*Michelia champaca* Linn., MAGNOLIACEAE) is one of the most valuable and esteemed local timbers. Its light-colored, fine-grained wood is used for construction, furniture, and carvings. The wood is strong and moderately durable. *Michelia* is a tall forest tree of up to 30 m, with simple, entire leaves, and large, pale yellowish-orange, fragrant flowers. Two varieties of *sagawa* are recognized by villagers in the Hukaung Valley, *sagawa*, the yellow variety, and *sagasein*, a green variety. It is unclear if the green variety is another species of *Michelia* or a different genus. The properties of the wood of each type are reportedly very distinct.

Yemane (*Gmelina arborea* Roxb,, VERBENACEAE) is a medium-sized tree with smooth, grey bark, opposite, cordate leaves, and bright yellow flowers arranged in large terminal inflorescences. The species is a lightweight hardwood and the wood is suitable for general utility purposes, especially light construction and structural work. The frequent poor form of the tree limits its utility as a sawtimber. *Yemane* is a light-demanding species and can exhibit very rapid growth under favorable conditions. It is frequently planted.

Khalaung (*Dysoxylum binectariferum* Hook. f. et Bedd., MELIACEAE) is another preferred timber species in the Hukaung Valley. The wood has a rich, deep red color with a hard, close grain that is easily worked. Many of the houses in the study villages were framed using *khalaung*, and stacks of boards cut from this species were observed in Takhet and Lajarbon. Although the Latin name used for this timber is frequently cited in the literature (e.g. Hundley *et al*., 1987; Kress *et al*., 2003), no flowers or fruits were observed to verify this determination.

Ma-u (*Neolamarckia cadamba* (Roxb.) F. Bosser, RUBIACEAE) is another fast-growing timber tree with fine to medium textured cream-colored heartwood that is easy to work. The tree is large, up to 45 m, with a broad crown and a straight, cylindrical bole. Leaves are opposite, simple; flowers are globose, fragrant, and produced in terminal inflorescences. This fast -growing tree is one of the most frequently planted trees in the tropics. The timber is used for plywood, light construction, pulp and paper, and furniture components.

Laukyahmwe (*Schima wallichi*i (DC) Korth., THEACEAE) is a medium-sized to large tree with a cylindrical bole and a dense crown. Leaves are spiral with toothed margins; flowers are white, born singly at the apex of twigs; seeds are winged. *Laukyahmwe* yields a medium to heavyweight heartwood of reddish-brown color that is easy to work and fairly resistant to rot. The wood can be used for beams, flooring, and utility furniture, and it has also been exploited to construct bridges in mountainous areas.

Yinmar (*Chukrasia tabularias* A. Juss., MELIACEAE) is a deciduous, medium-sized tree up to 30 m tall. Leaves are compound with 4 to 6 pairs of alternate leaflets. Flowers are white, axillary; fruit a woody capsule containing 60 - 100 flatted, winged seeds per locule. Heartwood is yellowish-red to brown with prominent dark streaks. The timber is prized commercially for cabinetwork and is used locally for light to medium-heavy construction, e.g. posts, beams, and planks. A yellow transparent gum exudes from the trunk upon injury.

Kanyin (*Dipterocarpus retusus var. macrocaprpus* Bl., DIPTEROCARPACEAE) is a large forest tree with flaky gray-brown bark, stout buttresses, and an aromatic, oily, white oleo-resin. Leaves are simple, alternate, leathery, with golden buff pubescence. Flowers are large, reddish, and sweetly scented. The wood is a general quality, all-purpose construction timber suitable for framing, rafters, posts, and beams. This species, as well as the whole genus, is quite variable, and the taxonomic designation assigned should be viewed with a healthy degree of skepticism until voucher specimens are collected.

Palm Thatch

Tawhtan (*Livistonia jenkinsiana* Griff., ARECAEAE) is the preferred roofing material in the Hukaung Valley. The palmate leaves of this beautiful palm can last up to five years and the amount of thatch that can be collected from one individual far surpasses that of any other local species. Small plantations of t*awhtan* were traditionally planted around the perimeter of wet rice fields (*lei zaba*) to provide an accessible supply of roofing material.

Yone, (*Salacca secuda* Griff., ARECACAE) is the substitute thatch people use when they can't find a supply of *tawhtan*. The stems of this palm are short, subterranean, and clustered. The sheaths and petioles are covered with short rows of spines; leaves are up to 2 m long and arranged in irregular, and spreading planes. Although accessible and relatively abundant, thatch made from *Yone* must be replaced every three years.

Bamboo

Because of its strength and light weight as a building material, its fast growth, and relative local abundance, bamboo is an especially important subsistence resource for villagers in the Hukaung Valley. Several different species, of dubious taxonomic identity, are harvested for house construction and agricultural implements.

Wabo (*Dendrocalamus hookeri* Munro, POACEAE) is a large, clumped bamboo frequently used for flooring, walls, and for making fences. Occasionally planted around rice fields. Culms are 15 - 20 m long with a diameters of 10 - 15 cm; culm sheaths are covered with dark brown hairs; internodes are 40 - 45 cm long.

Wanet (*Dendrocalamus longispathus* (Kurz.) Kurz, POACEAE) is another common building material in the region that is occasionally planted. Culms are thick-walled, 10 - 18 m long without nodal roots and 6 - 10 cm in diameter. Internodes are 25 - 60 cm long of a pale bluish-green or grey color; occasionally with a whitish bloom.

Tinkhawa (*Cephalostachyum pallidum* Munro, POACEAE) is one of the most widely used and abundant local bamboos. Culms are thin-walled, 6 - 12 m, with long internodes of 50 - 80 cm; nodal ridge is not prominent. Branches are clustered at each node; leaf sheaths pubescent. Split cane used for weaving mats.

Paungtinwa (*Cephalostachyum pergracile* Munro, POACEAE), a smaller, thin-walled bamboo, is occasionally collected for construction. Culms are 9 - 12 m long and 5 - 7 cm in diameter.

Paukwa (*Pseudostachyum polymorphum* Munro, POACEAE) is a small bamboo, the culms of which are split and used for weaving fences and mats. Culms are 5 - 10 m long and 1 - 2 cm in diameter; internodes are 15 - 20 cm long.

Hneewa (*Bambusa burmanica* Gamble, POACAE) is a thick-walled bamboo infrequently used for construction. Culms are 7 - 8 m long and 2 -3 cm in diameter. Internodes are 30 - 35 cm long; nodes prominent, with rings of whitish, silky hairs above and below sheath scar.

Forest Fruits

Kanasoe (*Baccaurea ramiflora* Lour., EUPHORBIACEAE) is a medium-sized understory or mid-canopy tree that produces large racemes of edible fruit along the old branches and main trunk. The fruit is globose, 2 -3 cm in diameter, yellowish to purple in color with a sweet, fleshy aril. The fruits are harvested and eaten raw, stewed, or made into wine. *Kanasoe* is dioecious with separate male and female trees.

Zibyu (*Emblica officinalis* Gaertn., EUPHORBIACEAE) is a small to medium-sized tree, frequently with a twisted trunk and a spreading crown. Leaves are simple, sessile, and arranged along the small branches such that they resemble compound leaves. Flowers are greenish-yellow; fruits are spherical, smooth, with six vertical stripes. The taste of *Zibyu* fruit is characteristically sour and astringent and the fruit is very fibrous.

Kyetmauk (*Nephelium lappaceum* Linn., SAPINDACEAE) is a medium, mid-canopy tree with alternate, compound leaves. Flowers are small, 2 - 5 mm, born in erect, terminal clusters. *Kyetmauk* trees can be either male, female, or hermaphroditic, i.e. with perfect flowers. Fruits are round, 3 - 6 cm, produced in large infructescences of 10 - 20 fruits. The leathery skin is reddish (or orange, or yellow) and covered with fleshy, pliable spines, or "hairs". The fruit contains a single, glossy brown seed surrounded by whitish fleshy aril with a sweet, mildly acidic flavor. The tree is occasionally cultivated.

Metlin (*Garcinia paniculata* Roxb., CLUSIACEAE) is a small, understory or mid-canopy tree with opposite, shiny leaves and yellow latex. Individuals are usually functionally dioecious, i.e. with separate male and female flowers. Fruits are yellow, 8 - 12 cm in diameter with an orange aril.

Tawngetpyaw (*Musa* spp., MUSACEAE) is one of several possible species of wild banana found in local forests. Leaves are up to 1.5 m long and 40 cm wide, dark green above and paler below. Fruit bunch very compact; individual fruits 8 - 10 cm long , ripening yellow and remaining strongly angled at full ripeness. Seeds dull black. *Tawngetpyaw* could represent either *M. itinerans*, *M. ornata*, *M. laterita*, or *M. velutina*clusters - or all of these. Specimens are sorely needed.

Rattan

Pyant kyein (*Calamus nambariensis* Becc. and/or *Calamus palutris* Griff., ARECACEAE) is the most widely used and, perhaps only high-quality rattan occurring in local forests. Stems clustered, 30 m long and 6 cm in diameter with scattered, triangular, flattened, downward-pointing spines; prominent knee. Fruits globose, 2.5 cm in diameter with grooved scales. *Pyant kyein* is used to lash palm thatch, make fences, weave baskets and mats, and as a general cordage. In spite of its importance, the taxonomic identity of *pyant kyein* is unclear. It seems most likely that the name "*pyant kyein*" is used to refer to both *C. nambariensis* and *C. palustris*. The two species are quite similar morphologically and can only be distinguished reliably with female inflorescences and fruits. Fertile herbarium specimens are needed to resolve this issue .

Mokesoema kyein (*Calamus leptospadix Griff.,* ARECACEAE) is a low quality cane used for cordage and occasionally palm thatch. Stems clustered, 25 m long and 2 cm in diameter; bristly with long, needlelike, brownish spines; prominent knee (shown below), ocrea, and flagellum present. Fruits globose, yellowish, 1.5 cm in diameter.

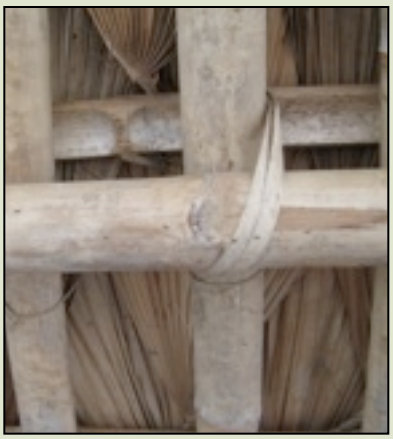
Kyet-u kyein (*Calamus tenuis* Roxb., ARECACEAE) is a medium-quality small cane rattan used occasionally for cordage and weaving. Stems clustered, often forming thickets, 20 m long and 2.5 cm in diameter. Knee present; flagella present; fruits globose, 1.5 cm in diameter. *Kyet-u kyein* is a very widespread species of *Calamus*.

Medicinal Plants

A wide assortment of medicinal plants are used by communities in the Hukaung Valley. Some are trees, some are climbers, and some are understory herbs. Most of the species compiled on the the original VCP interview list are as yet unidentified and known only by their Myanmar name. Herbarium specimens of all plants used in the local pharmacopeia need to be collected and identified.

Sindonemanwe (*Tinospora cordifolia* Miers, MENISPERMACEAE) is a herbaceous climber with cordate leaves. Sections of the stem are collected, dried, and made into an infusion to treat malaria, rheumatism, liver ailments, and as a general tonic.

Letpankha (*Alstonia scholaris* (L.) H. Br., APOCYNACEAE) is a small tree with thick, leathery, simple leaves produced in whorls. The tree has white, funnel-shaped flowers and yields abundant milky latex that contains numerous alkaloids. The bark of *A. scholaris* contains compounds similar to quinine that are used in the treatment of malaria and cholera; preparations with the latex are used to treat coughs, throat sores, and fevers.



Detail of roof in Kachin house showing tawhtan (Livistonia jenkinsiana) thatch, wabo (Dendrocalamus hooleri) joists, and pyant kyein (Calamus nambariensis) cordage.

Field Procedures

The sustainable use of forest resources is based on two fundamental pieces of information: 1) how much of a particular resource is being used, and 2) how much of the resources the forest is producing. The objective of management is to keep these two quantities in balance. With this in mind, the community forestry research in the Hukaung Valley Wildlife Sanctuary was designed to provide preliminary estimates of the *demand* and *supply* of important plant resources in the area.

The current demand for different resources was estimated through Resource Needs Assessment (RNA) interviews conducted with selected households in the evenings. The main focus of the interview was on the different materials that were used to construct the house. Actually being in the house and pointing to the materials greatly simplified this task. Although the interviews were conducted in such a way as to move progressively from roof, to walls, to floors, to medicinal plants and then farming implements, they were decidedly non-structured and the participants could move the conversation in any direction they wanted. On average, the interviews took about an hour to conduct.

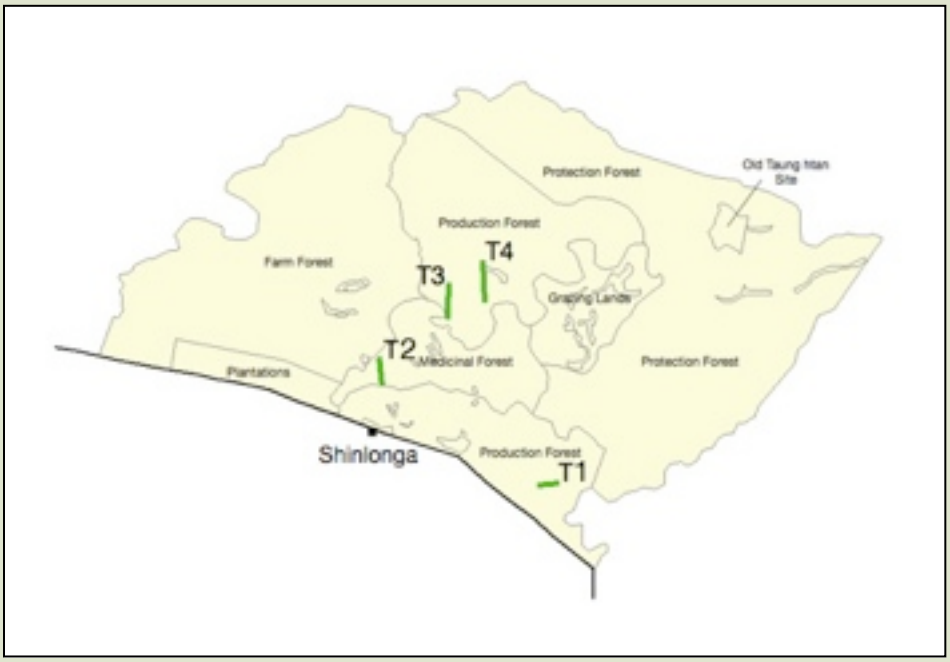
In addition to collecting information about the amount of timber, bamboo, and rattan that the household used in a given period of time, the

interviews were also very useful in eliciting information about the productivity and yield of specific resources. e.g. how many leaves can you harvest from a *Livistonia* palm, or how long before you can harvest *Dendrocalamus* culms after planting them. These types of data are very useful in trying to estimate the sustainable harvest of different forest resources.

The majority of the RNA interviews were conducted in Shinlonga, primarily because we stayed longer in this village. Eight households of varying economic status were interviewed in Shinlonga, while one household each was surveyed in both Lajarbon and Takhet.

Data on the supply of different resources was obtained through quantitative inventory transects that sampled the density and size-class distribution of 30 useful plant species. Because of time constraints - and the potential for subsequent community forestry activities there - the inventory work was focused exclusively in Shinlonga.

The inventory transects were composed of contiguous 10 x 20 m plots. The total number of plots in each transect varied according to local geography and the actual conditions in the forest. After first clearing the line and measuring out 20 m with a nylon transect rope, a plot stake was set and the transect rope laid out on the ground to represent the centerline of the plot. Two teams then slowly scanned 5 m to the left and 5 m to the right of the center line and reported the identity and size of every individual encountered that was on the species list. All trees ≥ 5.0 cm in diameter (DBH) were counted; all rattan stems, bamboo culms, and medicinal plants, regardless of size, were counted and recorded. The elevation and geographic location of each transect were recorded using a GPS device; transect bearings were maintained with a Silva compass.



Map showing location of four inventory transects (thick green lines) established in the forests surrounding the village of Shinlonga. Land-use designations are those selected during the initial Village Development Zonation (VDZ) process.

Survey team walking through a rice field (lei zaba) near Shinlonga on the way to an inventory transect. Note the abundance of bamboo planted around the perimeter of the field.

Four transects of varying length were sampled in the forests surrounding Shinlonga north of the Ledo Road. As shown on the map above, three of the transects were located in areas designated as *Production Forest* during the Village Development Zonation, while the fourth transect was located in an area classified as *Medicinal Forest*. It is important to note that these land-use classifications are preliminary and operationally tentative. In terms of forest structure and composition, there is little, if any, difference between *Production Forest*, *Protection Forest*, *Medicinal Forest*, and *Plantations*. The *Grazing Lands* and *Farm Forest* areas, on the other hand, are characterized by swiddens and fallows of varying age, i.e. the forests are successional and very disturbed.

Resource Need and Supply

The results from the Resource Needs Assessments for palm thatch and bamboo are shown in the table to the right. The numbers in parentheses represent the percentage of households that mentioned a particular species; quantities represent the average amount (± standard error) per household. Several points of interest should be noted in this table. First, the number of species that are used is relatively small, as is the total quantity of material, i.e. leaves or culms, required by each family. Palm thatch for roofing and bamboo for fencing are the largest, and most frequent, resource needs.

Second, it is important to note that the species reported in use for a particular purpose by each family can, at times, be different from the most desirable or appropriate species for that purpose. Everyone agreed, for example, that *tawhtan* is the best roofing thatch, yet less than half of the families interviewed used this species. Most of the families used *yone* for thatch and cited decreasing supplies and increasing difficulties of collecting *tawhtan* as the reason for doing this. Similarly, *wabo* seems to be the preferred bamboo for house construction, yet a significant number of families use *tinkhawa* for flooring and walls. Supplies of *wabo* are also declining.

Species and quantities of palm thatch and bamboo needed for subsistence use by sample households in Shinlonga, Lajarbon, and Takhet. Percentages based on total number of interviews (n=10).

Resource Group	Species (%)	Quantity	Replacement Rate
Thatch	Tawhtan (37.5)	1,000 leaves	5 years
	Yone (62.5)	3,375 ± 489 leaves	3 years
Bamboo			
Flooring	Wabo (87.5)	14 ± 4 canes	10 years
	Tinkhawa (12.5)	18 canes	
Walls	Wabo (62.5)	53 ± 20 canes	10 - 15 years
	Tinkhawa (50)	193 ± 62 canes	10 years
Framing	Wabo (50)	215 ± 21 canes	needed for new house
	Wanet (37.5)	73 ± 23 canes	needed for new house
	Paungtinwa (12.5)	160 canes	needed for new house
Fencing	Tinkhawa (37.5)	550 ± 200	every year
	Wanet (12.5)	100 canes	every year

Finally, the replacement rate of different species is useful in explaining these preferences. In terms of palm thatch, not only are less than a third of the number of leaves needed to roof a house when *tawhtan*, rather than *yone*, is used, the *tawhtan* leaves also last two to three years longer.

In terms of total annual need of palm thatch and bamboo, the 42 households in Shinlonga currently use an estimated 8,400 *tawhtan* leaves, 47, 250 *yone* leaves, 4,481 *wabo* culms, and 23,973 *tinkhawa* culms every year. An additional 100 - 200 bamboo culms are needed for framing every time a new house is constructed.

In terms of growth and productivity, villagers reported that *tawhtan* palms produce about 30 leaves/year. At least three healthy leaves must be left on the plant to insure its post-harvest survival. A healthy clump of *yone* can produce about 300 leaves/yr; a lower quality clump will produce about half this much. Care must be taken not to damage the shoot when harvesting *yone* palms and a few leaves must always be left on each plant. Various species of bamboo, e.g. *tinkhawa, wanet, wabo, hneewa*, can be planted using carefully selected rhizomes; survivorship usually ranges from 50 - 75 percent. The culms are harvestable after 5 to 7 years.

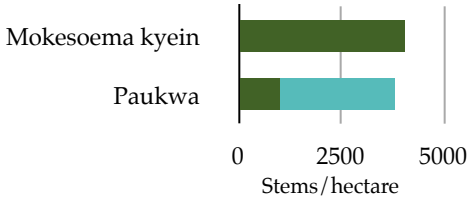
The usage data for timber, rattan, and medicinal plants are shown in the table to the upper right. Quantity and replacement rate information were understandably difficult to obtain for timber and medicinal plants. Some of the households had obtain scrap pieces of wood from local sawmills to frame their houses, or had gotten used boards from other family members, or simply couldn't remember how many planks it took to make the floor. In the case of medicinal plants, the common response was that "we just collect the plants when we need them".

Overall, the general consensus was that while there were still a lot of medicinal plants in the forest, it was getting harder and harder to find good timber trees and long rattan canes. The main reason given for this situation was over-exploitation - but not by the residents of Shinlonga. Apparently, large quantities of timber and rattan are harvested every year by companies from Tanai, leaving local communities with a decidedly restricted supply of natural resources to live off of. The nine posts of durable timber needed every time a new house is built are getting progressively difficult to find, and the almost 27 miles of rattan cane needed every year by the village for fencing and cordage may soon be unattainable.

The general conclusions from the interviews were verified once the actual supply of different resources was assessed by the inventories. A total of 2.48 kilometers of transect was run through the forest, and 515 individuals of 26 different species were counted and measured. The location, habitat, and plot results from each of the four transects are first presented, followed by a general summary of the local resource base at Shinlonga and then a more detailed analysis of the density and size-class distribution of natural populations of selected species of importance. The results from each transect are shown in two Rank Abundance histograms: one for the more abundant bamboos and rattans, the other for the timber species, fruit trees, medicinal plants, and the occasional rattan that occur at lower densities. The green part of the bar in the histograms is smaller, pre-commercial stems; the blue part of the bar represents stems of harvestable size.

Species and quantities of timber, rattan, and medicinal plants needed for subsistence use by sample households in Shinlonga, Lajarbon, and Takhet. Percentages based on total number of interviews (n = 10).

Resource Group	Species (%)	Quantity	Replacement Rate
Timber			
Flooring	Sagawa (12.5)		needed for new house
	Khalaung (37.5)		needed for new house
	Laukyahmwe (12.5)		needed for new house
Framing	Khalaung (37.5)	9 posts	needed for new house
	Yinmar (12.5)	9 posts	needed for new house
	Sagawa (12.5)	9 posts	needed for new house
	Laukyahmwe (12.5)	9 posts	needed for new house
Rattan	Pyant kyein (100)	3,357 ± 144 feet	every year
Medicinal Plants	Letpankha (25)		
	Sindonemanwe (50)		
	Kyauksetnwe (37.5)		
	Saythantai (25)		
	Katkyinyat (12.5)		

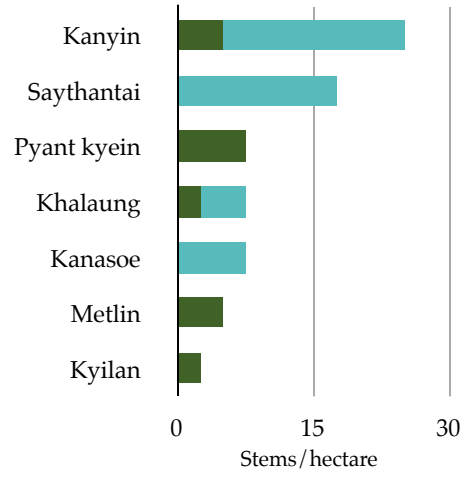


As is shown in the histogram above, *mokesoema kyein* was represented by over 4,000 stems, but all of them were of pre-commercial size, i.e. ≤ 5.0 m long. Similarly, over 3,500 *paukwa* were recorded, but this small diameter bamboo is of limited value for construction.

Transect 1

The first transect was established in Production Forest, about 2.0 miles east of the village (N26.51123°, E96.6595°). The area had been previously logged in 1996. The transect was oriented along a westerly (270°) bearing and contained twenty 10 x 20 m plots (sample area = 4000m^2)

In terms of basic resource groups, 35 timber trees, 4042 rattan canes, 3782 bamboo culms, 12 fruit trees, and 17 medicinal plants were recorded in this transect [NOTE: All data have been expanded to a per hectare basis].

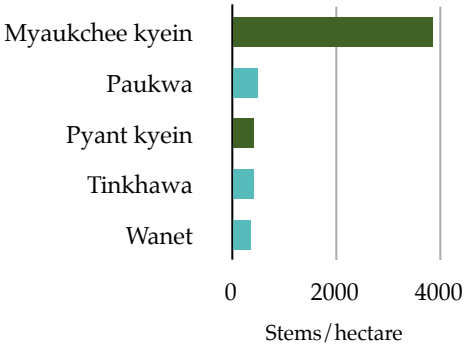


One of the preferred timber species, *kanyin*, was represented by 20 trees, 15 of which were of commercial size (second histogram on previous page). There was also a relative abundance of *saythantai*, an unidentified medicinal plant and *kanasoe*, a common fruit tree. All of the other useful species encountered were either of low density or pre-commercial size. For example, only two *kyilan* trees (probably *Shorea assamica* Dyer) were recorded and both individuals were ≤ 20 cm in diameter.

Transect 2

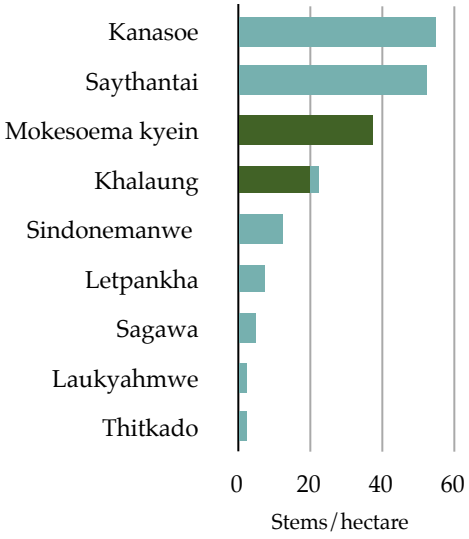
The second transect was located about 0.5 miles north of Shinlonga in an area mapped as Medicinal Forest (N26.52847°, E96.62807°). The forest was flat with a continuous closed canopy and scattered large trees. The transect was oriented in a northerly direction (330°) and contained twenty-seven 10 x 20 m plots (sample area = 5,400m^2).

In total, transect 2 contained 5 timber trees, 4,320 rattan canes, 1317 bamboo culms, 55 fruit trees, and 72 medicinal plants per hectare. As shown in the histogram below, *Myaukchee kyein* (*Calamus flagellum* Griff.) was the most abundant rattan, yet this species, whose name means "monkey feces" rattan, is seldom used. Over 400 *pyant kyein* canes/hectare were tallied, but none



of the stems were of harvestable size. Reasonable quantities, i.e. 300 - 400 culms/hectare, of harvestable bamboo were recorded for several of the preferred species.

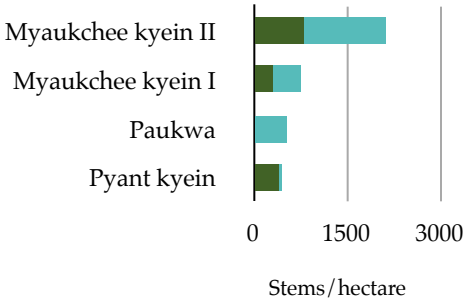
Four species of timber trees were recorded in transect 2. The most important of these was *sagawa*, and, surprisingly, all of the individuals encountered were of commercial size. Several large *khalaung* trees were also recorded; the remainder of the timber trees, e.g. *thitkado* (*Cedrela toona* Roxb.), were of small diameter. *Kanasoe* was the most abundant fruit tree resource found in the transect, while *saythantai* and *sindonemanwe* were the most prevalent medicinal plants.



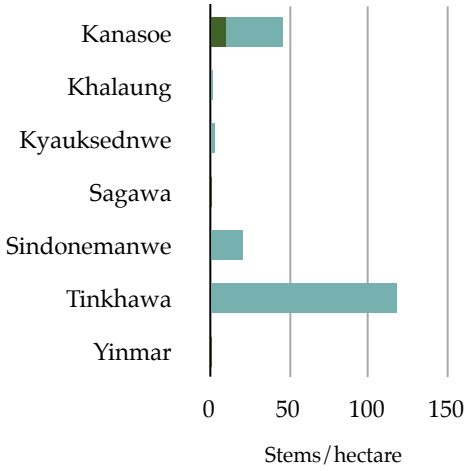
Transect 3

The third transect was located on the north bank of Mawning Stream in an area of Production Forest (N26.53992°, E96.63961°). The transect crossed Mawning Stream and several old river channels and was run due north. The transect contained thirty-seven 10 x 20 m plots (sample area = 7,400 m^2).

Because of the canopy opening caused by the river channels, a lot of rattan and bamboo were recorded in Transect 3. As shown in the histogram below, almost 3,000 *myaukchee kyein* canes were recorded. Two different types of *maukchee kyein* were recognized based on leaf size and stem morphology: *Myaukchee kyein* I is *C. flagellum*, while *maukchee kyein* II, recorded for the first time in this transect, appears to be *C. floribundus* Griff. This determination should be viewed as tentative until specimens are collected. A significant number of *pyant kyein* rattan canes were also recorded, although all of them were ≤ 5.0 m long.

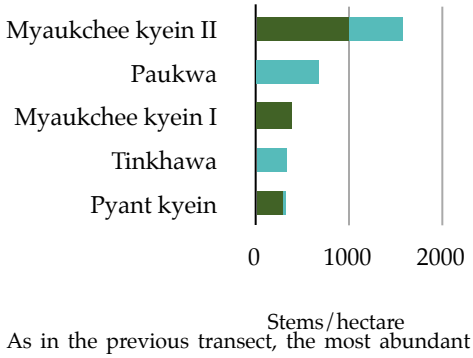


Several different species of timber trees were recorded, but all were at low densities, e.g. one *sagawa* tree, one *yinmar* tree, and two *khalaung* trees. *Kanasoe* was clearly the most abundant tree in the transect with almost 50 trees/hectare. Medicinal plants of varying species were scattered through the transect; *sindonemanwe*, with 20 plants/hectare, was the most abundant.

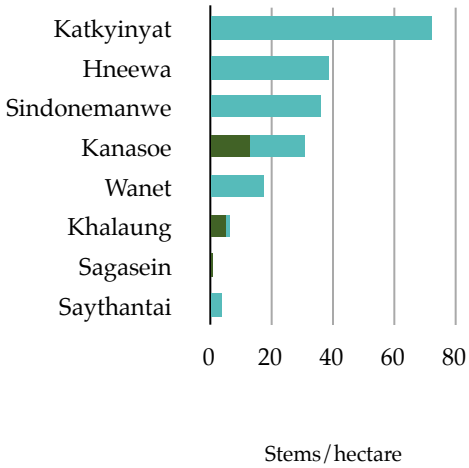


Transect 4

The final transect was located north of Mawning Stream in Production Forest (N26.54297°, E96.64613°). Forty 10 x 20 m plots (sample area = 8,000m^2) were established, but two of the plots were in large clearings and no plants were tallied.



As in the previous transcect, the most abundant species - and the most problematic one for cutting the line - was the marginally useful rattan, *Myaukchee kyeing* II. Several hundred *pyant kyein* canes were also recorded, and about 30 stems/hectare were of a useful size, i.e. ≥ 5.0 m long. There were moderate quantities of both *paukwa* and *tinkhawa* bamboo,

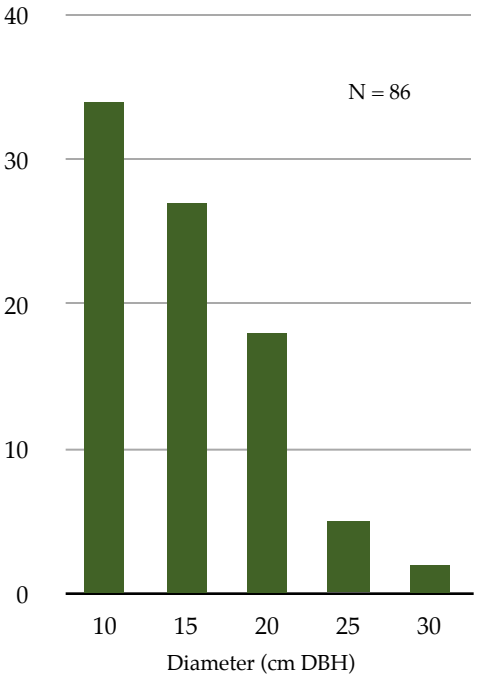


Medicinal plants were especially prevalent in transect 4. *Katkyinya*t (unidentified) was the most abundant with 72 stems/hectare followed by *sindonemanwe* with 36 stems/hectare, and *say than tai* (unidentified) with 4 stems/hectare. Bamboos were also well represented, e.g. *hneewa*, as was the fruit tree *kanasoe* with over 30 stems/hectare, over half of them of fruit-producing size.

Densities and Diameter Distributions

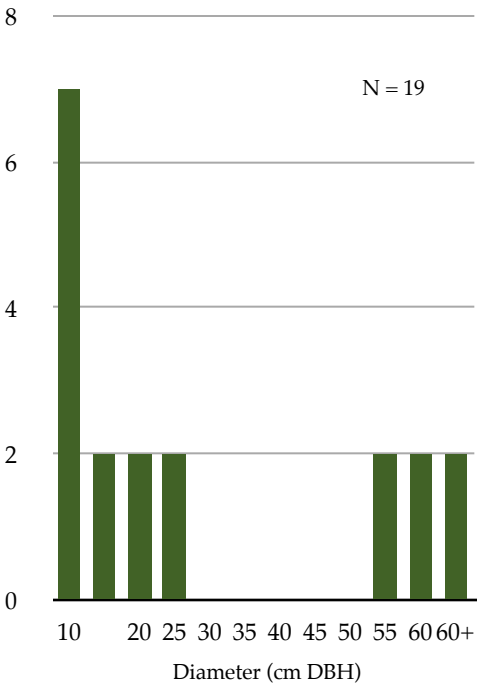
In addition to population density, an additional aspect of the ecology of the species recorded in the inventory is the diameter distribution of individuals. Species with many individuals per hectare may not be amenable to sustainable resource use if all of the individuals are more or less the same size or there are no seedlings and saplings. Conversely, populations with lots of seedlings and sapling - but few adult trees - may be candidates for management and sustainable use, but harvest operations will necessarily have to be postponed for several years until the individuals reach a merchantable size. In sum, not only is the *number* of individuals important, but also the *size distribution* of these individuals.

To given an example, the diameter distribution for kanasoe (*Baccaurea ramiflora*) is shown below:



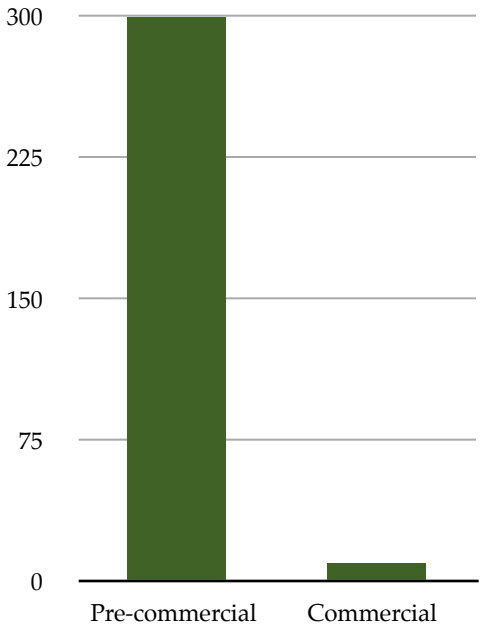
The *kanasoe* population exhibits a greater number of small individuals than large individuals, and the change in number from one size class to the next is relatively constant. This distribution, known as a negative exponential or inverse-J, is characteristically found in stable self-maintaining populations of forest trees. There are abundant seedlings to replace the death (harvest) of individuals in the larger size classes, and the absence of obvious gaps in the distribution suggests that regeneration is occurring more or less every year. Populations with this type of diameter distribution are ideally suited for management.

Another example of a common diameter distribution is exhibited by khalaung (*Disoxylum nectariferum*):



The *khalaung* population reflects a relatively constant number of individuals in different size classes, with large gaps in the distribution suggesting that regeneration is sporadic from year to year. Apparently, in some years there is a little regeneration, while in others, no *khalaung* seedlings at all get established. *Sagawa*, *kanyin*, and *ma-u* also exhibit this type of diameter distribution. Unless some form of management is initiated to facilitate the regeneration of these species, continued harvesting will gradually deplete them from the forest.

A final size distribution commonly encountered in the forests of Shinlonga is that exhibited by pyant kyein (*Calamus nambariensis*). In this case, the size parameter of interest is height, not diameter. Although the individual height of each rattan cane was not measured in the inventory because of time constraints, individual clumps were tallied as either commercial (≥ 5.0 m long) or pre-commercial (≤ 5.0m long). A simple histogram showing these two classes illustrates a useful principle. The 2.4 hectares of forest surveyed contain only 9.6 commercial *pyant kyein* rattan canes per hectare. This same area, however, contains almost 300 pre-commercial



pyant kyein canes, and some of these are 3.0 to 4.0 m tall, i.e. the will be of harvestable size in a few years. Much of the commercial cane has been removed through intensive harvesting by outside collectors, but the rattan continues to regenerate itself vigorously under the broken canopy. If harvesting is controlled and the regeneration is cared for, these rattan populations will quickly re-build themselves.

Many of the other rattans and bamboos sampled during the forest inventory exhibit a pattern similar to that of *pyant kyein*. Much of the harvestable cane and bamboo of the preferred species is being depleted - yet these species, all light demanding to a certain degree, continue to regenerate themselves in the forest. Management can usefully build on these population responses.

Clump of Calamus flagellum growing in a canopy gap.

Management Recommendations

The results from the recent fieldwork in the Hukaung Valley Wildlife Sanctuary suggest several general conclusions about the potential and direction of community forestry in the region. First, there is a great need for communities to take a more active role in the management of the plant resources that their livelihoods depend on, and there is unquestionable potential at the village level to actually do this. **Of the three villages visited, Shinlonga would appear to be the best place to implement a pilot program of community-based natural resource management.** The WCS project has already made a considerable investment in this village, and there is a greater understanding and acceptance of the concept of community forestry in Shinlonga than in either Lajarbon and Takhet. Additionally, the socio-economic conditions in Shinlonga, and the ecological conditions in the forests surrounding Shinlonga, would seem to be more amenable to the development of a program of sustainable resource use.

Second, different resource groups are in need of different management prescriptions. Wild populations of some species are sufficiently viable to merit *in situ* management in the forest; maintaining a continual flow of other resources will necessarily involve a conscientious program of *ex situ* cultivation. **In general, timber, rattan, and medicinal plant resources could be managed in the forest. More frequently needed resources that occur at relatively low densities in the forest, e.g. palm thatch and bamboo, would best be produced by planting them in selected areas near the village.**

Finally, whatever form of management is ultimately implemented for different resources, the most important thing is that harvest levels be closely controlled. Once a sustainable level of harvest has been defined for a particular resource, the long-term productivity of the resource should not be compromised by exceeding this harvest level. Operationally, what this means is that commercial harvesting by outsiders will somehow need to be curtailed in designated management areas.

In the case of palm thatch and bamboo, it is recommended that the traditional Kachin practice of planting these species around the perimeter of rice fields be re-initiated. Several of the villagers interviewed have already started doing this, and they are quite knowledgeable about the planting and tending requirements of different palm and bamboo species.

The village nursery established at Shinlonga could start producing *tawhtan* seedlings and promote their planting around rice fields. Training sessions taught by local farmers could be organized to disseminate the appropriate planting and cultural techniques for *taung htan*, and these initial plantings could serve as demonstration plots to monitor the survivorship and growth of the palms.

A similar strategy could be followed for selected species of bamboo, e.g. *wabo*, *wanet*, *tinkhawa*, but rather than using nursery seedlings, part of the training session would be a trip to the field to collect fresh rhizomes for planting. The growth and survivorship of these plantings should also be monitored in certain fields designated as demonstration plots (and perhaps labeled as such with signs).

The density of other resources is sufficiently high to warrant their management in the forest. Although several thousand hectares of land are designated as Production Forest on the existing Village Development Zonation map, **the current demand for timber, rattan, and medicinal plants**

could be supplied by a 100 hectare management area. The density of preferred timber species (e.g. *sagawa*, *khalaung*, *kanyin)* in the forest, for example, is about 10 - 15 merchantable stems/ hectare in the absence of any management. Some of these species appear to be regenerating. An estimated 1,000 timber trees would certainly be sufficient to supply the annual demand for house construction, which is usually about one new house year. Similarly, the estimated annual village demand for *pyant kyein* is about 140,000 feet, or 28,000 five foot canes per year. Based on the inventory results. a 100 hectare management area would contain about 30,000 *pyant kyein* canes of pre-commercial size. These would be ready to harvest in a couple of years, and, with management, the annual allowable harvest of rattan cane could be increased.

The next step towards community forestry in Shinlonga should be to locate and delineate a 100 hectare (1.0 km x 1.0 km or 0.5 km x 2.0 km) intensive management area. The selection of this area should be based on extensive reconnaissance to insure that all of the desirable species of timber, rattan, and medicinal plant, are found in the area and that there are indications that the species are regenerating. This area will later be divided into five 20 hectare harvest units.

After the management area is established, a systematic inventory of the entire forest area should be conducted. The basic methodology should follow that used in the preliminary resource assessment, i.e. 10 m wide line transects divided in to 10 x 20 m plots. The transects should be parallel and separated by 100m to provide a 10% sample intensity. All desirable timber species, rattan, and medicinal plants should be surveyed in this inventory. The use of systematic sampling allows for detailed mapping of habitats and species distributions. Data from the transects should be entered into a dedicated Geographic Information System (GIS) as was done by WCS during the Village Development Zonation and used to produce a base map of the management area showing transect lines, rivers, paths, clearings, and relative species densities. These data will be invaluable for directing harvesting and site treatment.

Based on the results of resource inventory, a detailed management plan should be developed for the area including harvest schedules, yield predictions, and silvicultural treatments to facilitate regeneration and enhance species densities. This plan should be developed in close collaboration with the village. Once completed, the management plan should be submitted to the Myanmar Forest Department for approval. Great care should be taken in the collection of baseline data and the development of management operations at Shinlonga as this experience will undoubtedly serve as a prototype for community-based natural resource management in other villages within the wildlife sanctuary.

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Morning mist in the village of Shinlonga.