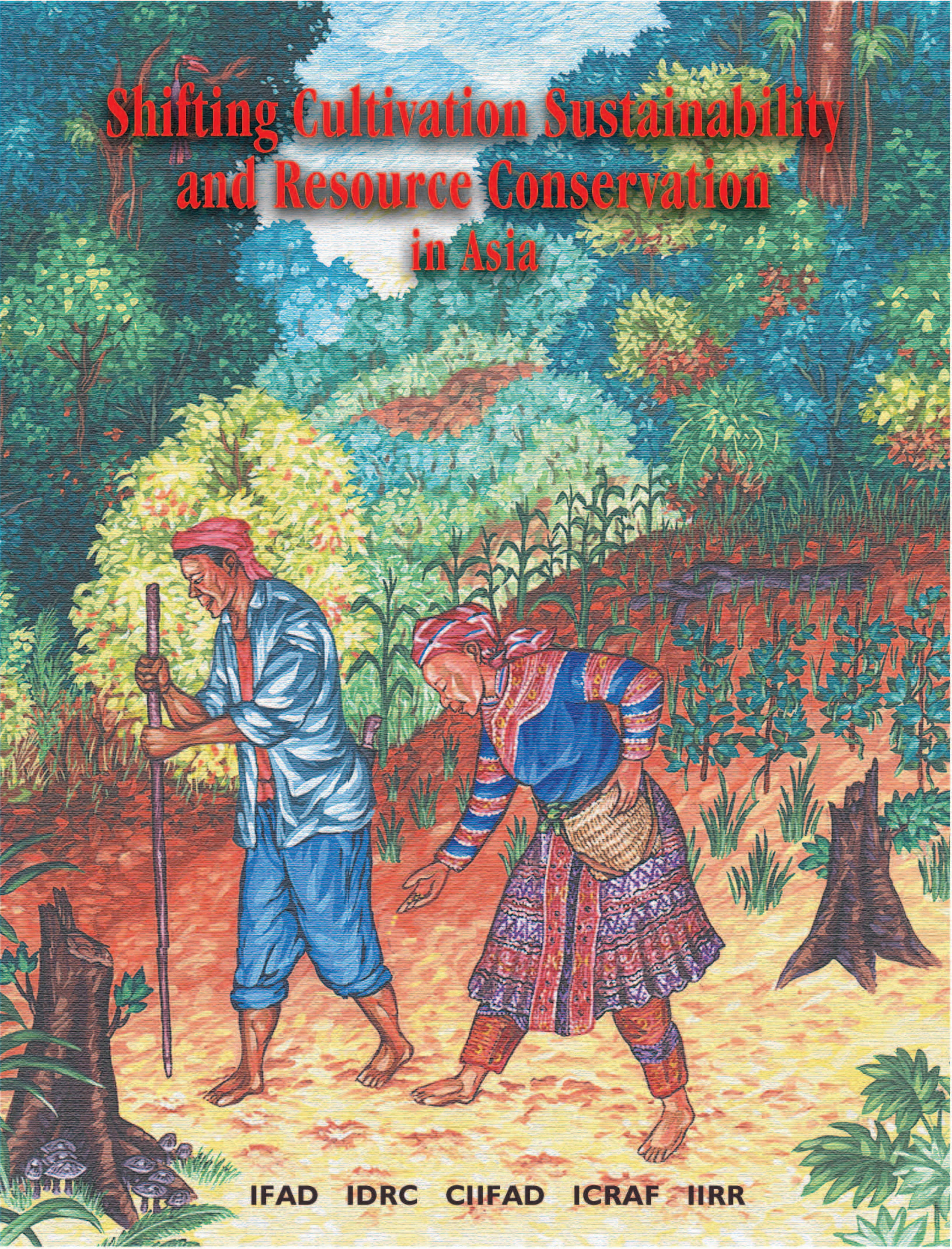
Shifting Cultivation Sustainability and Resource Conservation in Asia



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Shifting Cultivation: Towards Sustainability and Resource Conservation in Asia

June 2001

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about the resource book

Some of the world's poorest people in tropical Asia live among communities that have depended upon shifting cultivation for their livelihoods. Invariably, they are blamed for environmental problems occurring in forest margins and surrounding upland tracts and are under pressure from authorities to adopt more permanent forms of agriculture. But these farmers live within complex, risky and diverse environments and have had to develop a wide array of strategies to deal with the challenges of farming in these tracts.

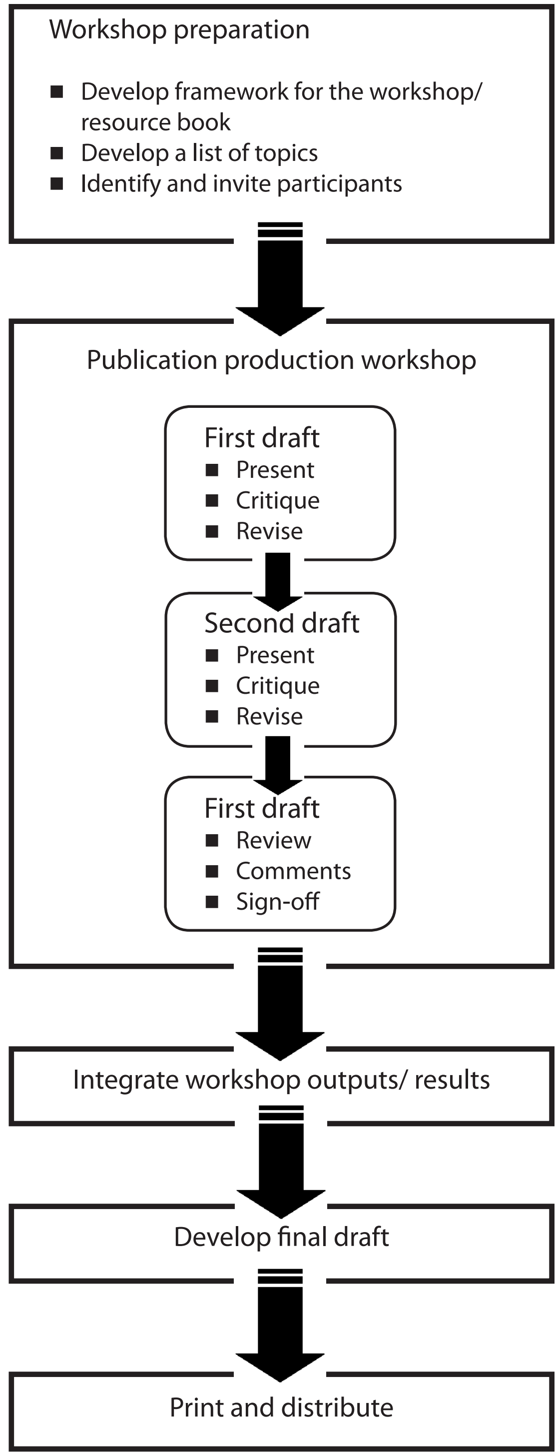
Many of their practices, unfortunately, are no longer relevant given current demographic trends. Research and development agencies have become involved in developing approaches to transform shifting cultivation systems into more sustainable forms of land use. But it is generally accepted that the uptake of these innovations by local communities is abysmally low. Meanwhile, demographic and economic pressures continue to mount in these areas, often characterized by a higher representation of ethnic minorities. Food and security concerns and questions about the impact (of such systems) on global warming and agro biodiversity are being raised. Fortunately the understanding of these challenges and limitation are better understood and an increasingly wide array of successful, best practices is being generated.

It is in this context that an activity was launched mid-1999 to document and then share more widely, relevant, field-derived experiences and exemplary practices. This activity centers on the use of a workshop to document lessons from across Asia. The workshop was held on August 2000 and organized by the International Institute of Rural Reconstruction (IIRR) and the International Center for Research in Agroforestry (Southeast Asia Office) and funded by the International Fund for Agricultural Development (IFAD), the International Development Research Center (IDRC-SAR0) and Cornell International Institute for Food, Agriculture and Development (CIIFAD).

An advisory committee was also set up to assist in the design of the workshop. This consisted of the following: Phrang Roy and Ganesh Thapa of IFAD-Rome, Dennis Garrity, Chun Lai and Paul Burgers of ICRAF, Oystein Botillen of UNDP-Hanoi, Merle Faminow and Madhav Karki of IDRC-SARO, Lucy Fisher of MOIST/Cornell, Julian Gonsalves, Joy Caminade and John Freeman of IIRR. A total of 29 participants attended the workshop and generously shared their experiences.

The aim, at the outset, was to ensure that this publication would be of special relevance to development workers and trainors from local and national governments, agricultural colleges, non-government organizations and small farmer organizations. The focus was therefore on short, succinct overviews rather than academic articles. These were generously illustrated and attractively presented. The materials benefited greatly from the peer review process and the presence of resident editors, artists and desktop publishing staff (features of the participatory workshop process used). The resulting resource book is to be used and disseminated widely and readers are encouraged to utilize the materials in any form considered relevant: articles could be used as training handouts or as reference materials. They could be recast and the main points used in farm-radio broadcasts. Higher secondary schools offering agriculture or environmental sciences as a subject might also benefit from this publication. Newsletters or even local newspapers could identify relevant materials for use in serialized issues. Often these articles can serve as prototypes for local programs attempting to produce location-specific versions. There is intentionally no copyright and readers are encouraged to widely use relevant materials and adapt and/or translate them.

The Workshop Process

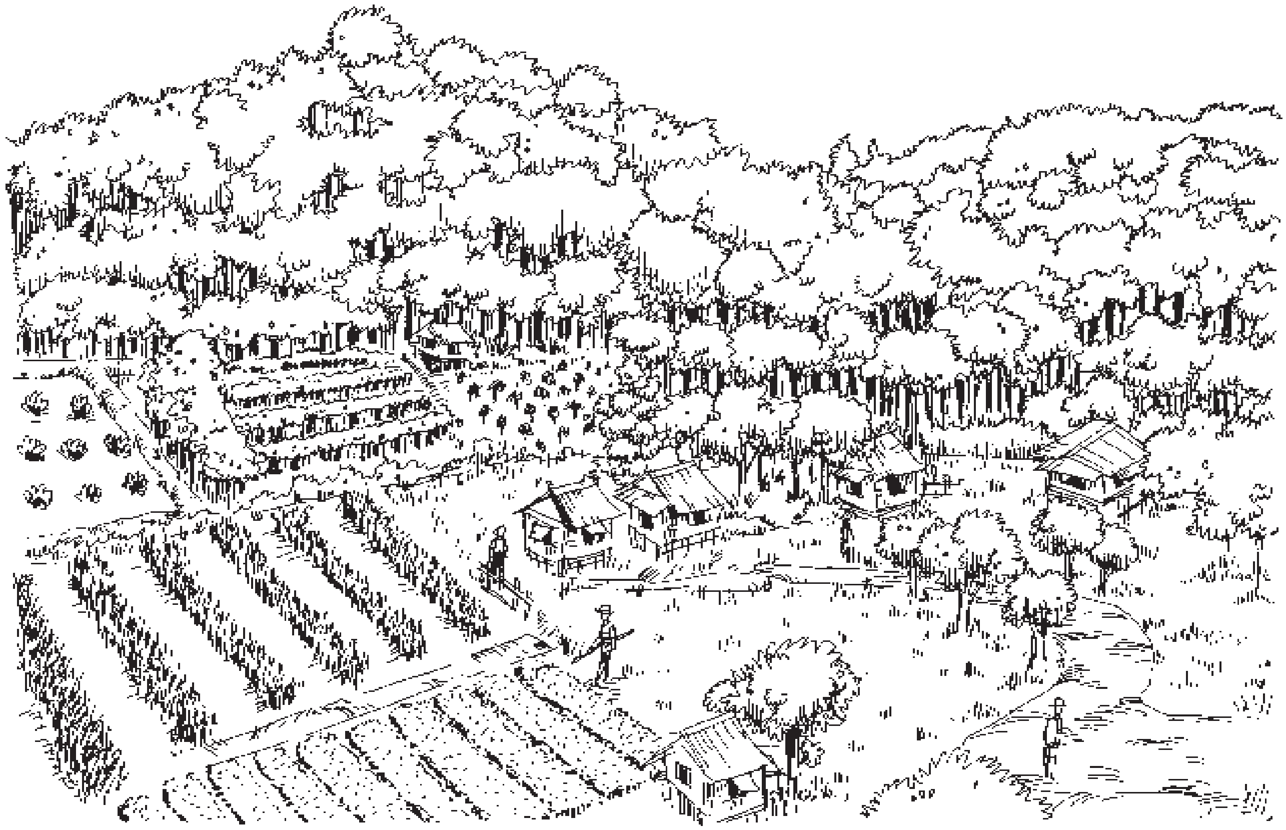


In this new century, 250 to 500 million people will continue to be engaged in various forms of shifting cultivation despite the escalating environmental concerns resulting from this practice. Extreme poverty, social marginalization and resource-tenure insecurities often characterize people living under these conditions. The current shift of focus of many development agencies towards the very poor must draw attention to these marginalized groups of minorities. This publication will offer reasons for being optimistic about what can be achieved under very challenging circumstances.

Chapter One

overview of shifting cultivation

Shifting Cultivation in Asia: Diversity, Change, Indigenous Knowledge and Strategies



Diversity and change in the Asian uplands

The original form of agroforestry

In Asia, as well as in most tropical parts of the world, shifting cultivation was the first form of agroforestry. It is characterized by the sequential rotation of forest vegetation and cultivated food crops, and is closely linked with socio-cultural values that are central to the lives and livelihood of shifting cultivators and their communities. Other terms commonly used to describe this practice include "swidden agriculture" and "slash-and-burn agriculture."

Shifting cultivators usually slash and burn secondary forests or fallows and prepare the land for food crops. Fallows, which restore soil fertility and suppress weeds, occur between periods of food crop cultivation. These may be natural fallow vegetation or 'manipulated' fallows (e.g., enrichment planting or other management practices by the farmer).

In the past, relatively low population density and abundant forest cover provided a favorable base for sustainable shifting cultivation practices with long fallow periods ranging from 10 to 60 years. In many uplands in Asia, shifting cultivation was the main farming system for producing food staples such as rice, maize, cassava and taro.

There are almost 450 million forest-dependent people in the Asia-Pacific region, or about 15% of the total population. These include forest dwellers who depend on shifting cultivation and/or hunting-gathering activities, as well as people who live outside forests but use them for their livelihood.

However, the conditions that historically underpinned the sustainability of rotations with long fallows have vanished in most areas. It has been imperative for many communities to evolve more intensive forms of land use.

Factors affecting diversity and change

- Rapid population growth and declining farmland per household.
- Deforestation and conversion of forests to other land uses.
- Establishment of protected areas and parks, and associated resettlement of people.
- State policies to sedentarize agriculture and discourage the use of fallows and fire.

There are many compelling examples where shifting cultivators have successfully managed local resources to solve local problems. Conversely, there are few examples where top-down technical approaches to stabilizing and improving the productivity of shifting cultivation systems have been successful.

Farmer rejection of researcher-driven solutions has led to greater recognition of farmer constraints. This experience underlines the need for participatory, on-farm research approaches to identify solutions.

It also underlines the need to better understand and effectively cope with the driving forces of change in the Asian uplands, including factors such as:

- the evolving policy and legal framework on land use and rights, particularly those that affect ethnic groups practicing shifting cultivation in mountainous and forest areas;
- trends toward decentralization and empowerment of local organizations;
- a push toward market- and export-oriented commodity production;
- the effects of globalization, transboundary trade and new information channels;
- population, migration and employment patterns; and
- trade-offs, tensions and conflicts between upland and lowland watershed users.

In reality, most of the policies, strategies and programs governing the uplands are designed by government agencies based on lowlander perspectives and solutions. There remains a general perception by states that shifting cultivation is 'unsustainable' and 'primitive,' and must therefore be 'sedentarized' and 'modernized.'

Can shifting cultivation be "sustainable"?

Instead of the simple dichotomy – 'sustainable' versus 'unsustainable' – work by the Alternatives to Slash-and-Burn Consortium (ASB) indicates that a remarkably wide range of smallholder land use options are agronomically sustainable, depending upon the larger environmental and economic context. However, household labor and land constraints are often limiting factors to intensification options. 'Sustainability' must also be viewed with respect to enhancing livelihoods, the availability of technical options, and cultural elements of shifting cultivators.

The ASB Consortium

The Alternatives to Slash-and-Burn Consortium (ASB) works on two interlinked global problems: the environmental effects of forest destruction and persistent rural poverty in the tropics.

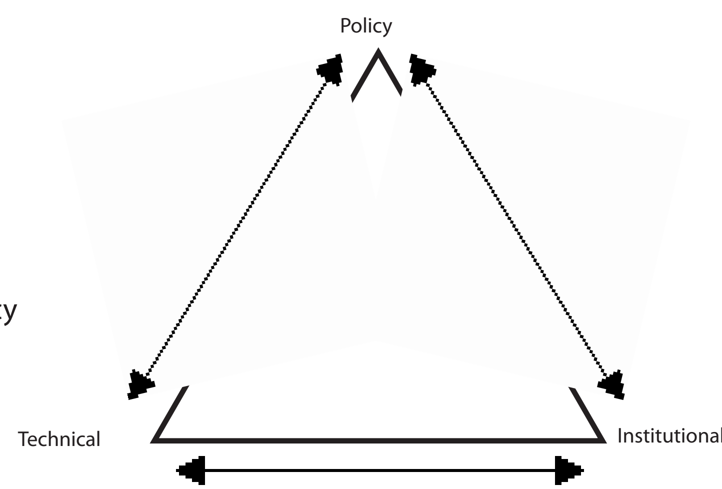
Its basic goal is to identify and articulate combinations of policy, institutional and technological options that can raise productivity and income of rural households without increasing deforestation or undermining essential environmental services.

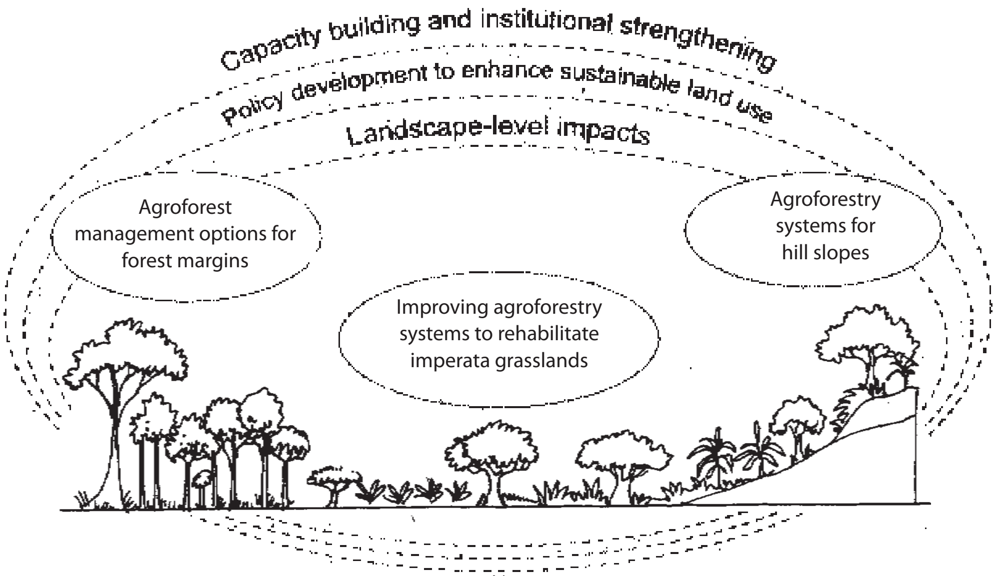
ASB, a system-wide program of the Consultative Group on International Agricultural Research (CGIAR), is a consortium of international and national research centers, as well as more than 50 independent centers, non-governmental organizations, and universities. The International Center for Research in Agroforestry (ICRAF) is ASB's convening center and hosts the global coordination office in Nairobi, Kenya. ASB is governed by a global steering group of 10 representatives from key institutions, and is chaired by ICRAF's Director of Research.

Emerging strategies

- The fundamental challenge of ASB is to identify innovative policies, institutions and technologies that can reconcile aspects of two of the greatest issues of our time: forest/biodiversity conservation and poverty alleviation.

- The diagram on the right highlights that it is not enough to focus solely on technical, policy or institutional innovations. To develop and support more sustainable shifting cultivation systems and livelihoods, all three sets of innovations are required.





ICRAF Southeast Asia Regional Themes

- In Southeast Asia, ICRAF and partners are working to improve agroforestry systems in forest margins, degraded grasslands and sloping uplands by developing appropriate technical, institutional and policy innovations.

Slash-and-no-burn alternative

In parts of Papua New Guinea, the forest vegetation is cut but the underbrush is not burned. The cut branches and leaves may be laid along the contour to provide some erosion control as well as to slowly release nutrients from the forest biomass to the soil.

Food crops are then planted using minimum tillage practices, such as dibble or digging sticks. However, this practice is not suitable for fallows under 10 years due to the existence of undesirable weedy species.

Intensification

In our common quest toward developing more sustainable shifting cultivation practices, as well as alternatives to unsustainable slash-and-burn agriculture, most strategies now being employed are towards intensification.

One major challenge is to document and evaluate indigenous strategies for intensification of shifting cultivation through an integrated and iterative process of research and development. This process involves identifying promising indigenous practices, understanding them and the context in which they are used, validating their utility, extrapolating them to other locations, verifying them with key farmers in new areas, establishing their recommendation domains and extending them more widely.

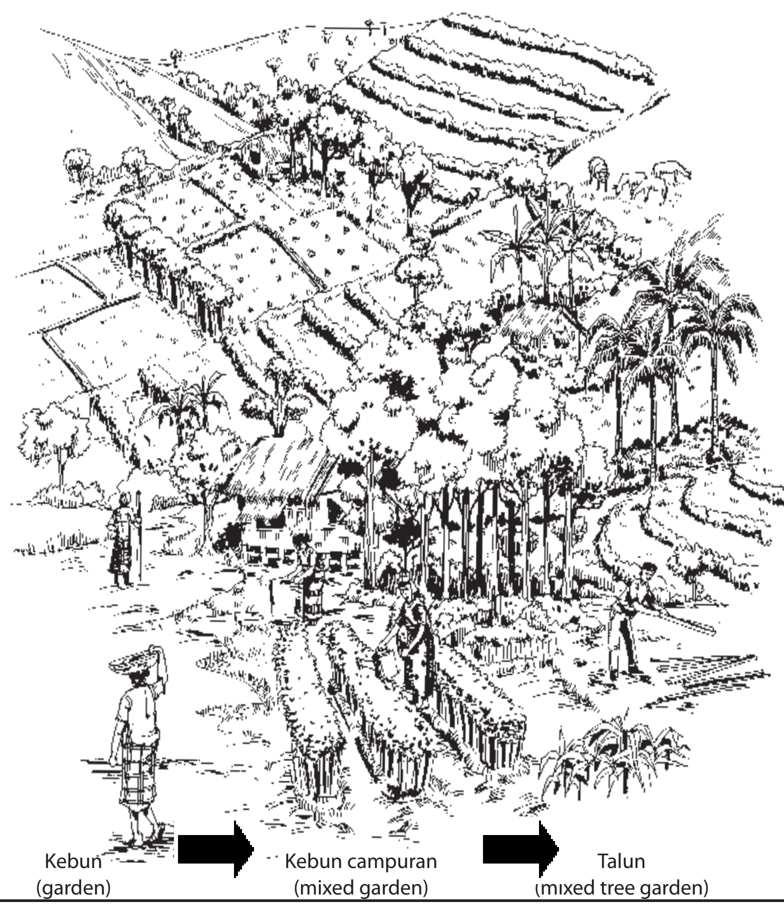
Moreover, we need to recognize under which conditions "dis-intensification" may occur. As urbanization, industrialization and rural-to-urban exodus trends continue, many young people are being drawn to cities. This reduces the labor available for intensifying shifting cultivation and can lead to more extensive forms of land use in some areas.

Kebun-talun system

Prevalent in many parts of Indonesia, the kebun-talun system usually consists of three stages: kebun (garden), kebun campuran (mixed garden) and talun (mixed tree garden). The kebun stage involves clearing the forest and cultivating annual crops, often in three vertical strata.

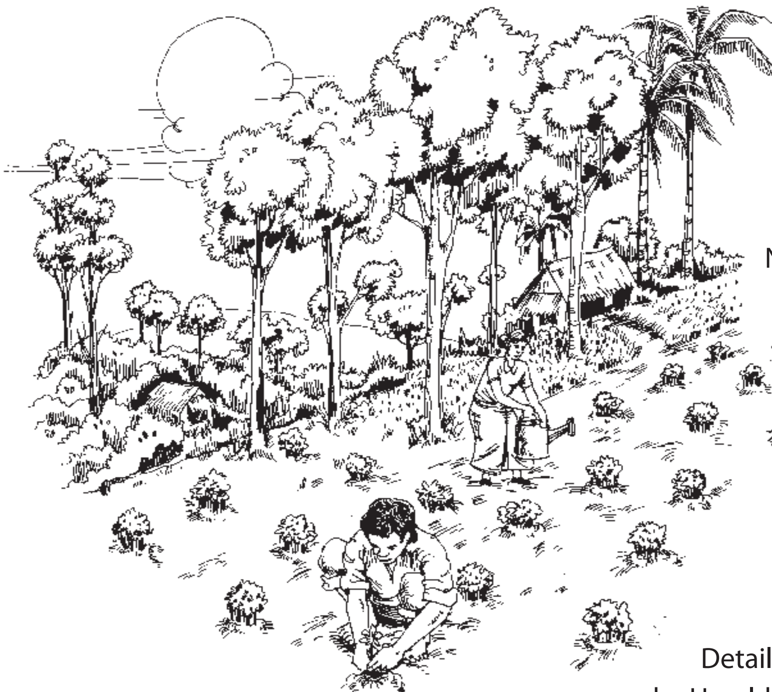
After two years, tree seedlings begin to grow and the garden evolves into the kebun campuran of mixed annuals and perennials. This second stage is generally more biodiverse but less economically valuable than the kebun.

After harvesting the annual crops for a few years, the farmer abandons cultivation and lets the garden develop into the talun, dominated by a diverse mixture of trees and bamboo, often forming three vertical layers. This stage may produce high economic returns compared to the kebun stage.



Indigenous strategies in the Asian context

Much of Asia is dominated by mountainous topography populated by diverse ethnic minority communities. Expansive forests and sparse populations allowed these mountain-dwelling communities to practice various forms of shifting cultivation, which enabled them to co-exist in relative harmony with their environments.



The annual cycle of slashing and burning that characterizes land preparation in shifting cultivation systems, however, has often drawn criticism as being inefficient and a leading cause of tropical deforestation.

National governments across Asia have given high priority to discouraging shifting cultivation, and facilitating the adoption of more intensive forms of agriculture. Suspicion, antagonism, and open conflict have thus often characterized the relationship between government officials and shifting cultivators.

Detailed anthropological studies, starting with work by Harold Conklin in the Philippines, evolved a much more favorable assessment of shifting cultivation. They presented persuasive evidence that it is a rational farming system in the context of the constraints and opportunities inherent in remote upland areas. They pointed to its long history as evidence of sustainability.

These studies argued that shifting cultivation is a land-use practice that does not wantonly destroy forests, but instead it generally reflects an:

- indigenous knowledge accumulated through centuries of trial and error;
- intricate balance between product harvest and ecological resilience; and
- impressive degree of agrodiversity.

More recent studies point to the custodial role often played by shifting cultivation communities in preserving forest ecosystems and natural species, and to the tight linkages between biological and cultural diversity. This suggests that efforts in biodiversity conservation will remain ineffective until they broaden their scope to also address cultural conservation.

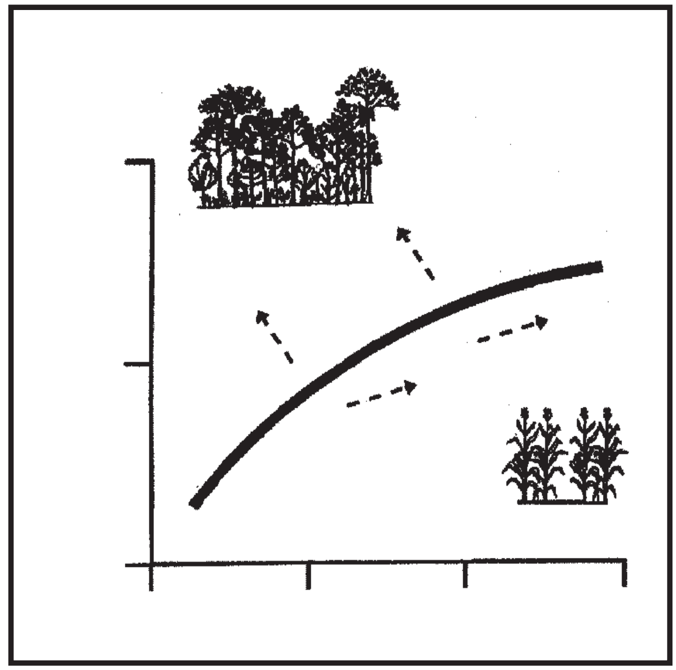
It is unlikely that these two extremes of opinion will be reconciled in the near future. We therefore need to reframe the debate and move forward in identifying research and development interventions that can stabilize declining upland agroecosystems and improve the standard of living of the most marginalized upland communities.

One cross-cutting issue of direct relevance to research and development priorities in Asia is identifying and disseminating successful indigenous strategies for managing fallow land in more productive ways. This will enable an intensified land use that provides a higher output per unit of land, labor, or capital investment. The resulting increased productivity will more ably support the growing population densities of the uplands and alleviate the pressure to convert remnant forests into agricultural land.

Indigenous pathways to intensifying fallow management

The approaches that farmers use to change their fallow management in response to intensification pressures may generally be classified as innovations to achieve:

- more 'effective' fallows — where the biological efficiency of fallow function is improved, and the same or greater production benefits can be achieved in a shorter time frame (e.g. weed suppression or soil fertility replenishment)
- more 'productive' fallows — in which fallow length remains the same or is actually lengthened as the farmer adds value to the fallow by introducing more economic species, or
- combination of the two — where both biophysical and economic benefits may be obtained.



from van Noordwijk, M, Hairiah K, Guntro B, Sugito Y and Ismunander S (1996) Biological management of soil fertility for sustainable agriculture on acid upland soils. Agrivita 19; 131-136

These alternative pathways toward intensification have different implications for land use. More effective fallows often provide an intermediate step in a transition to the permanent cultivation of annual crops.

Alternatively, in more productive fallows, the phase of reopening and cultivating annuals may eventually be foregone altogether, as the farmer chooses to protect valuable perennial vegetation, allowing it to develop into semi- or permanent agroforests. A wide array of more productive shifting cultivation systems are urgently needed if the forest remnants and their natural biodiversity are to be protected and shifting cultivators are to be afforded a better standard of living.

One of the most promising approaches to identify biophysically workable and socially acceptable technologies is to document and understand case studies of indigenous adaptations that are successful.

Unfortunately, there is little documentation of such indigenous innovations upon which to the national and international research agenda or to inform policy makers. Indigenous innovations are generally unobserved or misinterpreted.

The Indigenous Fallow Management (IFM) Network has been attempting to build a community of workers to fill that gap. The publication 'Voices from the Forest' (Cairns, 2001) contains a large and fairly comprehensive review of many systems.

Indigenous knowledge of shifting cultivators

There is a wide menu of components from which shifting cultivators may choose to intensify land use. Our operational definition of 'managed fallows' is broad and covers a spectrum from growing viny legumes as dry season fallows lasting only a few months to incremental inclusion of more economic perennials into the 'fallow' until it develops into a long-term complex agroforest.

The salient point is to understand the array of farmer-generated solutions that have successfully permitted an intensification of shifting cultivation in the face of increasing land use pressures.

Figure 1 categorizes indigenous strategies and species for fallow management that fall along the continuum from productive to effective fallows. Map 1 portrays roughly where these various systems are practiced by farmers in the region.

Case studies on many of these practices were presented at the regional workshop on indigenous fallow management organized in June 1997 by ICRAF and partners in Bogor, Indonesia. They helped to provide a foundation for the development of a longer-term, coordinated effort to stabilize shifting cultivation.

Follow-up work will explore the value of this indigenous knowledge for both researchers and policymakers. It will also help formulate more robust arguments for empowerment of local communities to manage their own natural resource.

The strategies of the follow-up work are to:

- document and evaluate indigenous strategies for intensifying shifting cultivation in Asia; and

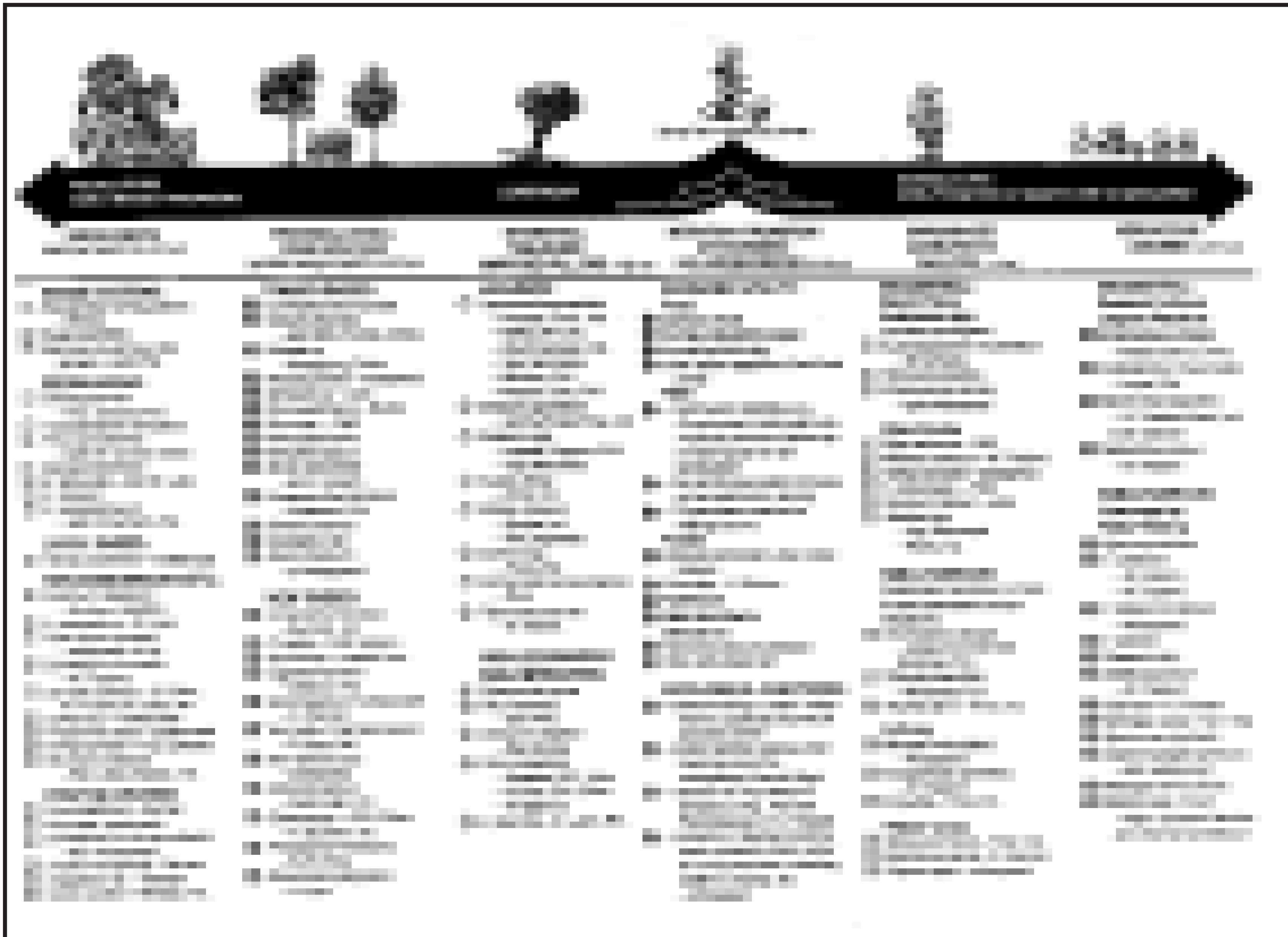
- strengthen the capacity of regional institutions and researchers to examine and illustrate the contribution of indigenous knowledge and innovations to the improved management of agricultural land.

This research thrust on indigenous fallow management is within the mandate and objectives of the broader ASB Consortium led by ICRAF, linking it directly with global efforts to mitigate the impacts of deteriorating shifting cultivation systems.

Map 1. Spatial Analysis of IFM Variations[1]

[1]from Cairns, M. and Garrity, D.P. (1999) Improving shifitng cultivation in Southeast Asia by building on indigenous fallow management strategies. Agroforestry systems 47; 37-48.

Figure 1. Spectrum of Indigenous Approaches to Modify "Fallow" Vegetation in Southeast Asia[1]



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Prepared by
Dennis Garrity and Chun K. Lai

Resource book produced through a participatory writeshop organized by IFAD, IDRC, CIIFAD, ICRAF and IIRR.

Slash-and-Burn in the Humid Tropics: Alternative Systems

The practice of slash-and-burn is found in a wide array of land-use applications. It is most commonly practiced in swidden (or shifting) cultivation, in which partial clearing of vegetation (in forest or brush fallow) is followed by flash burning and short-term mixed intercropping. Slash-and-burn is also used in many land-use transformations with aggressive forest clearing followed by other long-term land use that does not revert to bush fallow and subsequent cycles of slash-and-burn.

There is a large array of land-use options and technologies currently in farm use or under research, which are useful in transforming shifting cultivation systems. It is fully recognized that shifting cultivation, if properly practiced, can be sustainable. It must be accepted, however, that evolving demographics and changing economic, political and social environments make the traditional, formerly stable systems less and less workable. As downstream areas develop, often with their own increased environmental loading, the cost of decreasing water quality from upper watersheds shows exponential increase. It is increasingly recognized that both regional and global long-term ecological stability depend on maintenance of significant areas of forest cover as well as of natural sources of biodiversity. Unfortunately, much of the area now subject to slash-and-burn agriculture is seen as critical to maintenance of acceptable levels of both biodiversity and perennial plant cover.

A mere compendium of alternative practices and technologies is of little use to development planners and workers. One needs a topology of systems that categorize major groups of technologies with similar ecological, economic, and environmental characteristics and that have reasonably defined social and political impact. Technologies within classification groups should have reasonably similar land-resource needs and adaptation. Such classification then permits identification of policies and allocation of resources that will have a differential impact on each of the desired options and their path for change.

It is then necessary to understand the evolutionary pathways that these systems might follow. For example, when transforming systems involve perennial crops, the changes in structure occur over decades, influenced by economic, social, and political environments as well as by geophysical resources.

Slash-and-burn as a tool In land-use transformation

Slash-and-burn techniques can be viewed as land-clearing technologies for land-use transformation by low-resource farmers. Clearing may be of previously logged forest land, or more often of early-generation forest regrowth, and can be either cyclical or as part of long-term land-use changes. Examples of transformation pathways (Figure 1) use shifting cultivation as a central practice. It nearly always include slash-and-burn as the most economical and possibly least physically disruptive method of land clearing.

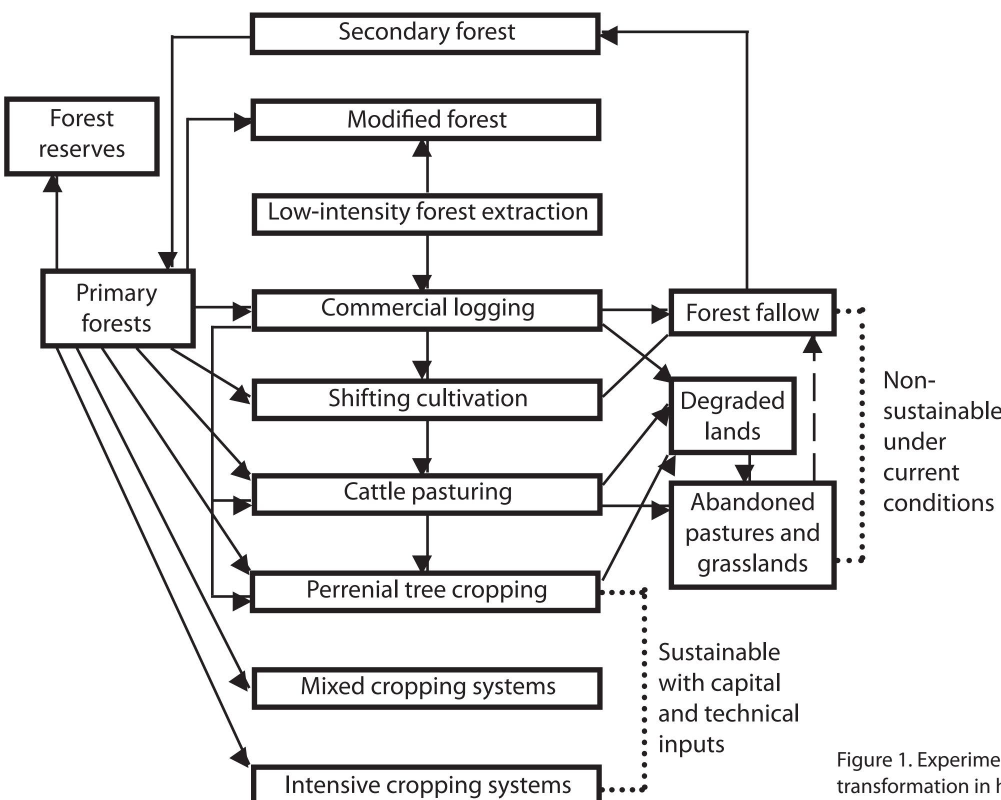


Figure 1. Experiments in land transformation in humid tropics (from NCR 1993, p.76)

Slash-and-burn may be a part of primary forest clearing, of transition from low-intensity forest extraction, or of forest regrowth. The social and economic forces driving land-use transformation are the determinants. The number of cycles of slash-and-burn, their duration, and ultimately the length of time the land remains under repeated slash-and-burn cultivation are critical to the desirability and sustainability of this system.

The pathways to sustainable land use (Figure 2) are thus critical to appropriate land use. It is assumed that increasing population pressure and the desirability for farmers to be participants in a market economy (to at least some extent) and in institutions that require physical permanence of family residence will minimize the area that will remain permanently in shifting cultivation. Thus repeated cycles of slash-and-burn following fallow periods of perennial plant regrowth are eliminated. The determinants of pathway choices have been defined as follows:

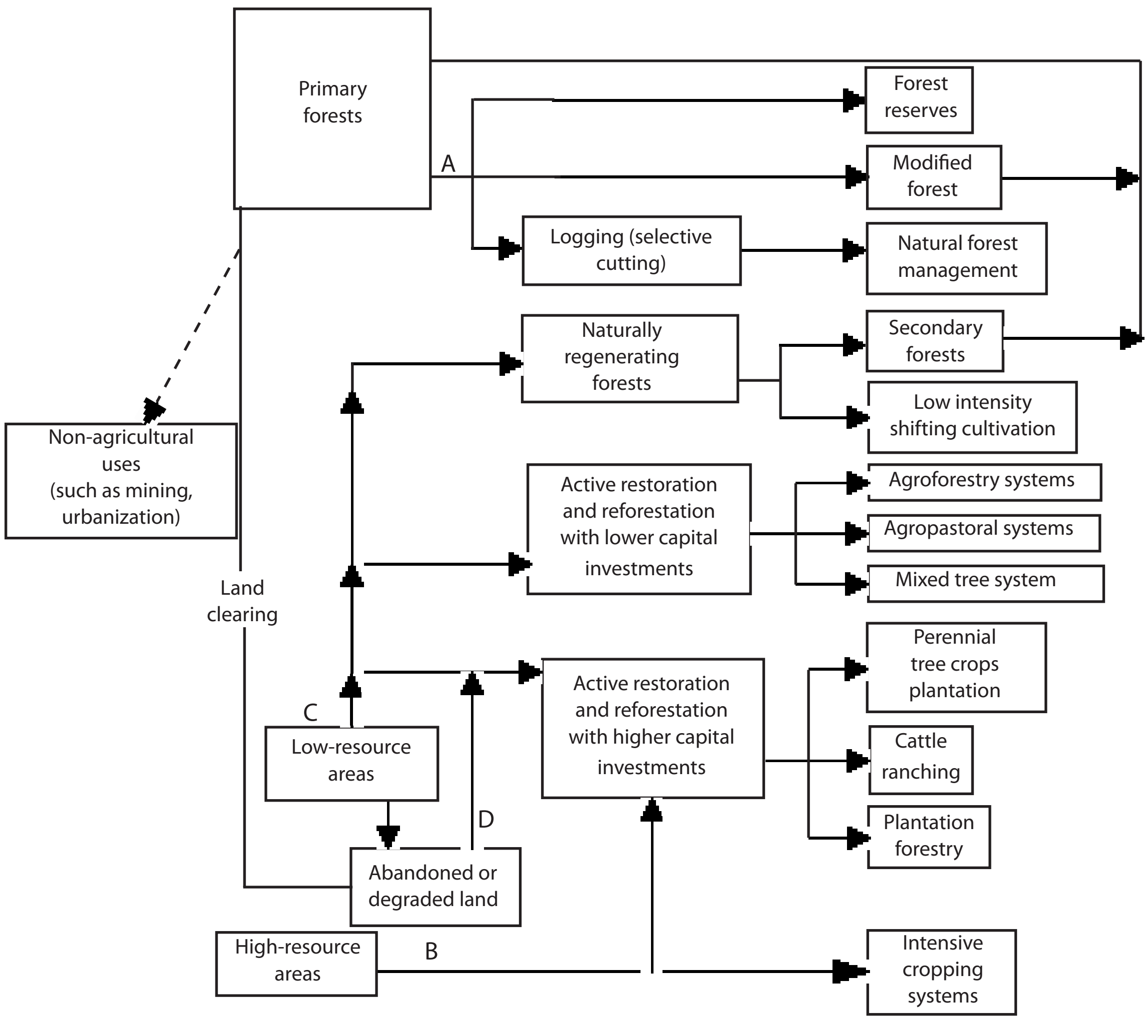


Figure 2. Pathways to sustainable agriculture and forestry land use (from NCR 1993, p.69)

Management of land resources for sustainability depends on social and political forces as well as technological and economic development at local and national levels. National policy plays a significant role, particularly when maintaining various forest types (Pathway A, Figure 2). Market forces determine the use of resource-rich areas following clearing (Pathway B). The more critical pathways follow the clearing of resource-poor areas with less fertile soils. In some cases, with appropriate market incentives, sustainable use may evolve with modest public support (Pathway C). Where the land resource has become severely degraded, more aggressive involvement of the public sector may be required , such as by offering incentives and subsidies, (Pathway D).

Patterns of change in biodiversity

Another way to view the evolution of development pathways is to use the level of interaction (or of biodiversity) as a unit of analysis (Figure 3). Biological structuring, defined as the purposeful arrangement in space and time of plants and animals by systems managers, is influenced by and in turn influences input requirements, resource-use efficiency, and the production environment. The trends illustrated here are typical of much of Asia. One pathway can be a shift to modified forestry. In this forest-dweller agriculture system (Figure 3), the

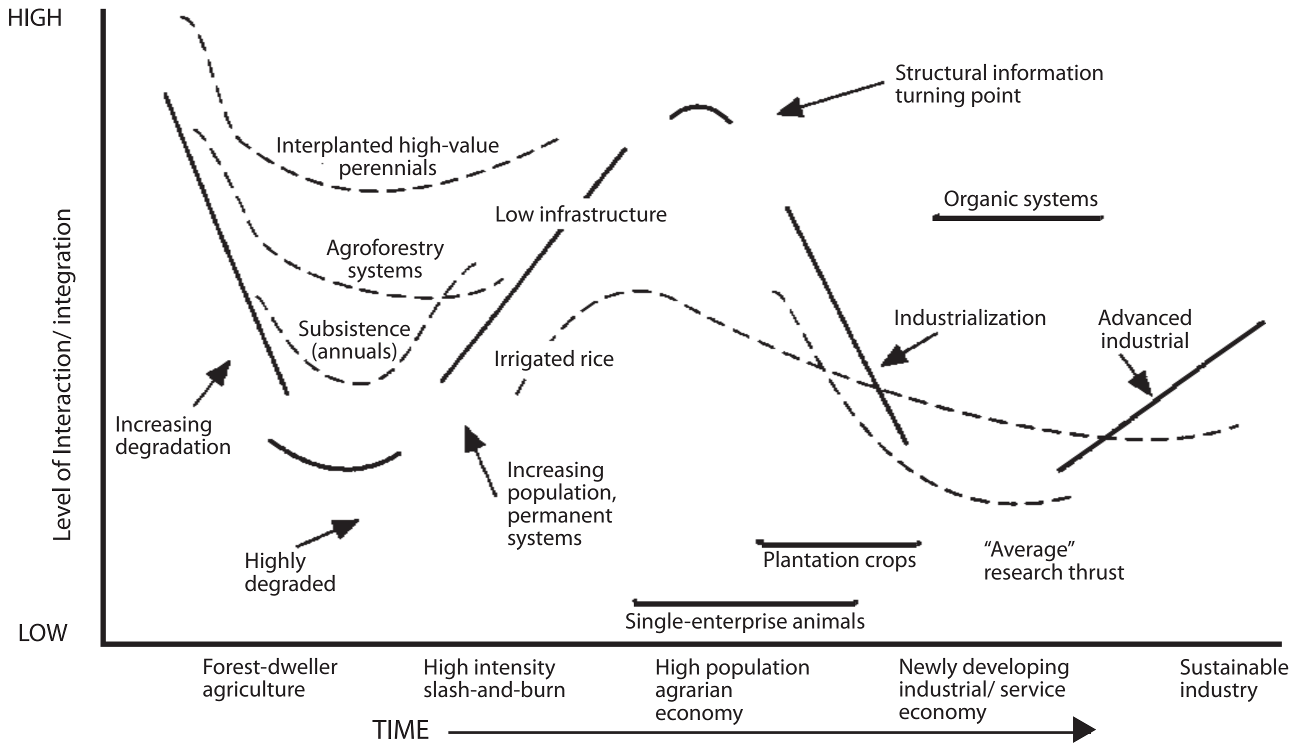


Figure 3. Evolutionary trends in biophysical/ chemical component interaction (adapted from Harwood, 1993, p.40)

forest is slowly transformed, using primarily labor inputs, to a forest analogue composed of multiple canopy layers of economic species (a "modified forest") to those who view the world from a forestry perspective. In this case, the level of biological diversity is moderately high as compared with the highest level found in forest reserves (Table 1).

This type of system evolves under smallholder conditions where markets are available for high-value forest products that fit in such mixed systems (Alcorn 1990; Brownrigg 1985) such as rubber, spices, or fruit products. A second and more common pathway, where markets are available, is agroforestry, or a mixture of cultivated crops and perennials. In such systems, the perennials nearly always have multiple uses, and the annual crops meet both subsistence and market needs. Such systems may evolve toward agropastoral systems if landholdings are intermediate in size. Slash-and-burn is often a forerunner to agroforestry systems but is less common in the transition to modified forests. The third pathway is that of continuous slash-and-burn cycles, often in a shifting cultivation mode. This can lead to land degradation and eventual abandonment, or soil resources permitting, to more intensive, permanent agriculture.

As populations increase and farm sizes remain small, the systems may be intensified as agrarian economies develop. With appropriate landscape and soil characteristics, lowland, bunded rice is the crop of choice. This pattern, under large-scale irrigation, usually fosters low biological diversity, both temporally and spatially at a landscape level. This can lead to serious problems of insect pests but is otherwise quite stable from the standpoint of soil conservation. In upland areas, a single farm may use over 100 economic plant species and several livestock species, leading to quite high biological diversity.

Patterns of planting vary with farm size, labor availability, and power source. Small farms that have no animal power for tillage may use intensive intercrop patterns in which crops are planted randomly. As animal tillage and tractors become available, regular row-planting patterns of lowland rice and rice-wheat-legume rotations fit in this phase. With irrigated lowland rice, crop diversity and structure are often limited because the puddled, flooded fields reduce options (and need) for crop diversity.

These systems reach a peak in diversity at the "structural transformation turning point", defined as the time at which the number of workers per unit area begins to decline. The beginning of decrease in both system structure and diversity is generally coincident with withdrawal of labor. This change generally takes place in agroforestry and in modified forest systems as well, with highly diverse, managed forest analogue systems gradually reverting back to dominance of a few tree species. The reduction in management, in particular, pruning, leads to the breakdown of the more economically productive structure. In addition farmers will sometimes introduce livestock into such systems in a transition phase as labor is withdrawn.

The final stages, those of industrialization, low diversity and eventually restructuring under social pressure for lowered environmental impact, are far removed in an evolutionary sense from slash-and-burn, but they may exist side-by-side geographically, depending on land ownership patterns. In this conceptualization, plantation forestry, estate crop plantings and extensive cattle ranching have moderate to low levels of biodiversity and conform to the economic and

Table 1. Comparison of the biophysical, social and economic attributes of the land-use systems in the humid tropics

	Biophysical attributes														
	Nutrient cycling capacity			Soil and water conservation capacity			Stability towards pests and disease			bio-diversity level			Carbon storage		
Land-use systems	L	M	H	L	M	H	L	M	H	L	M	H	L	M	H
Intensive cropping															
Low-resource area	x	x	x		x		x	o		x			x		
High-resource area	x	o		x	o		x	o		x	o		x		
Low-intensity shifting cuiltivation				x	o		x			x			x	o	
Agropastoral systems		x			x	o		x			x			x	
Cattle ranching	x			x	o			x		x	o		x	o	
Agroforestry		x			x			x		x	o			x	
Mixed tree systems		x			x	o		x			x			x	o
Perennial treecrop plantations		x			x	x	x			x				x	
Plantation forestry		x			x	o	x	o		x				x	o
Regenerating and secondary forests		x			x	o		x			x			x	o
Natural forest management		x				x		x			x			x	o
Modified forests		x				x		x			x				x
Forest reserves		x				x			x			x			x

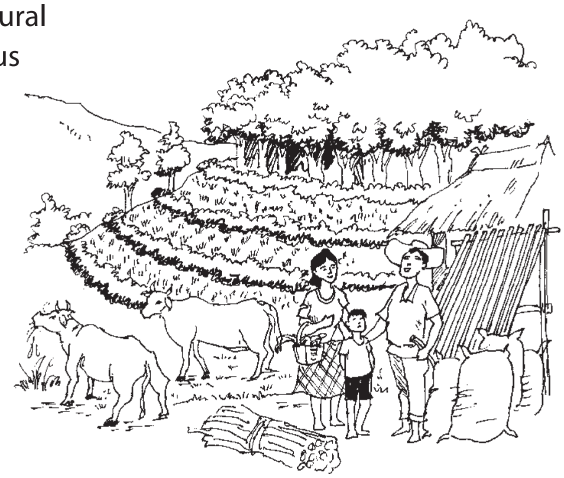
	Social attributes									Economic attributes								
	Health and nutritional benefits			Cultural and communal viability			Political acceptability			Required external inputs			Employment per land unit			Income		
Land-use systems	L	M	H	L	M	H	L	M	H	L	M	H	L	M	H	L	M	H
Intensive cropping																		
Low-resource area		x	o			x			x			x			x			x
High-resource area		x	o		x	o		x	o		x			x	o	x	o	
Low-intensity shifting cuiltivation			x		x			x			x				x		x	
Agropastoral systems		x	o		x	o		x	o		x			x	o		x	
Cattle ranching	x	o		x	o				x		x		x					
Agroforestry			x		x	o		x	o		x		x	x	o	x	o	
Mixed tree systems		x	o		x	o		x	x	x	o			x	o	x	o	
Perennial treecrop plantations		x			x				x			x			x x			x
Plantation forestry		x			x				x		x	x			x		x	
Regenerating and secondary forests		x			x			x		x				x		x		
Natural forest management		x			x	o		x	o		x				x		x	
Modified forests		x	o		x			x		x	o				x	x		
Forest reserves		x		x				x		x				x		x		

Note: The letters L (low), M (moderate), and H (high) refer to the level at which a given land would reflect a given attribute. An "X" denotes results using widely available technologies for each land-use system; an "O" denotes the results of applying best technologies now under limited location research or documentation. The system could have the characteristics donated by "O" given continued short-term (5- to 10-year period) research and extension. From NRC (1993, p. 140-141).

social characteristics of market-oriented, capital-intensive "industrial" agriculture. They are quite different, however, from large-scale arable agriculture in terms of soil and landscape adaptability and their environmental impacts (Table 1).

Intensification in cultivated agricultural systems

Intensification is essential to developing sustainable agricultural systems in the humid tropics and elsewhere, but it has various meanings in different contexts. Intensification in sustainable agricultural systems generally refers to the fuller use of land, water, and biotic resources to enhance the agronomic performance of agroecosystems. While intensification may involve increased levels of capital, labor, and external inputs, the emphasis here is on the application of skills and knowledge in managing the biological cycles and interactions that determine crop productivity and other aspects of agroecosystem characteristics.



This approach differs from that which has guided agricultural systems in industrial countries in recent years. Over the past five decades, these systems have sought to maximize yields per hectare or per unit of labor through the development and dissemination of relatively few high-yielding crop varieties and through increased use of external inputs such as fuel, fertilizers and pesticides.

Mixed tree systems

A wide range of mixed tree systems is found throughout the tropics, ranging from mixed "home gardens" to patches within forests of species that have been encouraged, spared, or planted by human inhabitants. Such plantings are normally managed by individual farmers as part of larger farming systems, which often include intensive cultivation, or by indigenous groups of small-scale farmers who manage regions of a larger forested area. Such systems may include slash-and-burn, usually in small areas of existing forest, as a land preparation method. The systems have relatively high diversity and have much the same nutrient flow and hydrological properties as the forest that they replace.

Perennial crop plantations

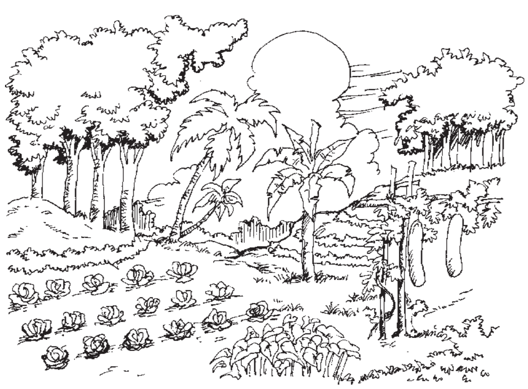
These are part of a broader category of plantation agriculture that includes short rotation crops, such as pineapple, sugarcane, and bananas, as well as tree crops, such as rubber, oil palm, and coconut.

Plantation forestry is similar, in many respects, to what are normally considered to be cash crop plantations. Such plantings in areas where slash-and-burn is practiced are relatively recent, having been practiced intensively only since the 1960s as high value timber species in native stands were reduced to where they could no longer meet market demand (FAO and UNEP 1981; Lanly 1982). Such plantations typically take longer to reach market maturity than do other plantation crops, and once established, have far lower labor needs and are thus socially acceptable (Table 1) to local people in populous countries.

Agroforestry

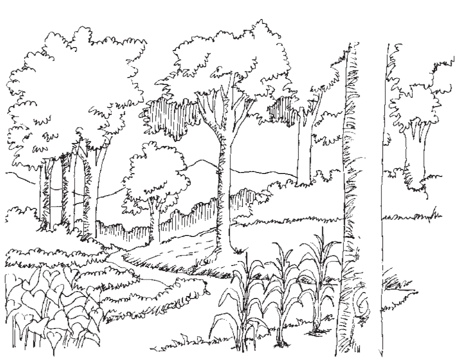
The mixture of woody perennials with cultivated crops, pastures, and other agricultural enterprises is the most widespread and adaptable practice on land that is marginal or unsuited for intensive cultivation, or where seasonal drought favors tree production. As land use Is transformed following slash-and-burn, the dominant feature of change is the introduction of woody perennials, particularly trees. From an ecological viewpoint, plant biomass is increased, with an increasing proportion representing long-term accumulation. In a more economic sense, the "biological capital" of the system is increasing.

The characteristics of an optimal mix of species in highly structured agroforestry systems are extremely environment specific. They can be classified broadly into types based on structural, functional, agroecological, and socio-economic factors:



- Agri-silviculture is the interplanting of crop and trees including shrubs or vines. It includes shifting cultivation, forest gardens, multipurpose trees and shrubs on farmland, alley cropping, and windbreaks as well as integrated multistorey mixtures of plantation crops.

- Silvopastoral systems are combinations of pastures (with or without animals) and trees. They include cut-and-carry fodder production, living fences, fodder trees and hedges, and trees and shrubs grown on pastureland.



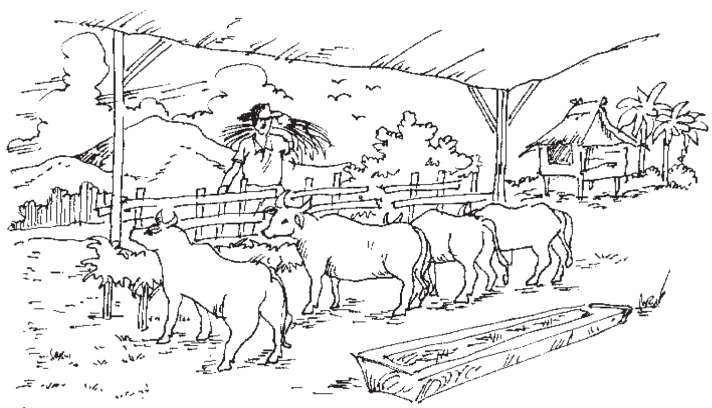
- Agri-silvopastoral systems are those that combine food crops, pastures (with or without animals) and trees, and include home gardens and woody hedges to provide browse, mulch, green manure, erosion control, and riverbank stabilization.

- Rotational agroforestry. In traditional shifting cultivation, trees and other woody species are naturally regenerated over a period of 5 to 40 years and rotated with annual crops. Improved tree species can be grown in place of native vegetation to achieve better soil conditions. In general, agroforestry systems, to be highly productive, have maximum advantage where markets are available for the high-value crops, which are usually included.

In some areas, an overriding production problem may lead to an opening for the start of agroforestry. In the Philippines, intensive population pressure has forced small farmers to settle permanently on land that was once under slash-and-burn cultivation. Land use has moved toward permanent cultivation, using draft animal power. Farmers have a choice of going to an uncultivated, intensive mixed-tree system or of gradually moving toward agroforestry plantings in regularized patterns, which still permit animal tillage.

Land tenure is often an issue. If farmers do not have either tenure or reasonable assurance of long-term access to land, they are obviously hesitant to invest in agroforestry. That insecurity, in slash-and-burn areas, often results from the vacuum left as traditional land rights of indigenous people break down and are not quickly replaced by central-government-backed tenure arrangements. Such conflicts are commonplace in Asia (Lynch 1990). In other systems the traditional tribal system of land tenure itself may limit tree planting.

Cattle ranching



The conversion of tropical rain forests to open pastureland for cattle ranching is governed by socioeconomic and political pressures existing in each country. In Asia, small forests are cleared through slash-and-burn, specifically for cattle ranching. Population pressure in the Philippine precludes the extensive use of new land for such purposes. The potential is for conversion of degraded lands, now largely dominated by Imperata cylindrica, to more productive pasture but social unrest leading to security problems reduces the attractiveness of large-scale investment. There is considerable small-farm grazing throughout Asia, but it is usually delayed until cropping systems are made permanent and thus comes later than slash and-burn clearing. Cut-and-carry systems are often a part of slash-and-burn practices.

The overall sustainability of a nation's agriculture depends both on the adaptability of its various individual forms and enterprises and on the overall balance of types of systems in its agricultural landscape. The geophysical land base, the overall stage of economic development in the country and the resultant social and economic climate all determine what that appropriate balance should be (Figure 4).

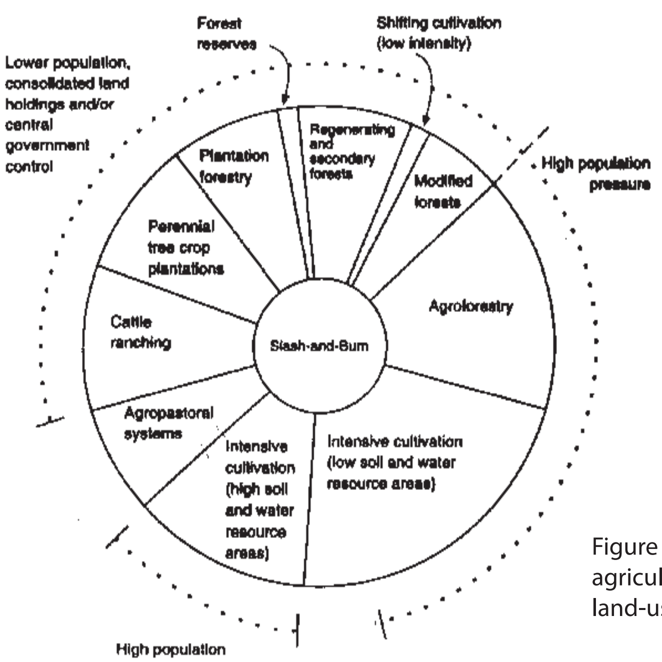


Figure 4. Area balance of agricultural and forestry land-use types.

Summary

- There exists an extremely broad range of agricultural and agroforestry land-use alternatives to the current slash-and-burn systems but much work needs to be done.
- There is a major need for scientific quantification of the many attributes of the most promising systems.
- There is need for national policy to discourage use of environmentally destructive systems and to encourage longer-term investment by finding solutions to land tenure uncertainty. Innovative marketing approaches that open large market segments for agroforestry fruit products (such as the soft drink market) have been extremely successful but not well documented in many parts of Asia.
- There is a need to "harness" and distribute the best farmer knowledge about integrated systems; we have little successful experience with this.
- Finally, scientists must realize that the scientific knowledge base covering the range of options is frightfully narrow, and the scope for learning is enormous. The success stories of imaginative application of the many options give hope, but at the same time stretch our ability to set priorities, to understand and to properly apply the numerous technologies waiting for more widespread use.

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Prepared by
Richard R. Harwood

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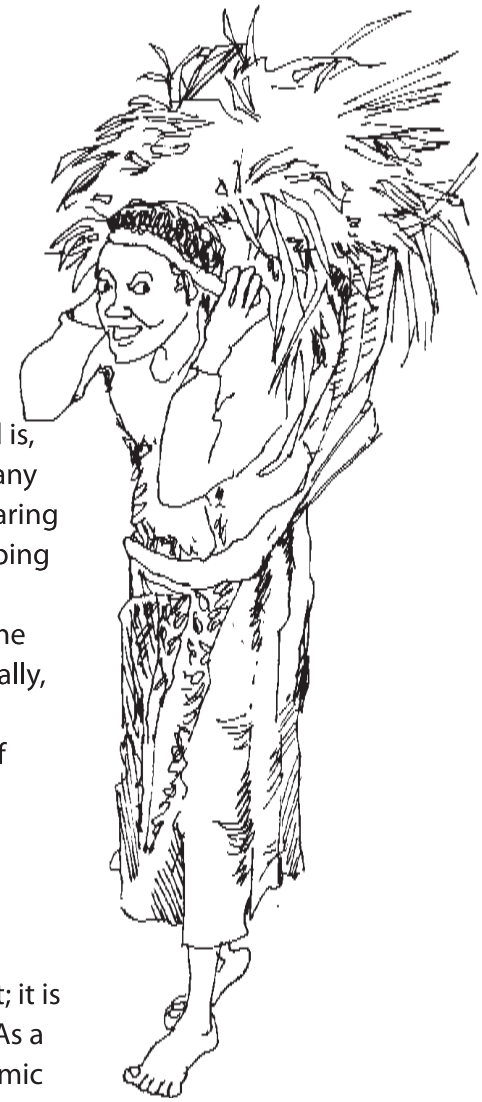
The Basics of Shifting Cultivation Systems



Shifting cultivation defined

Shifting cultivation consists of many diverse land use activities and is, therefore, difficult to define. Broadly speaking, the term refers to any temporal and spatial cyclical agricultural system that involves clearing of land - usually with the assistance of fire - followed by phases of cropping and fallow periods. Most shifting cultivation systems blend agriculture with hunting, fishing, gathering, and resource-use systems in multi-niche strategies that make economic and social sense in many settings. Typically, shifting cultivators incorporate perennial crops such as fruit, medicinal, nut, and resin trees. All shifting cultivation systems are actually forms of agroforestry systems

The colloquial term "slash-and-burn agriculture" refers to the method of clearing and preparing land, an activity common among shifting cultivators. This term, however, has pejorative connotations. Anthropologists prefer the term "swidden farming" as a neutral concept; it is drawn from the Old English word swidden meaning "burned clearing." As a term however, swidden farming does not adequately capture the dynamic quality and stages of shifting cultivation.

Extent of shifting cultivation

The total land area affected by shifting cultivation is difficult to assess because the practice includes many land use activities. In the mid-70s, various types of shifting cultivation were practiced on about 30 percent of the world's exploitable soil. By 1985, roughly one half of the land area in the tropics was modified through shifting cultivation. In 1994, the global area was estimated at 2.9 billion hectares.

Shifting cultivation was common in the temperate zones of the Mediterranean and Northern Europe until the 19th century, as well as in the south-western and north-eastern pine woodlands of North America until the 1940s. Currently, it occurs almost exclusively in the humid and sub-humid tropics of Africa, Asia, and Latin America.

Pioneer vs Integral Swidden Cultivators

Pioneer swidden cultivators are basically lowland farmers pushed into upland areas through demographic pressures or resettlement programs. Without experience and tradition of upland farming to guide them, their lowland practices become unsustainable and tend to give shifting cultivation a negative reputation.

Integral swiddeners are traditional upland farmers who have developed systems of sustainable shifting cultivation. Unless this system is disturbed by external forces, their farming operations will remain stable indefinitely.

Shifting cultivation is found in different topographies, ranging from steeply-sloped hilly areas to flat lands and low-lying valleys. It is also present in diverse ecosystems that range from tropical moist forests to dry tropical forests and savannas, grasslands, and even seasonal floodplains. Land uses derived from shifting cultivation often blend with, or are mistaken for, natural forests. Some forest formations, as in the Babassu forests in northeastern Brazil, are the results of resource management by shifting cultivators. Many forests in Kalimantan, Indonesia, are dotted with forest and fruit gardens planted over time by shifting cultivators.

The total number of people engaged in some form of shifting cultivation system has only been loosely estimated. Some conservative estimates cite 300 million to 500 million people in the 1980s. However, some have argued that more than 400 million people in Asia alone are forest dependent and that many of them engage in shifting agriculture. It is possible that about one billion people (22% of the population of the developing world in tropical and subtropical countries) rely directly or indirectly on some form of shifting cultivation. These shifting cultivators belong to at least 3,000 different ethnic groups.

Main features of shifting cultivation

Shifting cultivation is cyclical, and its cycles encompass an array of land use activities. The specific stages and features of each cultivation cycle vary and are sometimes difficult to distinguish. Shifting cultivation in woodlands and hills, for instance, has six stages: (a) site-selection and clearing, (b) burning, (c) planting, (d) weeding and protecting, (e) harvesting, and (f) succession.

In other forms, the stages do not follow such a clear pattern. Graphic portrayals of shifting cultivation risk oversimplification of its complexities, but attempts to show the main general stages and their relation to vegetation regrowth are in Figures 1 and 2, respectively.

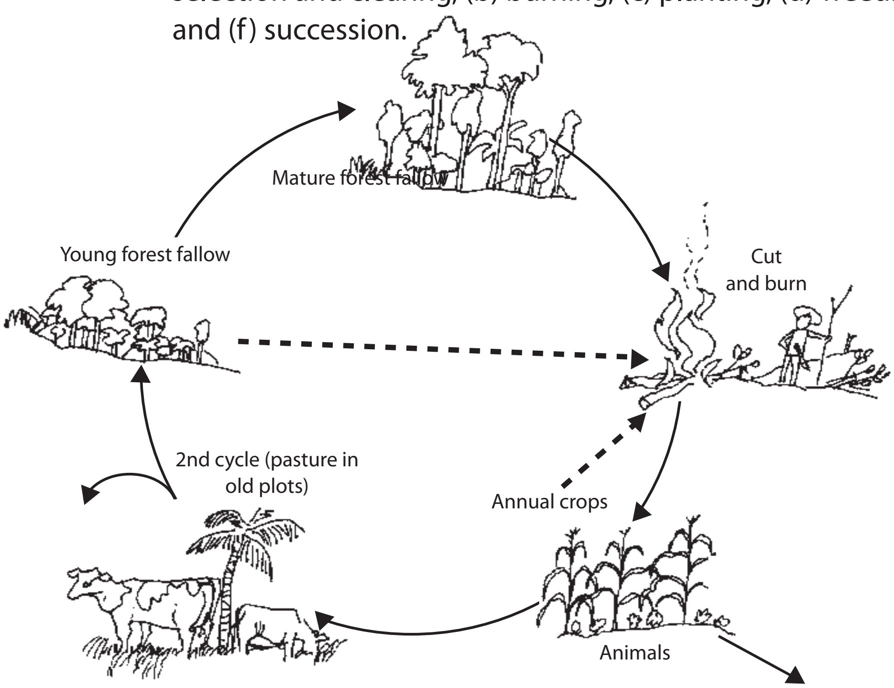


Figure 1. Shifting cultivation cycle

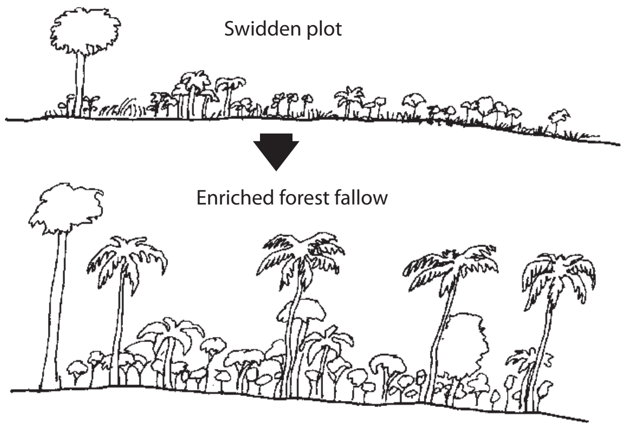


Figure 2. Improvement of forest fallow

In the Kalahan Reserve in Northern Luzon, Philippines, the farmers have over 100 varieties of sweetpotato.

The cropping cycle in shifting cultivation refers to the planting, care, harvesting, and protection of introduced flora. The types of crops and the manner in which they are planted differ greatly among shifting cultivator groups. In South America, for example, intercropping of many varieties of the same crop species may take the place of the intercropping of many species of different crops. In some areas, swidden plots are like miniaturized tropical forests or complex agroforestry systems. Even individual households commonly manage a variety of crops and trees, depending on the local economy and ecology.

In general, the cropping cycle in any given system lasts several years and is followed by a fallow period where natural vegetation regenerates and soil nutrients are restored. The fallow period, clearing of vegetation, and burning are important activities in the cropping cycle.

Burning is the typical method employed for clearing vegetation and preparing a site for planting. Shifting cultivators use different techniques for burning, fire protection, and reburning.

- Chitemene (dry forest) systems in northern Zambia and Bhutanese grass-fallow systems use supplementary fuels brought in from outside the burning area.
- Many groups prefer broadcast burning because it requires the least labor.

The fallow stage follows the cropping stage, typically after a swidden field has been used for several years. The native vegetation is allowed to regenerate so as to improve the physical properties of the soil and capture nutrients from the sub-soil. Fallow fields are often perceived by outsiders as abandoned or wasted land. In reality, shifting cultivators usually manage these fallows, using them for planting trees or crops, for collecting edible and commercial products, or for hunting and pasturing animals.

Certain trees of economic value are often protected within shifting cultivation fields both during burning and during the fallow cycle. Shifting cultivators also weed, transplant, and carefully manage vegetation regrowth during the fallow cycle in preparation for the next planting.

Benefits of burning

- Clearing of unwanted vegetation and weeds
- Elimination of unwanted insects and plant diseases. (Note: This will also eliminate desired species.)
- Alteration of soil structure to make planting easier;
- Increase in available soil nutrients;
- Decrease in soil acidity;
- Enhancement of soil fertility with nutrient-rich ashes from burnt plant biomass
- Sterilization of soil and reduction of microbial pathogens; and
- Reduction of labor requirements compared with other forms of clearing.

Fallow periods vary greatly in shifting cultivation systems and they are often adapted to existing demographic pressures and socioeconomic conditions. In many rainforests, shifting cultivation systems have long fallow cycles of one to three decades, and cultivation cycles of at least two to four years. In many parts of the world today, fallow lengths are becoming progressively shorter. In northeast India, for example, fallow periods historically reached as long as 40 years, but are now at an average of five years. This is well below the time required (10 years or more) to allow soil fertility to recover in a fallowed site. In Zambia, chitemene shifting cultivation systems have shortened fallow periods from 25 years to 12 years.

Succession refers to the multiple stages or cycles of vegetation regrowth in the fallow or in other lands adjacent to the cultivated plots. Shifting cultivators typically manage such successions for multiple purposes: they protect valuable species, plant desired ones, weed, burn, thin, and prune fallow vegetation and the remaining forest or woodland. This allows them to extract an array of forest products from the land. The products of the manipulated succession can equal or exceed the returns generated from the annual cropping phase or off-farm wage labor.

In most traditional forms, shifting cultivation practices are closely tied to cultural and spiritual activities. For example, among traditional cultivators in many Philippine upland regions, religious beliefs and practices are intimately linked to swiddening, especially in relation to activities like site selection, clearing, burning, planting and harvesting. The cultivators generally have detailed knowledge about local ecological factors and constraints and adapt their practices accordingly. Such complexity of culture and knowledge has been documented in many countries, such as Malaysia (see box below).

Culture and Ritual in Iban Shifting Cultivation

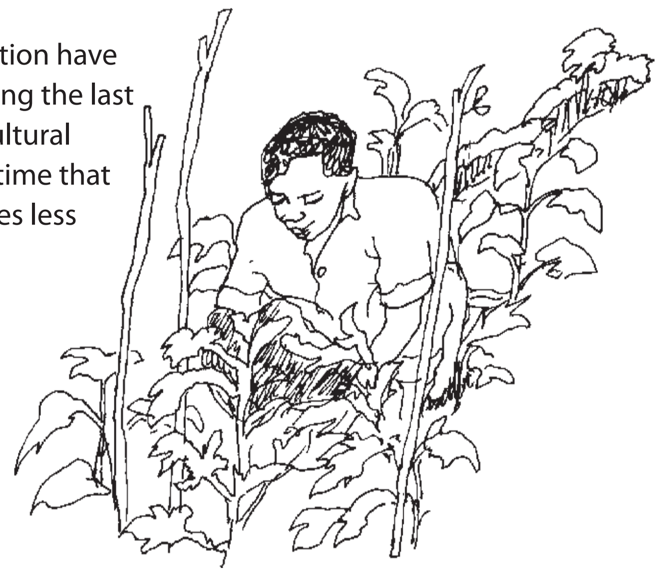
Among the traditional Iban shifting cultivators of Malaysia, rice production is interwoven with their worldview, beliefs, and social organization. Ritual and religion are integrated into all aspects of swiddening - from appeasing the "spirits of the earth jungle" with the mango ritual before clearing, to rituals associated with the storage of harvested rice. Rice itself is viewed as sacred. Various rituals before and during harvesting ensure that the spirit of the paddy is not frightened away, that there will be sufficient rice for the coming year, and that the crop will be abundant and easy to reap.

Ecological values of shifting cultivation

Swidden farmers have developed their own ecological values over long periods of upland cultivation. For example, they have internalized the importance of maintaining a high level of biodiversity as a means to insure a wide variety of food products to enhance family health, and to guard against widespread crop destruction by insects and diseases in monoculture crops. They likewise recognize the value of including animal components in shifting cultivation systems for multiple purposes like providing protein-rich food sources, acquiring animals for farm work, utilization of grass as fodder, and collection of animal manure for organic fertilizer use.

Dynamics of shifting cultivation

The features, stages and lengths of cycles of shifting cultivation have changed over time. The pace of change has been rapid during the last 30 to 50 years, largely due to the political, economic, and cultural transformations discussed here. In particular, the length of time that fields are left in fallow is increasingly shortened, which leaves less time for restoration of soil fertility.



At the same time, shifting cultivators generally have been intensifying their land use practices over time, usually through the introduction of new crops and technologies. In some regions, they have expanded their practices into forested areas. Such changes can sometimes increase the cultivators' immediate incomes.

However, these changes have also resulted in disruptions or instabilities in previously well-adapted shifting cultivation and resource use, and have made systems unsustainable ecologically and economically in some cases.

The main factors contributing to such changes include government restrictions of forest use, changes in land tenure systems, demographic pressures including large-scale migration and resettlements, and policies that promote cash crops. These factors have also raised concerns about the sustainability of shifting cultivation and have led to research and development efforts on alternative land uses.

Such unstable, changing conditions are not found in all shifting cultivation systems, but they have reinforced public misconceptions about shifting cultivators. The ecological and socioeconomic sustainability of shifting cultivation needs to be understood in relation to local conditions and the causes of change to these conditions. Finally, the general principles that underlie shifting cultivation must be appreciated.

This paper was based on the original publication by Lori Ann Thrupp, Susanna Hecht and John O. Browder with Owen J. Lynch, Nabiha Megateli and William O'Brien

Repackaged by Napoleon Vergara

Resource book produced through a participatory writeshop organized by IFAD, IDRC, CIIFAD, ICRAF and IIRR.

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Economies of Labor and Information in Swidden Intensification

Labor economics and the evolution of agricultural systems in the tropics

Most students of human behavior hold to the principle of "economic rationality." This states that traditional farmers are economically rational and will tend to choose the least costly means of achieving their ends (in terms of overall costs, not just monetary ones). Over the long term this means that they will tend to choose production systems that give the highest returns to the most limiting production factor.

One of the most common errors in technology promotion among shifting cultivators is the failure to understand which factors are limiting in the local situation. Most outside change agents come from backgrounds that are at the opposite end of the agricultural spectrum from shifting cultivators and their designs tend to optimize the wrong production factors.

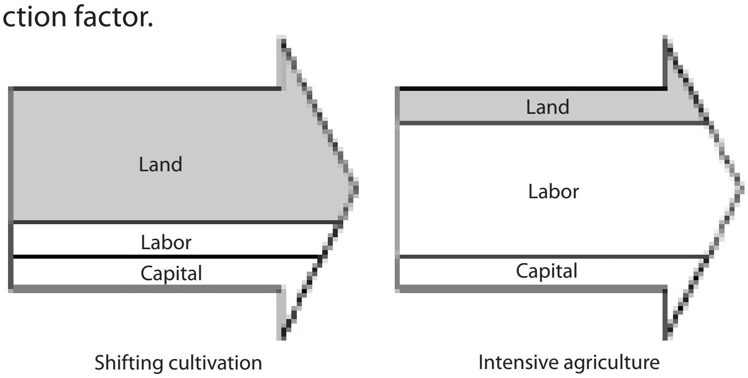


Figure 1. Economy of production systems

Where land is the scarcest factor, farmers will tend to favor those production systems that give the highest yields per unit of land. This is typical of intensive agricultural systems. Where land is relatively abundant and labor is the most limiting factor, as is typically the case with shifting cultivators before they come under pressure, farmers will tend to favor production systems that conserve on labor and give highest yields per unit of labor input.

This economic adaptation translates into the prevailing cultural attitude towards work. Peasant farmers in densely settled areas practicing intensive agriculture in order to grow enough food for their families on very limited land resources are notoriously hardworking. They are often contrasted with the more leisurely attitude toward work found among shifting cultivators, where land is relatively abundant and where labor is typically the most limiting factor. This is not just "laziness," it is economic rationality. Why work harder than you have to to meet your objectives?

Where land is abundant and fallows remain long enough to keep the land in good condition, shifting cultivators are in the enviable position of being able to let the land do most of the work for them. They work just as hard as they have to achieve their production objectives and no more. They can afford to place a high value on their leisure time and are free to pursue the traditional pleasures of an elaborate cultural and social life that may be largely invisible to outsiders.

Land scarce peasants work so hard because they have to. They no longer have the option of farming extensively; they are in the advanced stages of a process that has been gradually substituting labor inputs for land, as the quantity and quality of land decreased over time under gradually increasing population pressure. The only way to make their small land holdings yield enough to meet their family's needs is to put more labor into the production process.

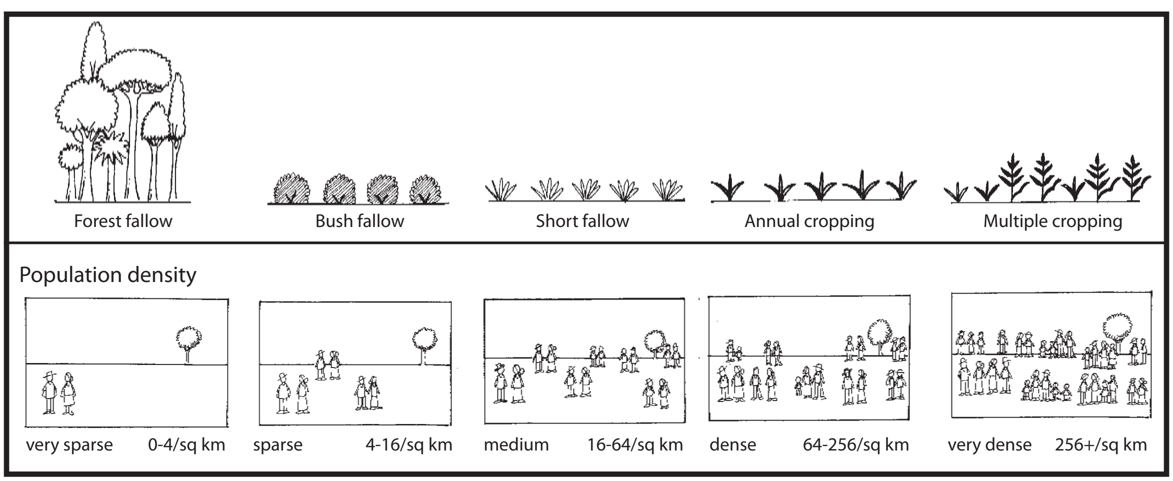


Figure 2. The main sequence of agricultural intensification in the tropics (showing typical trends in the majority of places, not what could be done with adoption of "best practices"). The landscape is always a mosaic of different cropping systems from different stages, but as the system evolves the proportion shifts toward the practices of the later stages. (Source: Raintree and Warner 1985, after Greenland 1974 and Boserup 1981).

This is a reluctant evolution. It goes against the grain of long established economies of labor and habits of leisure. The only reason it happens at all is that population pressure forces it. As human population increases relative to land availability, the standard response has been to adopt more labor-intensive farming systems. The same process can be stimulated by artificial restriction of land use (e.g. government policy).

The reverse process, "disintensification," can also occur if population decreases or more land becomes available or policy restrictions are released. Technological innovation is a major variable in all of this and can be used to capture unexpected efficiencies, which can alter the course of intensification. That is why the main pathway of agricultural evolution does not represent an inevitable sequence, just a descriptive generalization of the historical trend. It can be changed.

Natural process as resource

When outsiders think of a "good farmer", they generally have in mind some variant of the "hardworking peasant" model. What they don't see is that shifting cultivators often make very intelligent use of natural process as a resource in their farming. They use fire in preparing their fields and then they let natural fallow processes take over to suppress weeds and restore the fertility of the soil when the cropping cycle is completed.

Letting nature do most of the work is actually a very intelligent way to arrange a farming system in order to economize on labor when land is abundant. (The same occurs when farmers adopt mulch farming systems that let the earthworms do the tillage and the mulch control the weeds.)

The whole evolutionary sequence from hunter-gatherers to intensive agriculturists can be thought of as a gradual substitution of human effort for natural process.

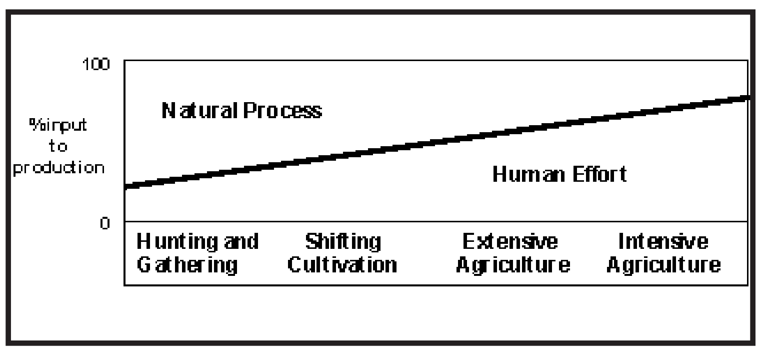


Figure 3. Replacement of natural process by human effort in the course of agricultural intensification (the general trend of history, not necessarily the way it has to be if new "best practices" are adopted).

Initially, people prefer to gather a product that nature provides. When nature no longer provides for the growing human population in sufficient quantity, then people will consent to grow crops — but they will tend to use the least labor-intensive way of doing this (e.g. swidden) as long as they can.

Only in the final stages of the intensification sequence will the farmers begin to think of using their labor to grow an input to grow a crop. Normally, they would prefer to grow a crop directly if they could. Or, better still, just gather it from nature. However, when this is no longer possible they will adapt to changing circumstances and do whatever they must to make a living.

Table 1. Changes that occur in the balance of natural process and human labor inputs in the course of intensification

Traditional Production Systems	Human Intention	Relative Importance of Natural Process and Human Effort
Hunting and gathering	Just harvest what nature provides.	Nature takes care of production; human effort mainly focused on harvesting. Human economic product is only a fraction of total biological production. Natural processes of production and regeneration are the main resources. Toward the later stages, the human beneficiaries may begin assist natural regeneration of the resources.
Shifting cultivation	Grow and harvest crops taking advantage of natural processes.	Human effort is increasingly important in clearing, planting, weeding, harvesting, etc., but managed natural fallow processes still provide a major input to the production system through natural regeneration of fertility, weed control through vegetative successions, etc. Returns to labor high initially, declining as fallow periods shorten.
Extensive agriculture (permanent fields)	Grow and harvest crops with increasing substitution of human effort for natural process.	Human effort substitutes for natural process to a greater degree, but labor inputs still held to a moderate level in unavoidable operations like plowing, planting, weeding, pest control. Permanent field farming replaces shifting fields but field size is still relatively large and occasional fallow periods may still be practiced. Domestic animals may become important as draft power and food but manuring is not intensive. Manual weed control is a critical input. Effort is still directly expended on crop production and there is little interest in growing a non-crop cultigen as an input to grow a crop (e.g. green manures, hedgerows, etc.)
Intensive agriculture	Grow and harvest crops with high level of substitution of human effort for natural process. In later stages of intensification, may even be willing to grow an input to grow a crop.	Labor and capital intensive human inputs substitute for what was previously done by nature. Highly "artificial" plant associations are dependent on human management. Economic output is high but has high labor and management costs. Nature is tightly controlled and genetic material is highly modified by breeding. Natural process often regarded as an "interference" rather than a resource. In the later stages, multiple cropping maximizes economic output per unit of space and time. Only in this stage will farmers think it is normal to grow inputs for crops and invest in infrastructure to support higher yields (e.g. irrigation, terraces, contour hedgerows).

The table displays the qualitative economic logic of labor use in main sequence agricultural intensification. Traditional farmers do not normally use quantitative decision-making tools. They base their judgements on a qualitative perception of the relative labor requirements of different cropping systems.

It is economically rational to adopt more labor- and management-intensive technologies only when such technologies offer a better alternative than other available options. As long as less labor requiring means of satisfying their needs are available, people will tend use them.

Shifting cultivators will adopt more labor-intensive means of production, but only when compelled to do so. What compels them to change in most cases it is the falling labor efficiency of traditional technology under pressure of the vicious cycle of the swidden degradation syndrome.

The amount of land required to operate a swidden system depends on the size of the fields and the length of the fallow period. As population grows, eventually the situation is reached in which there is not enough land for optimal long fallows, so farmers have no choice but to return to a plot before it has had enough time to recover completely. Further cropping leads to declining soil fertility and increasing weed problems, which in turn lead to declining yields.

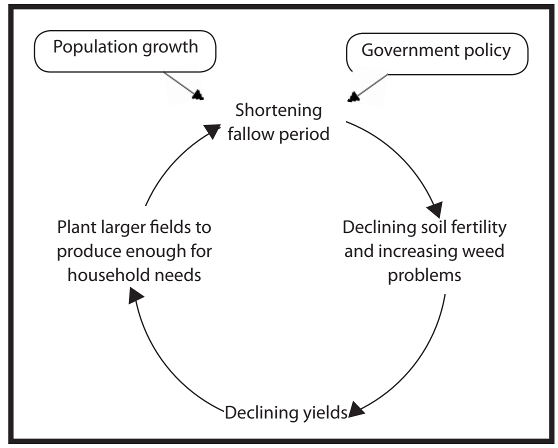


Figure 4. The swidden degradation syndrome under population pressure. Government policies that reduce land available for shifting cultivation can have the same effect.

In order to compensate for declining yields, farmers have to make larger fields. Since land is not increasing, this leads to a further decrease in the length of fallow periods, which leads to further decline in yields, and so on in a vicious circle of increasing resource degradation. An accompanying effect is that the farmers have to work harder and harder, clearing bigger fields, spending more time controlling weeds and other pests, etc. Declining yields per unit of land and labor are the result of the swidden degradation syndrome.

When the degradation process reaches the point that it actually requires more labor to continue to struggle with the old technology than to adopt a new technology, then farmers will switch. A widespread example is the historical tendency for swidden rice farmers to adopt wet rice cultivation when swidden rice yields per unit of labor input decline below the point where paddy rice offers more attractive returns to labor. In a graph of returns to labor vs. time, the transition point looks something like this.

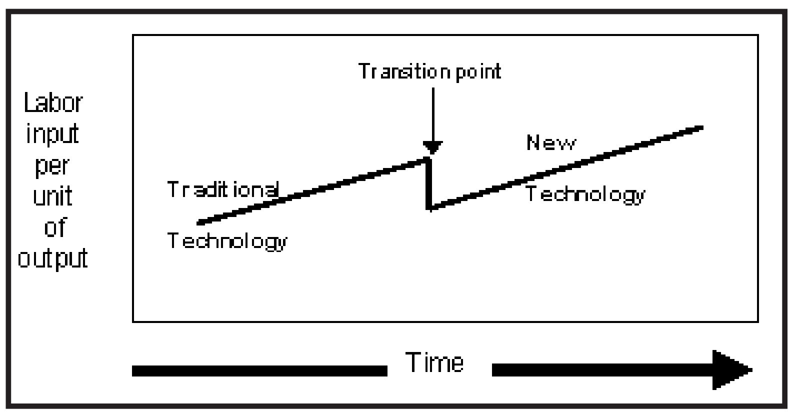


Figure 5. The zig-zag progress of agricultural intensification.

Intensification follows the "path of least resistance." Different technical options open up from different points along the intensification pathway. Success in extension work with shifting cultivators depends on being able to offer the right kinds of intensification at the right time. In particular, it depends on being able to offer a technology with a degree of labor intensity that people are ready to accept.

This is how considerations of labor economics affect agricultural intensification. Over the long term, this principle seems to hold as a major determinant of farmer adoption of new technology.

However, over the short run in particular cases, there is often a “lag time” in the adoption of new technology. The reasons for this are to be found in the relevant economies of information.

Economies of information in cultural change

The anthropologist Gregory Bateson pointed out that in ecological systems we are always finding two kinds of economies: economies of energy and economies of information. The labor model of agricultural intensification addresses the energy economy in swidden systems, but to understand the decision-making of shifting cultivators we also need to understand something of the economy of information.

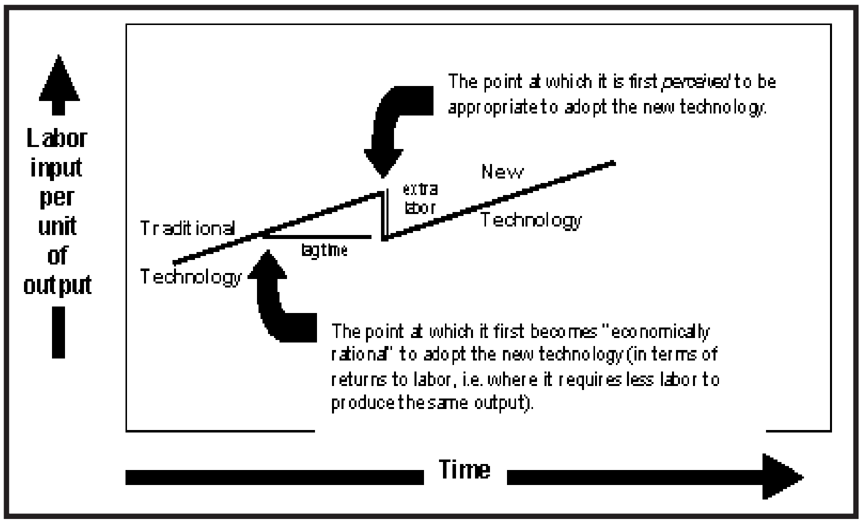


Figure 6. The lag in adoption of new technologies.

Why is there a lag time in the adoption of a new technology? Taking a closer look at the steplike transition to the new technology in the previous diagram, we see that there is a kind of overshoot of labor input associated with the lag in adoption. If labor economy were the only factor, farmers would adopt the new technology as soon as the old technology started requiring more labor per unit of output than the new technology. But typically they do not. Obviously, something else is involved. That something is human perception, an informational rather than an energetic phenomenon.

In reality it is not actual labor requirement but perceived labor requirement, and more precisely perceived effort, that is the determining factor in farmer’s decision-making. Perceived effort may differ from measurable labor requirements in two ways: 1) It involves a psychological step in processing information into a perception; 2) Perceived effort includes not only physical effort or energy cost but also mental effort or information processing cost.

“Information” in the broad sense used here includes all of the following meanings:

- the conventional concept of information
- structural information contained in social institutions and habits
- cultural information contained in concepts and symbols
- cultural programming (culture conceived as the “software” of a social group or individual)

A change in any of these has a cost.

Information costs of technological change

Farmers economize on “total perceived effort”. They don’t immediately adopt new technologies as soon as it is justified by labor costs because these are not the only costs involved. The other costs are “information” processing costs, and the lag time is the time it takes to pay – or decide to pay – these costs. The information costs of innovation are typically overlooked in assessing the probability of adopting innovations.

Action	Associated "Information" Costs
Giving up the traditional technology	■ Foregoing the mental "efficiency" of being able to practice the old technology almost without thinking. ■ Loss of "cultural efficiency" in giving up a traditional technology that is deeply interwoven with cultural symbols, values and attitudes (such "cultural costs" are often very high in traditional swidden societies and this may cause strong cultural resistance to technological change). ■ Loss of efficiency in giving up the social organization of labor and other productive relations associated with the traditional technology (social costs).
Adopting a new technology	■ Information requirements of the new technology. ■ Mental effort required to learn the new technology and change one's attitudes about it. ■ Mental effort and attention required to manage the new technology on a day-to-day basis. ■ The need to elaborate new social institutions, cultural symbols and other information structures to integrate the new technology into the society and replace what has been lost through change.

The adoption of a new technology can have a high cost for the culture conceived as an information system, i.e. the system of interconnected symbols and values and indigenous knowledge that comprises the operating system or cultural programming of the society. These costs are not to be taken lightly, but in fact they are hardly ever explicitly recognized in development work.

In the long run, if the culture is to remain viable, the information costs of adjusting the culture to changes in the underlying energy economy caused by environmental change must be paid. But it takes a certain amount of time and mental effort to recognize that change is necessary, to evaluate the technical alternatives, to learn the new technology well enough to give it a try, and to change the attitudes that have served one so well in preserving the old ways but which may no longer be appropriate for survival.

Practical application of the theory

Summary of basic principles

1. Farmers are economically rational. They economize their behavior in accordance with prevailing economies of energy (labor) and information.
2. Among shifting cultivators, the energy economy is largely concerned with economizing on labor inputs: farmers do not work harder than they need to to achieve their objectives.

3. The information economy has two main components:
    a. adjustment level – the indirect information costs of cultural adjustment to technical change (foregone efficiencies, efforts to achieve new efficiencies, etc.)
    b. implementation level – the direct information costs of implementing the new technology
4. Cultural adjustment processes may exaggerate the perceived implementation costs and create a lag in adopting the new technology.
5. At the implementation level, what farmers actually economize on is not just physical labor but the combination of physical effort + mental effort = Total Perceived Effort.
6. The mental effort component of the requirement for adopting a new technology itself has two parts:
    a. perceived labor requirements (how difficult is it perceived to be in terms of physical labor?)
    b. perceived management requirements (how difficult is it in terms of the mental effort, knowledge or attention required to implement the new technology on a day-to-day basis?)

A case in point: alley cropping

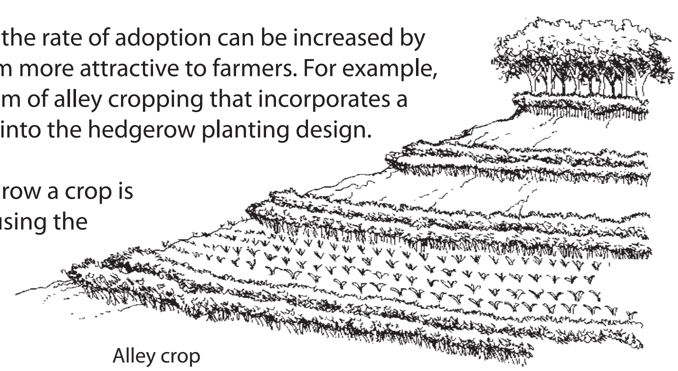
Alley cropping may be defined as an improved bush fallow system in which the fallow functions are performed simultaneously with the cropping phase, rather than sequentially as is normally done in shifting cultivation. It is an extremely attractive alternative to degraded swidden systems in the eyes of researchers and extensionists concerned with soil conservation, but in many places it has not enjoyed a high adoption rate among farmers. Why is this?

Application of the above principles can answer this question: Alley cropping is a relatively labor-intensive alternative. Fundamentally, alley cropping is a system in which farmers are asked to grow an input (green manure) to grow a crop. Our principles tell us right away that this is unlikely to be acceptable except in intensive farming systems. Alley cropping has been almost universally recommended, but it is an inappropriate recommendation wherever the prevailing farming system (and the local attitudes toward labor input) are at the other end of the spectrum. Only where farmers have long been applying labor-intensive methods will alley cropping be perceived as a reasonable way of meeting the farmer's production objectives. The exception proves the rule: where alley cropping has enjoyed a relatively higher rate of adoption tends to be places where population density is very high and very labor-intensive hillside farming systems prevail. In those circumstances, alley cropping has a chance to make sense to the local farmers.

Even where alley cropping could, in principle, be adopted, there may still be a lag time in the adoption process. This may be simply because alley cropping is such an "outlandish" technology! Most traditional communities don't have anything like alley cropping in their repertoire of indigenous technology. Consequently, the information costs of understanding alley cropping operations, subjecting the system to trial, forming a favorable attitude towards adoption, and creating space for it within the traditional social organization of farming are all relatively high. It may take time to work all this out, and there may be less costly alternatives.

Where alley cropping does have a chance of being adopted, the rate of adoption can be increased by modifying conventional alley cropping designs to make them more attractive to farmers. For example, SALT (Sloping Agricultural Land Technology) is basically a form of alley cropping that incorporates a variety of fruit trees and other economically attractive crops into the hedgerow planting design.

The unpopular move of asking farmers to grow an input to grow a crop is avoided (or at least masked in terms of perceived effort) by using the alley cropping arrangement to grow valuable crops directly! Again, the exception proves the rule: SALT is the one variant of alley cropping that has enjoyed a relatively higher rate



Alley crop

of adoption. But even here, it succeeds best where prevailing farming systems are already quite intensive (or at least where farmers have no other viable alternative and where the traditional system is failing badly enough that they are desperate to try anything).

Whether the other, more conservation oriented, elements of classical alley cropping will be retained in the SALT designs that farmers adopt and retain after the project is finished is another question. It depends partly on how well perceived the conservation benefits are, and also the perceived costs of these elements. Planting perennials on contour lines is not much more laborious that planting them in a random pattern, but it is certainly a more information intensive operation, requiring higher management skills and attention to detail. It may also run afoul of cultural value systems that do not appreciate the beauty of having everything in straight lines (many swidden systems seem to value trying to mimic natures own chaotic diversity). When it comes to straight lines, the opposite might also be true. One African farmer reported that for him, the most important reason for adopting alley cropping was that "it is beautiful in my eyes."

Another possible reason that SALT enjoyed a high level of adoption at its point of origin is the fact that the adoption process was facilitated by a socially sophisticated extension process associated with membership in a religious organization. This kind of approach to extension can often radically reduce the adoption lag by providing group support for information processing and reduced net costs of cultural change by assisting in the adjustment of cultural symbols to support the new technology. We can expect more efficient adoption of basically viable technologies whenever we can "socialize" the adoption process.

Adoption of the green manuring component of alley cropping, which is incorporated into many SALT designs, can sometimes be problematic. There are reports of SALT adopters who dropped this feature as soon as the project that promoted it was over, even though they continued to plant fruit trees and other directly economic crops on contour hedgerows.

Sometimes, all it takes to completely change the perceived value is a change in the use concept. For example, in one of ICRAF's first on farm trials of alley cropping, farmers in Machakos, Kenya rejected the labor-intensive use of the leucaena hedgerows for in situ green manure (growing an input to grow a crop), but were more than happy with the hedgerow arrangement for growing animal fodder. Same plant, same arrangement, different end-use emphasizing the value of leucaena as a crop in its own right.

Even if you argue that animal feed is simply an input to growing animals, the farmers would still say that they get more value out of the alley cropping system by feeding the hedgerow cuttings to their animals than feeding it to their crops. As regards erosion control and soil fertility maintenance, they still get the benefit of both because: 1) they adopt the hedgerow planting design, and 2) they return composted manure from the stall-fed livestock to the fields.

The example comes from a highly intensive farming system in which the farmers could afford to reject the "green manure strategy" because they already had a "brown manure strategy" for fertility maintenance. Same cropping system, virtually the same labor requirements, but a higher perceived value in a differently organized farming system, and much lower information costs because of its familiarity.

This example underscores the importance of paying very close attention in farm trials of any new technology to the ways in which farmers modify the technology to increase its perceived value.

Promoting technologies that incorporate natural processes

Perhaps the strategy that could offer the greatest advantages for the least costs and meet with greatest acceptance among the largest number of shifting cultivators is one that reinforces the swidden farmers' own well established habit of making optimum use of natural process.

One way to do this is by planting complex forest-like polycultures such as homegardens and other multispecies agroforests. Homegardens are one of the most ubiquituous features of tropical land use. Notably undeveloped in many long fallow swidden systems where natural forests perform all the functions of homegardens (except spatial convenience!), homegardens become increasing important as swidden communities progress along the intensification sequence. Examples are everywhere.

Multipurpose Green Things

Farmers' demonstrated preference for fertility enhancing crops that yield direct economic products and/or have an extremely low management cost can be satisfied by using "MGTs" suitable for different niches within the farming system:

- woody green manures from productive shrubs and trees in enriched fallows or simultaneous polycultures;
- herbaceous green manures, mulches and cover crops that yield food, fodder or cash; and
- azolla, a nitrogen-fixing aquatic plant for rice paddies (low cost).

A classic example of the more extensive agroforest type system is the traditional Ifugao woodlot – a totally man-made forest-like association that boasts a higher species diversity index than the prevailing natural forests of the area. Not only were these traditional agroforests enormously productive with very little labor input, but they were also an integral part of the watershed supplying water to the famous Ifugao rice terraces. But there are many more "best practices" described in this manual.

Applying the principles developed here, we can predict that the technologies that will have the best chance of adoption are those that:

- grow crops directly (with sustainability benefits "piggy-backed" on top of this main selling point);
- make use of Multipurpose Green Things (see box) which include food or other crop uses as one of their purposes in systems which mimic nature; and
- incorporate best practices described in this resource manual to shift the course of intensification toward greater labor and information efficiencies as shown in Figure 7.

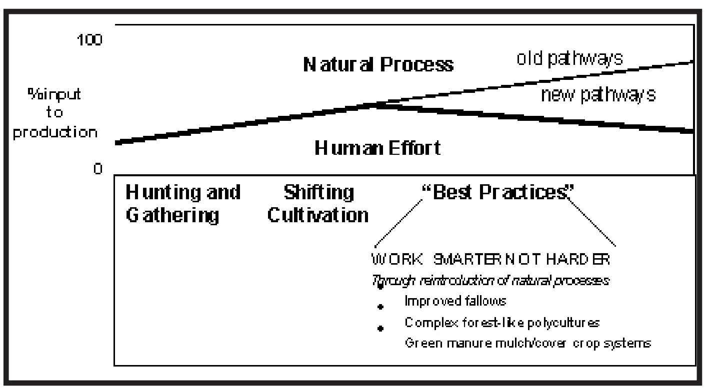


Figure 7. New pathways of intensification in shifting cultivation.

The adoption of such "Best Practices" will be faster if we can take a systematic approach to helping shifting cultivators pay the information processing costs of adapting and adopting these innovations.

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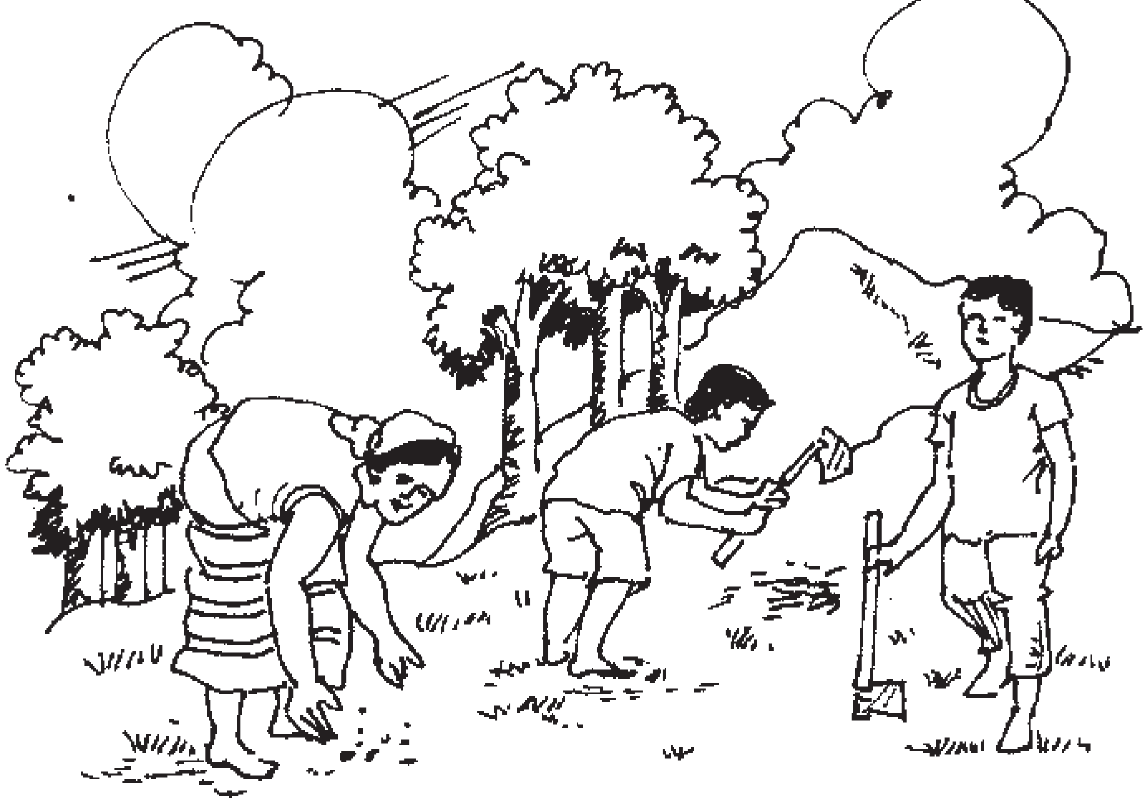
Prepared by
John Raintree

Resource book produced through a participatory writeshop organized by IFAD, IDRC, CIIFAD, ICRAF and IIRR.

Shifting Cultivation on the Forest Farming Continuum

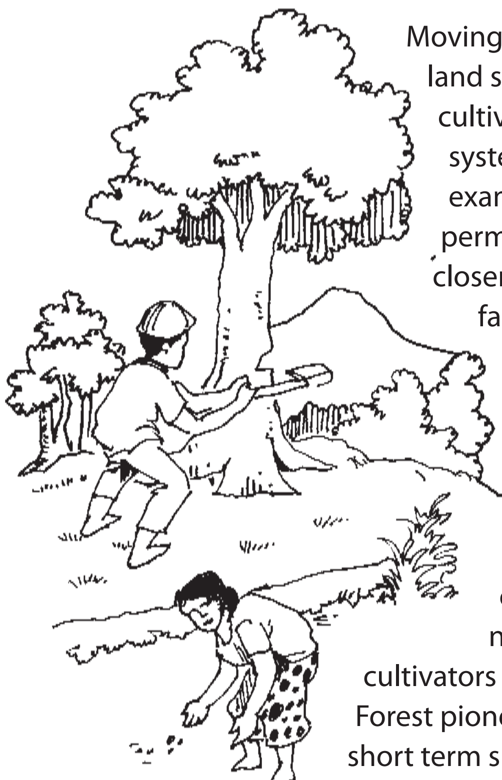


Most countries in Asia are now confronted with the "problem" of shifting cultivation. Discussion and debate continues regarding the perceived positive and negative impacts of shifting cultivation even while millions of resource-constrained farmers across the region persist with these practices. In many cases, the two sides of the debate are talking past each other, because each refers to different farming systems at opposite ends of what Sunderlin (1997) terms the forest farming continuum.

Shifting Cultivation: Long fallow	Shifting Cultivation: Short fallow	Forest Pioneer Farming
■ Long fallow rotation ■ Traditional ■ Mainly subsistence crop ■ Mainly self-generated capital ■ Far from urban area	■ Short fallow rotation ■ Semi-traditional ■ Mixed subsistence and cash crops ■ Mixed capital sources ■ Intermediate distance to urban area	■ No rotation ■ Modern ■ Mainly cash crop ■ Mainly outside capital ■ Close to urban area

⟷ Forest Farming Continuum

Broadly speaking, shifting cultivation refers to any temporally and spatially cyclical agricultural system that involves clearing of land – usually with the assistance of fire – followed by phases of cultivation and fallow. The classic model of long fallow shifting cultivation, with two to three year periods of crop growth followed by long fallows, is found at one extreme under conditions of low population pressure. It is generally known that such shifting cultivators both assist and rely upon the natural processes of forest regeneration to maximize their labor for food production. This form of shifting cultivation is often heavily interwoven with traditional culture.



Moving along Sunderlin's forest farming continuum into areas where land scarcity exerts a pressure on resources use, short fallow shifting cultivation is likely to predominate. Some farmers intensify their systems further by managing the fallow land in various ways, for example, planting leguminous crops or even establishing more permanent agroforests. Typically, urban centers and markets are closer permitting some cash cropping. However, such short fallow farmers retain many of the traditional practices recognized as a positive contribution to sustainable resource management.

Nearer to settled areas where land becomes even scarcer, opportunistic migrants may be drawn into 'forest pioneer farming.' This type of farming involves slash and burn to open the forest and cropping for both food and cash. Soil fertility often declines to a point where the farmer then moves to a new forest site. However, these shifts are unlike those of shifting cultivators who generally intend to return when the soils have recovered. Forest pioneer farming is thus clearly distinguished from both long and short term shifting cultivation. Researchers, policy makers and the public generally should be made more aware of this distinction.

Prepared by
John Freeman

Resource book produced through a participatory writeshop organized by IFAD, IDRC, CIIFAD, ICRAF and IIRR.

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Shifting Cultivation: Myths and Realities

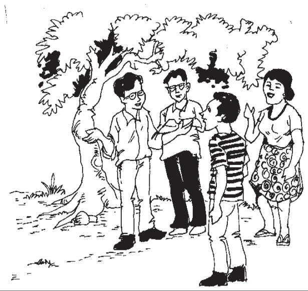
Shifting cultivation and the people who practice it are often negatively stereotyped. They are widely perceived by many scientists and policy makers, as well as the general public, to be primitive, backward, unproductive, wasteful, exploitative and destructive of the environment. Regardless of the location, they are believed to be destitute and lead subsistence-based lives. They have been blamed for most of the world's tropical deforestation, land degradation, and climate disruption. Thus, many current national laws and policies that affect shifting cultivators are antagonistic toward them and aim to replace shifting cultivation with forms of farming considered to be more modern. The result in many areas has been the assertion of state control over lands used by shifting cultivators, and the forced displacement of local people.

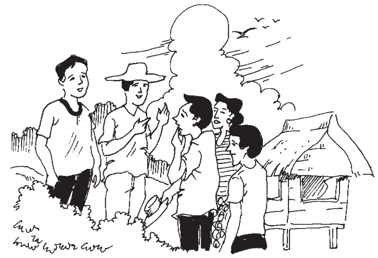
Negative attitudes toward shifting cultivators are also prevalent in agricultural research and development institutions in both hemispheres. Many research analysts and decision-makers presume that modern agriculture always means agriculture that is settled, intensive, and makes use of monocultures and Western technologies. They often overlook opportunities to learn from, use, and improve some of the effective features of shifting cultivation.

These perceptions on shifting cultivation and cultivators, which have led to policies and laws adverse to the practice and its practitioners, are based on misinformation and oversimplifications that have deep historical roots.

Eight common myths about shifting cultivation as prepared by Thrupp et al are summarized and expounded upon as follows:

	Myths	Realities	Issues/Concerns
1	Shifting cultivation is a primitive precursor to more commercial forms of production in the theoretical stages of agricultural development.	Shifting cultivators respond to agroecological and socio-economic factors in dynamic, nonlinear ways.	Culture and tradition are factors that can be constraining at times but non-linear reactions make it difficult to make policies that are suitable for shifting cultivation.
2	Shifting cultivation systems in tropical rainforests are uniform and unchanging; and shifting cultivators are homogeneous poor people.	Shifting cultivation systems encompass a remarkably diverse range of land use practices developed and changed over time by farmers in varied social, ecological, economic, and political settings.	Most migrant shifting cultivators are poor; and they have land use practices not always understood by outsiders. In fact, this is one of the reasons why they move to remote uplands to practice slash and burn farming.
3	Shifting cultivation is the sole activity among rural subsistence farmers in forest margins and is unconnected to commercial market activities.	Shifting cultivators engage in a wide variety of activities in subsistence and cash economies and often merge subsistence production with commercial surplus-oriented production.	Capacity to engage in commercial production depends on accessibility and types of products needed in the market e.g. swidden-based indigenous rice varieties as high-value crops.
4	Shifting cultivation is always characterized by low productivity and low yields and can support only low population densities.	Shifting cultivation systems are often productive, make relatively efficient use of resources, and support large populations.	Shifting cultivation practice is more holistic than simply a function of production. In some aspects (e.g. labor), shifting cultivation is more efficient than intensive cultivation (depending on the type of shifting cultivators e.g. lowland migrants vs. indigenous swidden cultivators).





	Myths	Realities	Issues/Concerns
5	Shifting cultivation systems are environmentally destructive, wasteful, unsustainable, and cause the majority of tropical deforestation and soil erosion.	Shifting cultivation systems are not responsible for the majority of deforestation or land degradation, and they have varying and complex environmental impacts, some of which may be sustainable and enhance biodiversity.	Most traditional shifting cultivation systems are sustainable and frequently enhance biodiversity. However, regardless of its extent, ecological impact of shifting cultivation on some watersheds is too critical to be belittled.
6	Shifting cultivators usually use primitive and low levels of technology; have limited knowledge about agriculture and the environment; and rarely adopt new technologies.	Techniques used in shifting cultivation systems are generally appropriate for their agro-ecological contexts (although not "modern"). Cultivators often have complex and useful knowledge about resources, land use, and surrounding environment.	Shifting cultivators also adopt new and appropriate technologies that can be considered "modern" but not necessarily destructive of the environment.
7	Shifting cultivation systems exist in empty, open-access forests without any form of legal rights or controls, thereby, necessitating state and private control for management.	Shifting cultivation cultures embrace a variety of tenure regimes that mediate access, use, and transfer of resources. It includes informal community-based, household, and individual rights that overlap with state authority.	The tenure system differs from one community to another. Some confirm the myth while some negate it.
8	State and international agencies use interventions and policies to bring about beneficial agricultural and environmental changes affecting the practice of shifting cultivation.	Mainstream programs and policies influencing shifting cultivators are biased and not neutral. They have often been unilaterally designed to stop, alter, or replace shifting cultivation or to introduce land use practices that may not be appropriate or desired by local people.	Some forest policies may be detested by shifting cultivation farmers but they may be designed to benefit the broader national interest.

1.For detailed discussion of these myths and realities, refer to the following publication from which this material was extracted:
The Diversity and Dynamics of Shifting Cultivation: Myths, Realities and Policy Implications by Lori Ann Thrupp, Susanna Hecht and John Browder (with Owen J. Lynch, Nabiha Megateli and William O'Brien). World Resources Institute. September 1997.
2.The third column "Issues/ Concerns" was based on a review of the original article by the participants at the workshop. The third column therefore, should not be attributed to the original authors.

Resource book produced through a participatory writeshop organized by IFAD, IDRC, CIIFAD, ICRAF and IIRR.

Shifting Cultivators: Are They to Blame for Deforestation?

The international environmental movement and growing interest in biodiversity conservation has brought shifting cultivation back into the foreground of rural development debates. Opinions remain divided as to the role shifting cultivation plays in deforestation in the tropics.

While it is viewed in some quarters as a major cause of tropical deforestation, recent researches suggest that the reality is often more complex. Explanations for deforestation must be sought in a variety of factors, many of which should be placed at the door of the government and international capital rather than on the shifting cultivators. The realization that it is mistaken to put the primary blame on the small cultivator and expansion of traditional shifting cultivation practices is increasingly being acknowledged by international agencies such as the World Bank.

Alternative causes of deforestation

Critics of shifting cultivation increasingly focus on the tension between the individual and social costs and benefits, particularly on the alleged negative environmental effects.

- Although it was found that slash-and-burn agriculture accounts for the clearing of over 10 million ha of tropical rainforests every year, primary forests are only cleared in a relatively small proportion of reviewed cases. Even fewer cases entail a permanent conversion of forests to a completely treeless land use.
- Shifting cultivation does cause serious damage to forest when population pressure increases and technology is not adapted. However, the main culprits of deforestation are: loggers, miners, rangers, immigrant farmers, and politicians.
- Deforestation under modern conditions is also the result of market and policy pressures arising outside the traditional farm economy. Such influences include:
    - resource privatization and tenurial changes particularly associated with damaging practices;
    - land speculation ;
    - fiscal incentives; and
    - government "development" projects.

A study conducted in Honduras showed that shifting cultivation, practiced by tribes living within the forests and still observing a long fallow rotational system, mimics natural forest clearing; and that long fallow periods allow for a diverse and rapid re-growth of secondary forest. This supports the idea that this type of shifting cultivation may not actually lead to forest destruction, but rather, over many centuries, contribute to the present structure and composition of existing rainforests.

Biodiversity and shifting cultivation

The assumption that shifting cultivation is a major cause of biodiversity loss has been challenged by recent research as well.

Many areas of prolonged habitation are marked by high biodiversity, and in some cases biodiversity may be higher in inhabited areas than in neighboring zones of climax vegetation. Likewise, where historical records exist, these usually attest to the innovativeness of traditional societies and their dependence on a very broad range of biodiversity.

This suggests that farmers actively manage their landscapes, bringing tree species onto the farm at such times as the forest fails to provide the range and quantities of benefits desired.

Differentiation needed

Shifting cultivation is not a single stage in the evolution of agricultural production. It is a variable element within a wide variety of farming systems encompassing stable rotational systems, extensive forest fallow cultivation and forest mining. Clearly, the impact on forest cover and composition of systems at varying points on the continuum are very different e.g. shifting cultivation by inexperienced immigrant farmers is far more damaging than by indigenous people. Thus, there is a need for both the researchers and policy-makers not to generalize, but to make a distinction between different shifting cultivation systems and to discuss the matter in a much more rigorous fashion. For this, frameworks of classification have been made (e.g. by ICRAF).

Key Variables for Classifying Shifting Cultivation Systems

- the initial type of vegetation cleared;
- the user or type of person involved in the clearing;
- the length of any fallow period;
- the nature of the final vegetation.

It is understood that the interaction of users with the resource base is determined by a number of factors: (1) availability of market and social infrastructure; (2) relative profitability of other forms of land use such as monocropping and livestock; and (3) availability of better paying economic activities outside agriculture.

Downhill all the way?

Historical records show that it would be mistaken to assume that as population pressure increases, there is an inevitable developmental sequence from viable low density forest fallow systems to increasingly unstable bush fallow ones. If true, this would lead to a crisis in traditional agriculture that can only be resolved by the abandonment of the practice of shifting cultivation and the adoption of more sustainable permanent cultivation. To the contrary, ethnographic data points to complex pathways and considerable situational variations. Not only may pressure on natural resources decline (where, for example, urbanization rates are high, leading to rural depopulation), but the progression in either direction may be marked by a range of variant livelihood systems.

The common belief that shifting cultivation is an outmoded and 'irrational' system, and that there is an urgent need of replacement through external intervention, must therefore, be treated skeptically.

Where changes in farming systems do come about, the causes are not always internal to the practice itself. In the past, communities tended to migrate to new homestead areas once they have cleared most of the primary forest in near their village. Now, changes may occur due to the communities' increasingly keen interest to reap the benefits of sedentarization (schooling, ease of transport, access to health care, etc.).

Development interventions in long fallow systems

Until the rise of the conservation movement, long fallow systems were generally seen as unpromising sites for agricultural activities due to:

- low population pressures:
- generous rainfall regimes; and
- the capacity to exploit the surrounding forest for a range of non-timber forest products (i.e. oil-bearing fruits and seeds, mushrooms, wrapping leaves, vines and rattans, bush meat and skins).

In recent years, conservation projects have been drawn to these sites precisely because of their low population densities and lack of development. However, the optimism that it is possible to offer peasant farmers more attractive alternatives is rarely borne out in practice. More often than not, attempts to modify shifting cultivation systems through the instrument of aid projects have ended in comprehensive and expensive failure.

Policy steps to improve conditions for land management

A strong case can be made for the rationality and viability of many systems of shifting cultivation as seen from the farmer's perspective. However, there may be instances in which the differences between the private and social costs and benefits of shifting cultivation are significant (e.g. where timber is a highly profitable commodity). Converting such facts into a change in farmer behavior requires a number of policy steps:

- Improve Tenurial Security

  This step is most likely to be the most effective way of changing all farmers that their interests will be respected in the longer term.

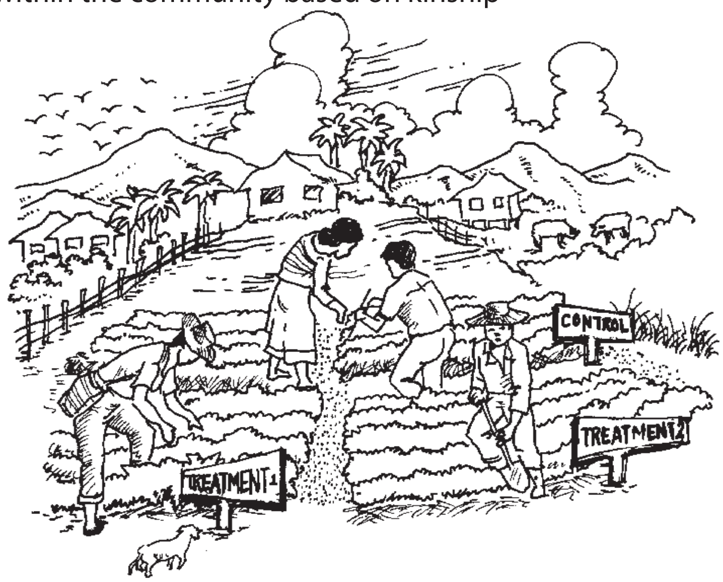
- Revenue Sharing

  Tenurial security may not be a sufficient condition to change land management practices. Revenue-sharing arrangements in timber concessions may, for example, play an important role in encouraging farmers not to cut down trees for agricultural purposes. It goes without saying that if the farmers can gain more from the long-term husbandry of their tree resources than from their destruction, then they are more likely to act accordingly.

■ Incorporate fallows into legislative reform

Though this step holds promise, it may prove to be too far for many governments in the high forest zone, given the extent of loss of control over timber resources that it may entail.

Despite an outward appearance of homogeneity, forest communities are often quite highly stratified. There may be important distinctions within the community based on kinship and tribal affiliations, length of residence and circumstances of the original land claim. Such distinctions may reduce the capacity of communities to manage the forest resources for long-term benefits.



Until ways are found to address the institutional and legal constraints in a manner acceptable to the shifting cultivators, it may be better to support innovative capabilities within the constraints of the existing land use systems. Above all, interventions should be based upon a more differentiated and location-specific assessment of the evidence.

Policy conclusions

- There are many causes of deforestation other than shifting cultivation. These include resource privatization, land speculation, fiscal incentives for land conversion, tenurial policies, and government development projects, particularly resettlement schemes. To prevent generalizations, a situational approach is therefore needed to generate policies appropriate to local circumstances.
- The term shifting cultivation does not refer to a single farming system but rather a broad range of land use types. There is need for a careful diagnosis of the farming system before any attempt is made to change its practices.
- Attempts to replace shifting cultivation systems often fail because of an inadequate understanding of the decision-making processes involved. Although shifting cultivation systems may have some longer-term social costs, they may offer greater shorter-term efficiency in resource use than any of the available alternatives. Development interventions need, therefore, to make the link between societal interests and farmer decision-making. Farmers will only change their traditional practices where the alternatives represent a more rational use of their labor time.
- Incentive schemes, which have sought to encourage changes in farming practices, have often done so without the necessary understanding of the underlying factors and have proven unsustainable.
- Changes to the tenurial system such as giving the farmers greater security of their cultivation rights are likely to be the intital step in any attempt to change farming practices to the direction of permanent cultivation.

Reference:

ODI. 1998. Mailing 21. Rural Development Forestry Network, ISSN 1356-9228
Brocklesby and Ambrose-Oji, 1997.

Based on an article by
David Brown and
Kathrin Schreckenberg

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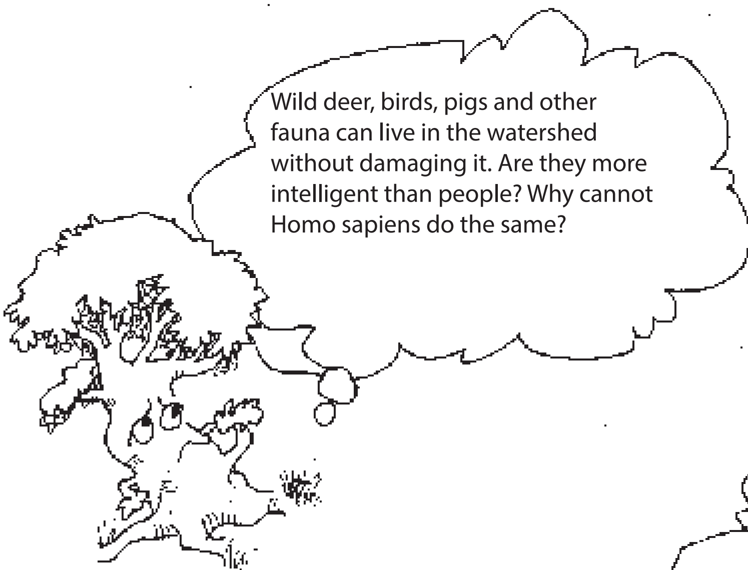
The Role of Homo sapiens in the Forests

The Philippines contains approximately 30 million hectares of land. That figure is fixed. There will be no significant increase in land area and there may even be a decrease. It has been estimated that a fourth of the land area should be kept functioning for watersheds and carbon sequestration in order to keep the rest of the ecological systems functioning. Much of the limited land area, however, is already covered by concrete basketball courts, highways and buildings which prevent percolation and the growth of plants. Such infrastructures are likely to increase in the future.

In the past the government has often worked on the principle that watersheds must be "off limits" to people. Watersheds, they say, must be sanctuaries for wildlife where effective percolation can take place and carbon can be sequestered. Those are the policies but they are not the facts. People are already living in the forests and many of them were already there before the government existed. Even if we ignore the legal issue of who has prior rights to the forests, the mere mathematics of the population situation forces every thinking person to see that the population is too great to allow a policy of exclusion.
Mankind is supposed to be able to THINK. Can he not think of a way to occupy the forests while actually improving their ability

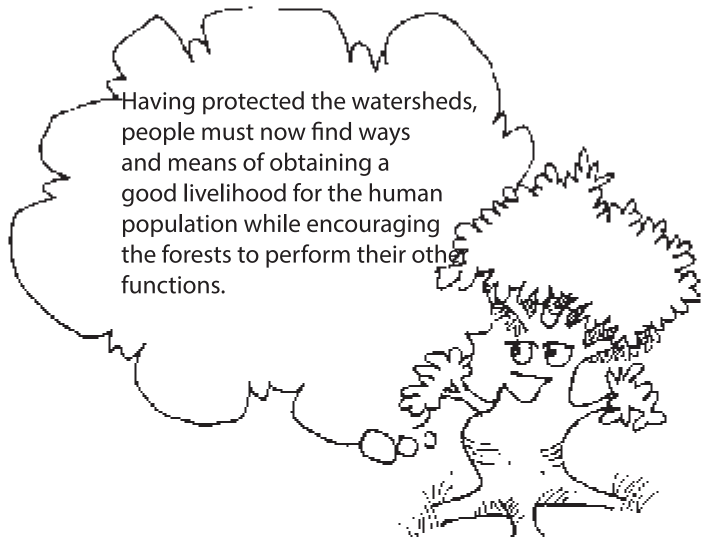
> The Philippines now has a population of approximately 70 million people. It is likely to reach 120 million by the year 2015. Where are they going to live and where will they obtain their sources of livelihood?



to perform their other functions? Can he not do so without damage to the forest, the same forest upon which he depends for a living?

Legal and intelligent means must be provided for Homo sapiens to use his sapience, his ability to think, to do this. The forests must be allowed to provide livelihood for some of the people while still sequestering carbon, recharging the aquifers and performing the multitude of other functions assigned to them by the Creator.

This is the challenge which the residents of the Kalahan Reserve have been consciously confronting for two decades.



The Ikalahan tribe is one of several Cordillera tribes of Northern Luzon. Sometimes called the Kalanguya, they live in the upper forested portions of the mountains. Their tribal name explicitly identifies them as "people of the mossy oak forest." The total Ikalahan population is approximately 50,000 people but the 2,500 who reside west of Santa Fe, Nueva Vizcaya negotiated an agreement with the Philippine Government in 1974 that established the Kalahan Reserve. It has an area of 14,730 hectares.

The people were originally animists with a protective and respectful attitude toward the forests, an attitude which the Christian missionaries were careful not to disturb. Most of the people are now members of the Kalahan Parish which considers all people to be stewards of God's Creation.

Control and protection of natural resources

Before anyone will willingly become involved in protecting a forest, it will be necessary to settle the tenure issue. For the Ikalahan, this was accomplished through Memorandum of Agreement # 1 which established the Kalahan Reserve in 1974. It continues through the ANCESTRAL DOMAIN COMMUNITY BASED FOREST MANAGEMENT AGREEMENT # 1 which was signed in 1999.

Having gotten control of the resources, the Ikalahan people worked for several years to implement effective means of protecting those resources. This took some experimentation and a bit of creativity but everyone agreed that it was an important prerequisite to the development of sources of livelihood.

In the beginning, the people had a vague vision of their goal but hardly an inkling of how to get there. Now, after more than two decades of struggle, they verbalize the process by simply stating that Homo sapiens must do as all the other species do: find his own sustainable niche in some part of the ecosystem without trying to dominate the entire system. Simply stated, the people look for resources in the forests which they can utilize benignly and sustainably to make a living while encouraging the forest to continue to perform its other functions. It is a basic principle of ecological balance and biodiversity that Homo sapiens should not limit himself to a single niche. Different individuals should endeavor to utilize different niches in order to ensure the proper balance among them all.

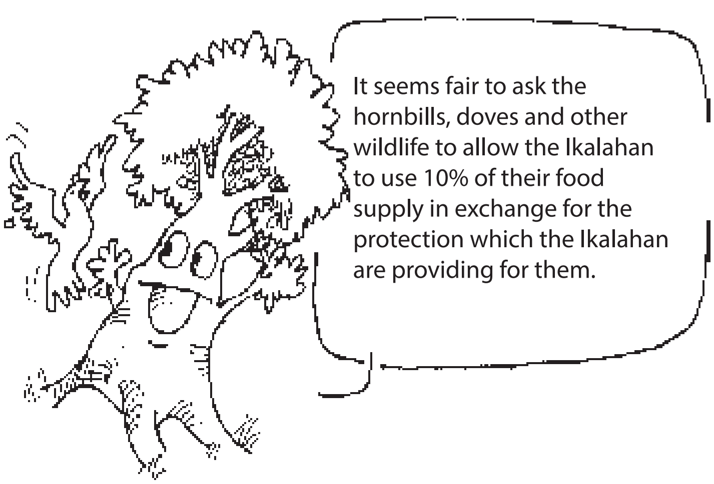
Livelihood niches for the Ikalahans

Wild fruits

For ten years the Ikalahan have been harvesting wild fruit from the forests and processing them into jams, jellies and marmalades for the metropolitan markets. The Philippine market is big enough to consume all of their production capacity so there is no real need for them to export to other countries.

Some of the fruits which they use, such as guavas and santol (Sandoricum koetjape), are quite well known to the customers. Others, such as dagwey (Saurauria bontocensis) and dikay (Embelia philippinenses A.D.C.), are completely new and it is necessary to educate the customers before the Ikalahan can sell a significant amount. They have found this to be more difficult than they expected. Their products are sold under the MOUNTAIN FRESH Brand in all of the better supermarkets in the Metro-Manila area.

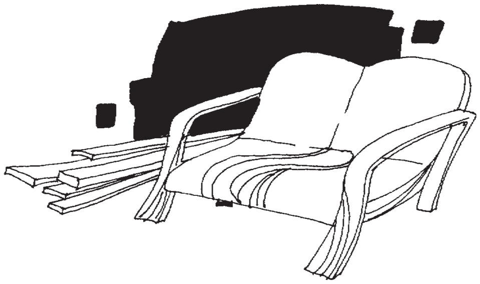
In some cases, they were forced to plant additional trees or vines because the supply of wild fruit was limited. The plants were put into the forests, however. The farmers can obtain a significant income from the sale of these fruits to the Kalahan Food Processing Center so there is little or no motivation for them to cut down any wild plants to replace them with some kind of field crop.



Just to be sure that their utilization of the resource was benign and sustainable, the Kalahan staff actually computed how many tons of each fruit was being produced within the forests each year and compared that estimate with the amount of fruit which

The Kalahan Educational Foundation

It was necessary for the Ikalahan to have a legal personality in order to get legal control of their Ancestral Domain. They did this by registering the KALAHAN EDUCATIONAL FOUNDATION (KEF) with the Securities and Exchange Commission (SEC) of the Philippine Government. KEF is a legal corporation and through it the Ikalahan have gotten control of a large section of their ancestral lands, established the Kalahan Food Processing Center, the Kalahan Academy (a High School), the Shalom Bible College and several other programs for community welfare. It is managed by a Board of Trustees composed of 13 tribal leaders chosen by themselves and employs about 40 persons, all of them tribal people, as teachers, processors, foresters, etc.

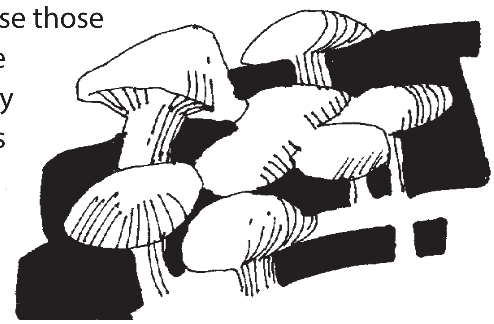


the Food Processing Center purchased. It was discovered that they were using only about 10% of the normal production of each wild fruit per year.

Orchids

The forests in the Kalahan Reserve have more than 70 species of wild orchids. In the past, some of the people gathered these wild orchids and sold them to buyers outside the Reserve. This, of course, could not be maintained for long because the supply would soon be exhausted. Orchids in the wild do not multiply rapidly.

The forests are now used merely as a gene bank. The Ikalahan gather only a few orchid plants to serve as mother plants, propagate them and sell their offspring to local farmers to be raised in "backyard-forests". The reserve has a few very rare species. The Kalahan Foundation is working hard to develop proper propagation techniques because those orchids are likely to provide the best source of income. The only other resource that is needed is the climate. Such a program is not likely to damage the climate.



Mushrooms

Several of the more valuable mushrooms are known to be choosy about their environment and demand a cool, moist climate which the forests provide. At least one of those species, shiitaki, commands a very high price but also prefers a substrate of either oak or alder wood. The production of oak is very slow. However, the Ikalahan have very large quantities of alder and it is growing much faster than it can be used. The only other resource needed for this program is the climate.

Lumber

Much emphasis is being placed on non-timber forest products but it is not wise to merely let mature trees die and rot in the forest. A rotting tree produces carbon dioxide the same as a smoke-belching car and thus contributes to greenhouse gas production. The best means of accomplishing good carbon sequestration is to expedite

the growth rate of the wood in the forest and then utilize it in permanent forms such as furniture.

The Ikalahan recognized that logging was not a sustainable method of extracting the wood from the forest so they developed the Forest Improvement Technology (FIT) which is described elsewhere in this book. As the forests continue to develop, the Ikalahan can obtain a significant income from the forests with the use of the FIT.

Wild meat

The Ikalahan are not yet harvesting wild meat but it is an interesting possibility. Meat from wild deer and wild pig could definitely command a very high price in the five-star hotels of the various metropolitan areas in the Philippines. It would not be difficult to allow such wild animals to multiply in the forests and cull a few individuals from time-to-time for sale to such a specialty market. It is being done in other places and could also be done in the Kalahan Reserve.

Ecological jewelry

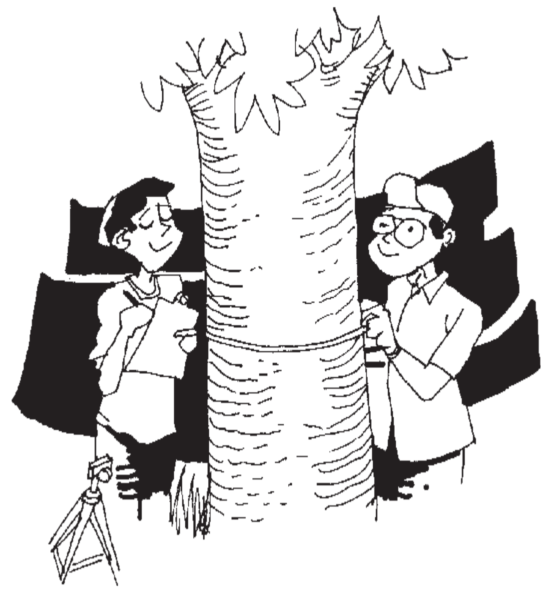
The Ikalahan are presently working on the technologies needed to electroplate leaves and other natural products with gold or silver in order to make jewelry. This could be done together with the polishing of some of the more attractive stones found in the river beds. They do not yet feel capable of designing finished products but there are jewelry designers and manufacturers in Metro Manila who could be a potential market. This process is presently being done near Boston and could easily be done in the Philippines.

Organic vegetable production

Some of the limited level areas within the Kalahan Reserve could be used to produce vegetables organically. It will be easy to do this within the Reserve because no chemical fertilizers or poisons are being released into the area. The population of natural predators is adequate to keep any potential pests under control. This program has been started but is not well developed yet because of marketing problems.

Swidden farming

It is not necessary to eliminate swidden farming from the list of forest niches, but people must definitely use their brains to ensure that it remains sustainable. Such crops as ginger, sweet potatoes, beans and taro can be produced in this way.



Value added to the niches

The unique contribution of Homo sapiens should be the processing of the raw materials found within the forest ecosystem into saleable or usable products. The Ikalahan, therefore, do not want to sell guavas — they sell jams and jellies. They do not want to sell lumber — they want to sell tables and chairs or other finished products.

Every community has children. These children grow up and many of them go on to college and develop advanced skills. If the communities would sell their raw materials to the city, the educated youth would be forced to follow the raw materials to the city in order to find a job. It would be much better for the community to develop means of processing its raw materials into finished products. The engineers, chemists, accountants, and businessmen and women could then come home to manage such businesses and provide educated leadership for the future of the community.

The most valuable resource of any community is its children.

There is no limit to the kinds and numbers of niches which can be developed. The limiting factor is within the human species. Such a program requires several things, however.

- First, the forest dwellers need to have control of their resources, including land, forest and water. Every niche requires that the forest dwellers invest much time and energy. Without tenure, no intelligent person will make such an investment.

- Second, creative minds are needed to try to identify various flora and/or fauna which could become sustainable resources. The Philippines is rich in NGOs which have creative minds. Once encouraged, the local communities usually become creative also.

- Third, individuals within the communities need to develop the necessary skills to match the identified niches. This should be the easiest problem to solve.

Now that we have studied it, let’s do it!

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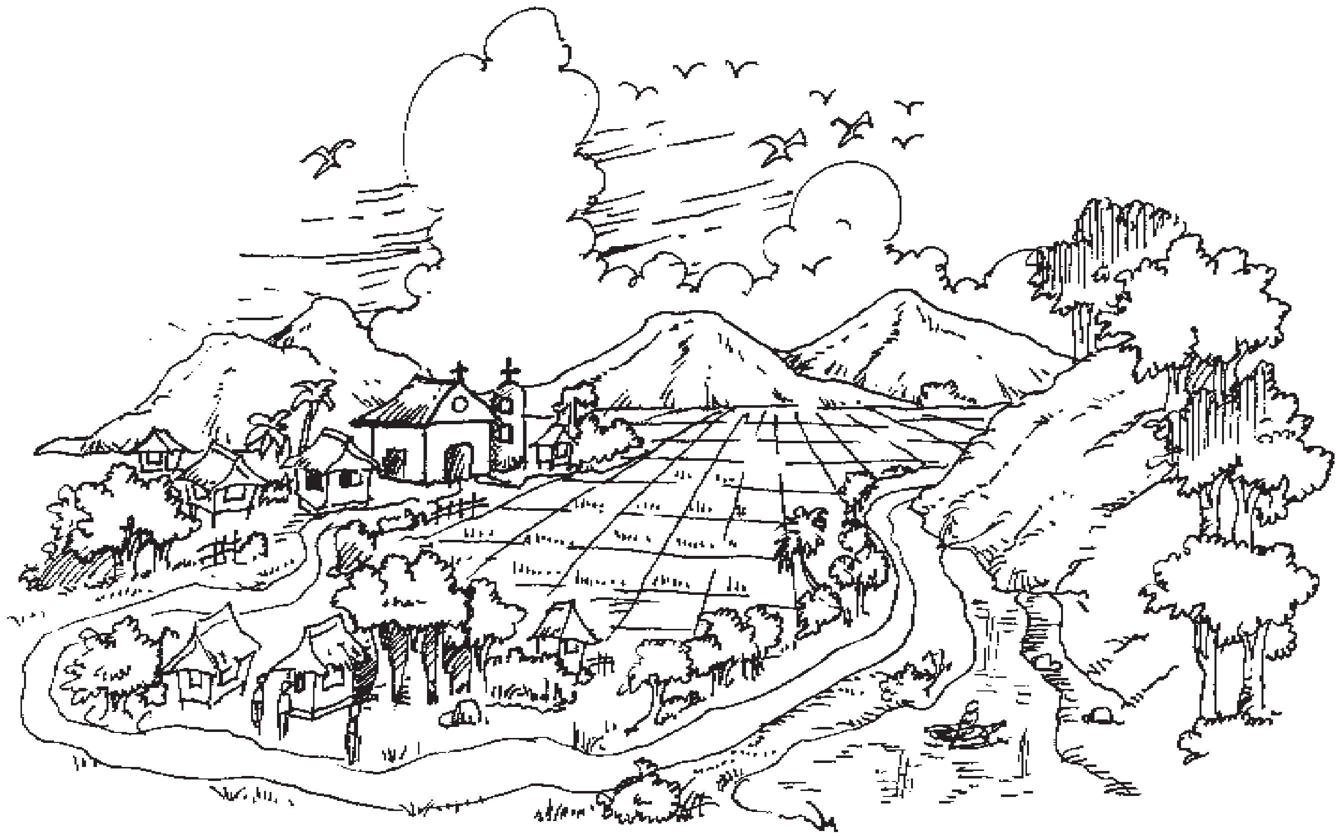
Resource Tenure Systems and Stabilization of Shifting Cultivation



Resource tenure systems in the Asia-Pacific Region

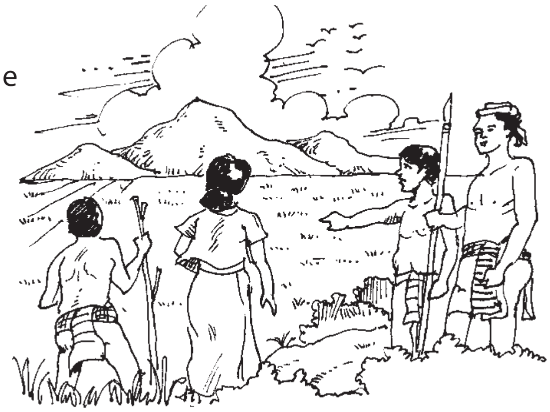
Resource tenure, especially land tenure, is recognized as one of the most important factors that can motivate farmers to invest in the improvement of their upland farms to increase productivity and improve sustainability. It is, thus, necessary to analyze tenurial systems: their nature; their effects on various land use practices; and their stabilizing impacts on shifting cultivation.

Land tenure is not coincident with plant tenure, i.e., the group owners of land are not automatically the owners of the plants growing on it, and vice versa. However, in many traditional societies, plant tenure can lead to eventual land ownership: the planter of a tree, by reason of his long association with that plant and consequent long association with the land, may eventually end up as the land owner. This same pathway may also lead to the splintering of large group-owned estates into smaller traditional farms controlled by individuals or families.

Types of land tenures

In general, two broad types of land tenures prevail in the Asia-Pacific Region: customary or traditional; and state or "regalian".

Customary or traditional land tenure



Land tenure is customary when all lands belong to the people and not to the state. This type of tenure had been in place long before "Western" influence arrived. Unlike the usual private ownership, however, the owners in this case are tribal or clan groups rather than families or individuals. Thus, the tenure is both "private" in the sense that it is not government, and "public" in the sense that it is group ownership.

The South Pacific region has preserved this form of customary tenure despite the fact that many of the countries have been subjected to colonial rule. Either the colonizers ruled benignly and did not impose state ownership, or the local people resisted strongly the efforts to classify their lands as "public" domain.

State or "regalian" land tenure

State land tenure refers to the system in which the national government owns all public lands. State land ownership came about in two ways. First, in some countries governed absolutely by kings and emperors (example: early Thailand, Japan) almost all the lands were owned by the royal family (thus the term "regalian".) When kings were replaced (or reduced to figureheads) by democratic governments, the royal lands became public domain and were placed under the jurisdiction of the state.

Second, when undeveloped tropical countries were conquered and colonized by developed Western nations, state ownership of all lands was imposed to establish complete control over the countries' natural resources, despite the fact that customary tenures were then in place.

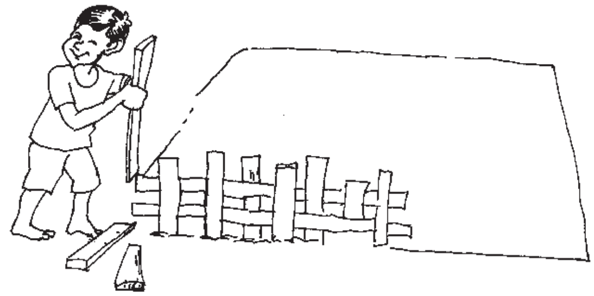
Tenurial conflicts and resolution

As expected, problems arose when native populations resisted the imposition of state tenure that disrupted customary tenures and made them "squatters on their own land." When such resistance was shown by individuals or small groups, they were regarded as mere "agrarian" problems akin to landlord-tenant relations. On the other hand, when resistance was regional, or even countrywide, they were viewed as "rebellion" and were often put down with violent force, as in the case of the farmers' anti-tenancy movements in the northern Philippines in the 1930s.

Many colonies gained political independence after World War II and became sovereign nations themselves. Not surprisingly, they conveniently adopted in their new constitutions state ownership of natural resources, especially land. Thus, the conflict between the two classes of tenures that started during the colonial days has continued until now.

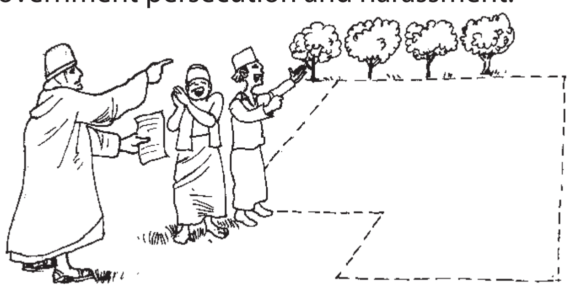
Partial solution: privatization of state lands

To soften the impact of the home-grown "regalian" tenure, some of the earlier absolute rulers transferred portions of royal lands to private entities, such as close relatives, friends and subjects who were loyal and have rendered faithful service to the king. The greater mass of the populations, however, remained "tenants of the king." Depending on how benevolent the rulers were, or how well the people respected their king, tenure-related problems ranged from nil to serious.



National governments operated by democratically-elected leaders, on the other hand, developed formal procedures whereby arable lands suitable to intensive cultivation were classified as agricultural and transferred in orderly fashion to private owners (such as through enactment of homestead laws.) This process satisfied, to a large extent, the people's desire for lands for farming or for residential/industrial needs.

However, since shifting cultivation areas are generally located on the hilly terrain that are considered unsuitable to intensive agriculture, they were retained as parts of the public domain and classified as forestlands. Thus, to this day in much of Asia, ethnic shifting cultivators who are customary owners of lands have continued to be regarded as "illegal occupants of public lands" and have been the subject of government persecution and harassment.



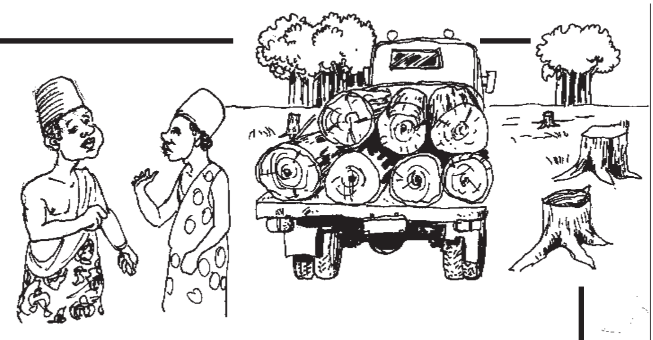
Partial conflict resolution: privatization of communal lands

Community-owned customary lands are traditionally used and managed on a communal basis and are regarded as "common property" among the members of the community. Temporary exemptions may be granted when members use portions of the land for "private" uses, such as homesites, food crop area or site for growing food trees. Such temporary arrangements could become permanent, depending on the available traditional mechanism for conversion.

The types of conflicts that have been resolved by privatization of customarily-owned lands are those that have arisen from:

- inequities in sharing labor inputs in communal undertakings;
- unequal distribution of outputs from joint projects;
- imbalanced opportunities for using choice portions of the estate; and
- unfair sharing of decision-making in land uses.

In Papua New Guinea, the traditional system of conversion of tree tenure to land tenure has some implications in the sustainability of communal forests. In one case, a foreign logging company was allowed to commercially harvest logs on condition that it pays royalty to the communal owners as well as reforest the logged over area to insure continuity of forest production. Later, the company was prevented from performing its contractual obligation. The tribal landowners banned reforestation work for fear that tenure over the land may pass into the hands of the reforesting company.



Other approaches to resolution of tenure conflicts

The largest and most serious tenure-related conflict continues to be that between the ethnic groups and the state. The ethnic groups believe that they have been deprived of their land rights and the state (represented by the national agency responsible for natural resource management) is regarded as the proponent of "state-sponsored land-grabbing" through the imposition of the "regalian" doctrine.

To defuse such tenure-related problems, certain governments have started liberalizing state tenures in the following manner:

Formal recognition of customary land rights

Some countries have conceded that certain tracts of land have been occupied and used by indigenous communities for many generations even before the birth of the nation (since time immemorial). Policies have been developed to restore land rights to the appropriate communities as in the case of India, Malaysia, Indonesia and the Philippines.

In 1993, the Philippine Department of Environment and Natural Resources (DENR) issued Department Administrative Order 2 recognizing the legitimacy of the claims of certain indigenous communities over Ancestral Domains, and claims of some indigenous families or individuals over Ancestral Lands. The basic requisite for the recognition of claims is effective control and management of the area by the claimant community or family, not merely possession and occupancy (See also. Sacrificing Peoples for the Trees: The Cultural Cost of the Forest Conservation on Palawan Island, Philippines, pages 173-179).

Institutionalization of the recognition process

Moves to ease up on the tight implementation of the "regalian" doctrine need to be institutionalized so that they will not be subjected to the whims and caprices of the government officials responsible for implementation. The Philippine example of restoring land use rights to indigenous communities was initially carried out through an administrative order. Recently, the landmark law on Indigenous People's Rights was passed and it was a big leap towards institutionalizing the process. Certain problems have arisen regarding its implementation, which is to be expected in a legislation that supports a drastic paradigm shift in resource tenure in the country.

Tenure-related policies and institutions

Policies

In countries where customary resource tenures are the norm, unstable tenurial conditions are not a problem to shifting cultivators. If any instability occurs in such countries, the causes could not be linked to insecure tenures.

On the other hand, in nations where the prevailing tenure is state or regalian, forest policies that have impacts upon shifting cultivation are of three kinds, depending on how "enlightened" the policymakers are:

- policies designed to stop or control shifting cultivation through police action and imposition of penalties for violation of forestry regulations. This policy is typical of the early forest policies that had no appreciation at all of the potential economic and ecological sustainability of shifting cultivation;
- policies that allow shifting cultivation to be practiced but limiting it to narrowly prescribed areas to minimize what they view as negative impacts of that land use system; and
- policies that allow shifting cultivation to be practiced and providing technical, credit, institutional and other support to increase and stabilize farmers' outputs and improve sustainability.

Institutions

Institutions (as established norms or rules that govern behavior) relevant to tenures may be found at various levels: from local to national levels. In India, there are local-level agreements that determine who can and cannot gather fuelwood from a jointly managed forest area while, in the Philippines, there are national-level rules on the qualifications and requirements for communities availing of the Community-Based Forest Management (CBFM) Program. These institutions tend to favor shifting cultivation and are, therefore, strategically positioned to help in stabilizing that land use system.

Indigenous institutions, such as those that determine when a tree tenure is transformed into land tenure, are in place and operational in traditional societies. They likewise contribute significantly towards the stabilization of shifting cultivation.

Institutions (as organizations that have a bearing on how tenurial instruments) are applied operate likewise at various levels, from local to national. The local government units at the grassroots are in closest contact with the shifting cultivation farmers and are, therefore, in the best position to help apply tenure instruments in ways that would favor stabilization of shifting cultivation. At the top level, national agencies generally help formulate as well as implement tenurial policies and are probably most familiar with the conditions that have triggered the emergence of certain forms of tenures. In the middle ground would be the non-government organizations (NGOs) that, through their advocacy roles, have contributed immensely towards the formulation of shifting cultivation-friendly policies.

Implications of tenure to the sustainability of shifting cultivation

Whether in agriculture, forestry or agroforestry (including shifting cultivation), empirical evidence shows that farmers become more highly motivated to improve productivity and achieve sustainability if their tenure over land is secure. This principle has become the firm basis of land reform movements in different countries that led to the abolition of tenancy by transferring land ownership to the legitimate cultivators. This is the case in shifting cultivation farm areas under both customary and regalian tenure. To help shifting cultivators achieve the desired state of high production at sustainable levels it is, therefore, necessary to assure them long-term and secure tenures over their farms.

Since hilly areas classified as forestlands are the most frequent venues of shifting cultivation activities, they fall under the jurisdiction of forestry authorities that generally regard shifting cultivation as anathema to forest conservation and management. This situation leads to confrontation and contributes immensely to the insecurity of shifting cultivation practice and the consequent acceleration of shifts. This is a strong evidence, even in a negative way, that tenure issues impact heavily upon stability of shifting cultivation.

The formulation and implementation of people-oriented forestry programs, such as the Joint Forest Management of India, Panchayat Forestry Project of Nepal, and the Community-based Forest Management (CBFM) program of the Philippines, have resulted in numerous cases of shifting cultivators being enlisted and granted long tenures over their shifting cultivation fields. Preliminary observations indicate that these participants have embraced the programs and have remained in their farms since the start of their participation.

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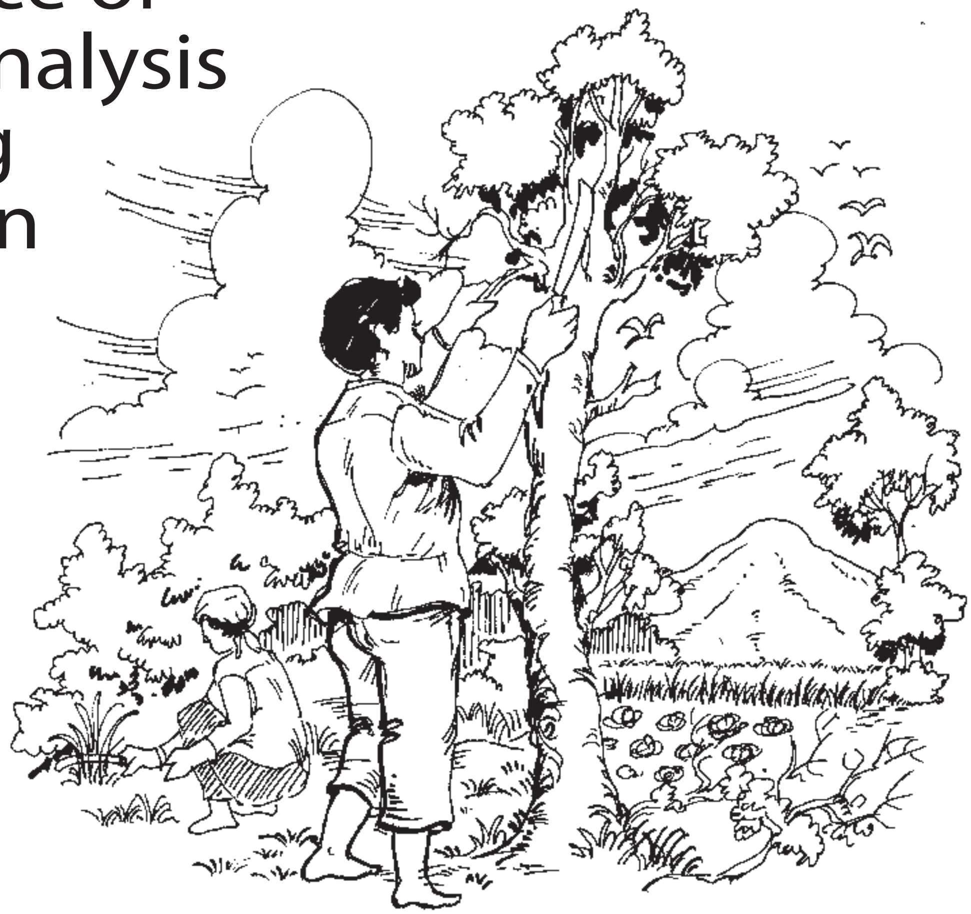
Importance of Gender Analysis in Shifting Cultivation



Gender is a cultural and social construct, therefore it changes over time and from one culture to another. Given their gender roles in their culture and society, both men and women play important and distinct roles in shifting cultivation. Hence, contributions of both men and women must be recognized and respected. Likewise, their different roles and responsibilities, as well as the intrinsic value of their knowledge in the management of shifting cultivation must be understood.

Gender stereotyping and gender biases often have their roots in culture. These, along with other factors such as movements in population, degradation of agricultural land, commercialization and industrialization must be considered.

Some major factors leading to gender issues

Access, control and decision-making

Men and women do not have equal rights over resources because laws, customs and cultural practices create differential gender access and control over resources. Therefore, in most societies, women do not have control over land although they have access to it-the legal owners (male members of the family, the community and the government) control their access to it. This has its repercussions on decision making – being only workers, women are generally either ignored or have only advisory roles in decision-making.

Gender division of workload and responsibility

Among many shifting cultivation communities, it is found that based on dominant and accepted cultural symbolisms, women are associated with this form of cultivation (e.g. Nagas of Nagaland in northeast India and Lepchas of Sikkim, India, pages 110-116). Besides, "women's sphere" traditionally includes subsistence crops, which are usually cultivated in shifting cultivation areas and home-gardens; while "men's sphere" includes commercialized cash cropping in the form of monoculture practiced in permanent agricultural fields. Furthermore, men's role as providers and women's role as managers, and caretakers adds to this "sphere-type" of gender division of roles and responsibilities.

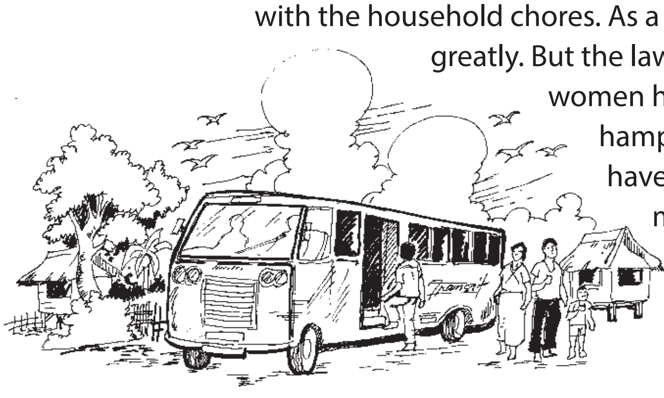
Due to their culturally and socially assigned roles, as well as their daily practical needs, women are a source of vast and detailed knowledge on the practice and management of shifting cultivation. However, this knowledge is often over-looked and undervalued. Such an attitude leads to misinformation and may affect development interventions and programs.

Commercialization

Commercialization has brought about new dimensions of gender issues in relation to shifting cultivation. The introduction of high value cash crops has led men only to be involved in the production of such crops. Women are often left to do all the work in the cultivation of subsistence crops grown in shifting agricultural areas. Furthermore, men occupy more of the good lands for the cultivation of cash crops. Thus, the women are left with the more marginalized and degraded lands to use for shifting cultivation.

Male out-migration

The increase in population and degradation of agricultural lands has led to the out migration of most men in some areas. From the rural and mountain areas, they go to the urban centers for employment, while the women are left to shoulder all the agricultural works (shifting, as well as permanent), along with the household chores. As a result, female-headed households have increased greatly. But the laws, customs and practices remain the same with the women having the same limited rights and control. These hamper their work and responsibilities. For instance, they have to wait until the men return before they can make major decisions on leasing, selling or buying of lands, or getting access to the community-owned land to do shifting cultivation.



In some communities and countries (e.g. in Philippines) there is a large amount of female out-migration. In such cases, men are left shouldering all the responsibilities in the family, and also most of the workload.

Access to new facilities, technologies and practices

With the introduction of new facilities like credit, training and new technologies/practices for management of sustainable shifting cultivation, various gender issues have unfolded. For instance, access to credit facilities is based on land as a collateral. Since women do not own lands, they often do not have access to this.

With regards to training, new technologies and practices, women are very much over-looked. This is mainly due to the following reasons:

- Extension and development workers usually think that training men and introducing them to new technologies and practices is enough. They assume that the men will pass the information on to the women. However, this rarely happens because either the men are not interested enough since they are not directly involved in shifting cultivation, or because women are too busy with their wide range of work and responsibilities.
- Women do not have the time to attend training and demonstrations because of their many responsibilities.

Strategies adopted by women to counter their disadvantaged position

The disadvantages faced by women have led them to adopt various strategies to counter this position and have their voices be heard in major decisions. Decision-making is a complex process and it is more a question of how decisions are made, rather than who makes the decisions. Decision-making depends on the context and the situation that it is being made. However, due to the disadvantages faced by women with regard to control and ownership, their roles are more on the suggestive and advisory type. Therefore, in cases where their suggestions and advices are ignored, women (as do all people under such circumstances) adopt various resistance and bargaining and/or negotiating strategies.

Common resistance strategies adopted by women

- not talking to their husbands or with family members
- not attending family and/or village functions or ceremonies

Common bargaining/negotiating strategies

- threatening or actually leaving the husbands' house temporarily and goes to friends or relative's house
- using seniority of age (in case of older women)

A common bargaining/negotiating strategy adopted by the Lepcha women in Sikkim

One common bargaining/negotiating strategy adopted by the Lepcha women is through group pressure. This is done during village get-togethers. Here, the women voice their grievances (real or felt) to each other, and in case the "accused" man happens to enter the women's group he is harassed and teased by all the women for his alleged inconsiderate action to his wife. Thus, in order to avoid such harassment and embarrassment, the man usually stops such discriminating actions and listens to his wife's suggestions and opinions in decision-making.

Conclusion

Although gender differences are not always a question of power, it is important to remember that gender relations are partly about power relations. In order to carry out any type of intervention and/or development programs, gender and power relations in the community must be understood properly. It is not enough to just record the roles, activities and preferences of men and women; there must be further and deeper probing about why things are as they are, what it all means and how it affects the gender relations. Further examinations should include how society and culture legitimize gender roles, how changes in crops and practices change these roles, its implications in gender relations and how people use these changes to further their own interests.

Checklist of considerations for development workers concerning gender dimensions of their work

- ☑ Reason or basis for men and women being associated with different types of cultivation practices (monoculture in permanent fields vs. shifting cultivation) and different types of crops (major crops and cash crops vs. subsistence crops).
- ☑ Conditions (besides the immediate practical needs) that determine men and women's preference in crop species and varieties.
- ☑ Basis for the gender division of roles – culture or daily practical needs.
- ☑ If roles are embedded in their culture, then how are they legitimized in the cultural symbolism?
- ☑ How do men and women perceive their roles in their society and culture?
- ☑ Resistance and bargaining/negotiating strategies adopted by women.
- ☑ Effects of all these in shifting cultivation.
- ☑ Implication of all these with regard to interventions and development programs.

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Changing Our Understanding of the Fertility of Tropical Soils
Nutrient Banks or Nutrient Access?

- Forests keep the soil fertile for thousands of years.

What we thought in the past

The traditional thinking says that the level of fertility in a soil basically depends on the quantity of nutrients the soil contains. That is, our crops will grow best if all the nutrients a plant needs are present in the soil in large, well-balanced quantities. Therefore, we thought that if the farmer applied enough of the correct chemical fertilizers, and the soil had enough Cation Exchange Capacity (CEC) to hold the fertilizer there, the farmer's soil would be fertile.

The soil is therefore thought of as a bank. As the farmer adds fertilizers, the amount of nutrients in his or her bank account will grow. Then when the crops are sown, there will be plenty of nutrients for them to withdraw from the bank account. Of course, the soil is more complicated than a bank; some nutrients in a soil can be lost when they erode away, and others can be added by nature, as when legumes fix nitrogen.

CEC

The nutrients in a soil are held in place by a series of things that work like very small magnets, which scientists call "cation exchange sites." These nutrient magnets exist mostly on the edge of particles of clay soils and organic matter. Some soils have very few such magnets, and therefore cannot hold on to the nutrients we give them. Sandy soils and many tropical soils that have almost no organic matter, like those we have in shifting cultivation systems after several years of cropping them, have very few magnets. The quantity of these magnets in a soil is called its "Cation Exchange Capacity," or "CEC". Therefore, a soil with a low CEC is one that can only hold on to very few nutrients.

Nevertheless, for many years the idea was that the soil basically acted like a nutrient bank.

Many scientists, in fact, have come to the conclusion that the only way to maintain soil fertility is to use large amounts of chemical fertilizer. For instance, one famous agronomist, Dr. Norman Borlaug, has said, "Some people say that Africa's food problems can be solved without the application of chemical fertilizers. They're dreaming." Dr. Borlaug has also said that efforts to raise crop productivity will fail unless chemical fertilizers are used in large quantities.

Problems with the banking concept of soil fertility

More and more, farmers and agronomists working in shifting agriculture are finding that this banking concept does not explain what they are seeing and experiencing in practice. Far more important than the total number of nutrients in the soil are many other factors including:

- whether the soil is moist;
- what kinds of compounds the nutrients are in;
- how acidic the soil is;
- how deep the soil is;
- whether roots can penetrate into the soil;
- what kinds of plants and animals live inside the soil; and
- whether it has enough organic matter, etc.

> The soil also contains millions of microorganisms, extremely small plants and animals that improve soil structure, make organic matter rot so its nutrients are released, make nutrients more accessible to plants, and even produce antibiotics, like medicines, that protect plants from diseases. Mycorrhizas are plants that attach themselves to roots and pull nutrients into the roots from as far as a meter away from the roots themselves.

The growth of a crop depends much more on these factors than on the total amount of nutrients in the soil.

It is also found that the banking idea of soil fertility is leading to mistakes in practice e.g., to reject technologies that might be very useful, especially to farmers using shifting agriculture.

Probably the most important mistake of the banking concept is that many scientists dismiss completely the ideas of ecological agriculture. This kind of agriculture chooses to use simple, often locally available resources (for instance, legumes rather than chemical fertilizers) to help crops grow in ways that are more natural, rather than using expensive chemicals to kill pests. For instance, many scientists are now saying, "low input agriculture is low output agriculture." This means that if farmers don't use a lot of chemical inputs, they cannot achieve good harvests, or outputs. Consequently, a whole series of very good ecological agriculture technologies, such as green manures and natural pesticides, are largely being ignored by many researchers. They are totally unwilling to work with the inexpensive, simple technologies that would be most useful to shifting agriculture farmers.

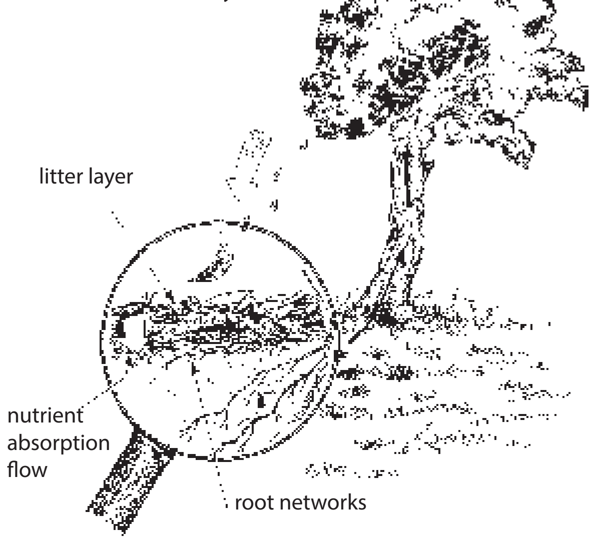
Another major negative result of the banking concept is the claim that, because many tropical soils have a very low CEC, they cannot hold enough nutrients to feed a crop well and thus will never be very productive. As a result, certain scientists have decided that huge areas of the developing world are "low potential" areas. Some governments do not invest much agricultural development money in these "low potential" areas because they believe the productivity of these areas will never improve much. Once again, people who live in these areas—the poorest people, the ethnic minorities, and those farmers who use shifting agriculture—are discriminated against.

Another major problem with the banking concept is that we are increasingly realizing that it does not agree with what we are observing in the field. Over and over again, very good yields are being achieved on soils that, according to the banking concept, could never produce such yields, and these yields are being achieved with applications of only one-half to one-fifth of the quantities of nutrients that the banking concept would recommend. The following are several cases in which the banking idea fails to agree with experience:

1. The yields achieved with green manure/cover crop systems (gm/cc's) in nation after nation are greater than should be possible according to the banking concept. With increases of only 100 kg/ha of fixed N and no additional P or K, yields of maize crops have often doubled. Yields of 2.5 t/ha of maize have been produced on relatively poor soils every year for 40 years, with no application of chemical fertilizer. According to the nutrient banking concept, these soils must have lost enough phosphorus by now (in the maize that was harvested) that they couldn't produce a good yield at all. Yet even after 40 years, yields have been maintained and adding phosphorus does not improve them at all.

2. In Madagascar, hundreds of farmers are using the "System of Rice Intensification," or SRI. These farmers harvest from 12 to 15 t/ha of rice using only small amounts of compost and no chemical fertilizers on low CEC, acid soils. Yet, according to scientists, rice is only capable of producing a maximum of about 12 t/ha, and even then only with heavy applications of chemical fertilizers. In this case, the amazing yields are probably due to many different factors, but in any case, they prove that the idea that "low input agriculture is low output agriculture" is definitely mistaken.

3. The banking concept cannot explain, either, how soils under shifting agriculture have remained fertile for thousands of years. How is it that the soil loses its fertility after two or three years of farming, and then, seemingly miraculously, has totally recuperated its fertility some fifteen years later when it is farmed once again? If the soil's fertility is to be explained by the number of nutrients in it, then somehow those nutrients left the soil during the two or three years of cropping, but then somehow



The Nutrient Cycle

returned fifteen years later.

Banking concept scientists have tried to explain this puzzle by saying that the nutrients must have seeped down deep into the soil, where the crops' roots could not reach them, and then were lifted back up by tree roots during the fallow years, like a pump lifts water. But much of the fallow land has no trees, only grasses. And very few grass roots grow deep enough to pump up many nutrients in the subsoil. So the banking concept still cannot explain how farmers make their soils so fertile by fallowing them.

4. The banking concept also cannot explain how tropical rainforests can grow so many plants and trees, year after year, when their soils usually have such low CEC's. In this case, banking concept scientists usually admit that the tree leaves fall on the ground, forming a "litter layer". Then the forest plants' roots, which form a dense mat of feeder roots just below the litter layer, quickly absorb the rotted leaves' nutrients and move them back up into the tree, forming new branches and leaves again. This circular motion of nutrients is called a "nutrient cycle." These scientists are thus saying that even with very few nutrients in the soil, forest trees are able to continue growing green and vigorously year after year because they live off this very rapid "nutrient cycle". But then they turn to say that crops, even including tree crops and forest trees in agroforestry systems, are not capable of doing the same thing—of growing rapidly, even in very poor soils, by feeding off a rapid "nutrient cycle". Yet our crops and trees feed the same way forest's plants and trees do. Thus, the banking theory scientists are contradicting themselves.

5. Chemical fertilizer companies are spending millions of dollars to develop chemical fertilizers that only release a few nutrients at a time. Thus, even though these companies support very strongly the banking concept in their words, they are admitting in their actions that small amounts of nutrients released slowly will help plants grow even better. Thus, there is a contradiction between the banking theory and its own proponents' actions.

Scientists can grow almost any plant in pure water to which they have added a series of nutrients (water with nutrients mixed in it is called a "solution"). Scientists often grow plants in this way to learn what nutrients plants need, in what quantities they need them, and what happens to plants when they lack a certain nutrient. This way of growing plants in solutions is called "hydroponics".

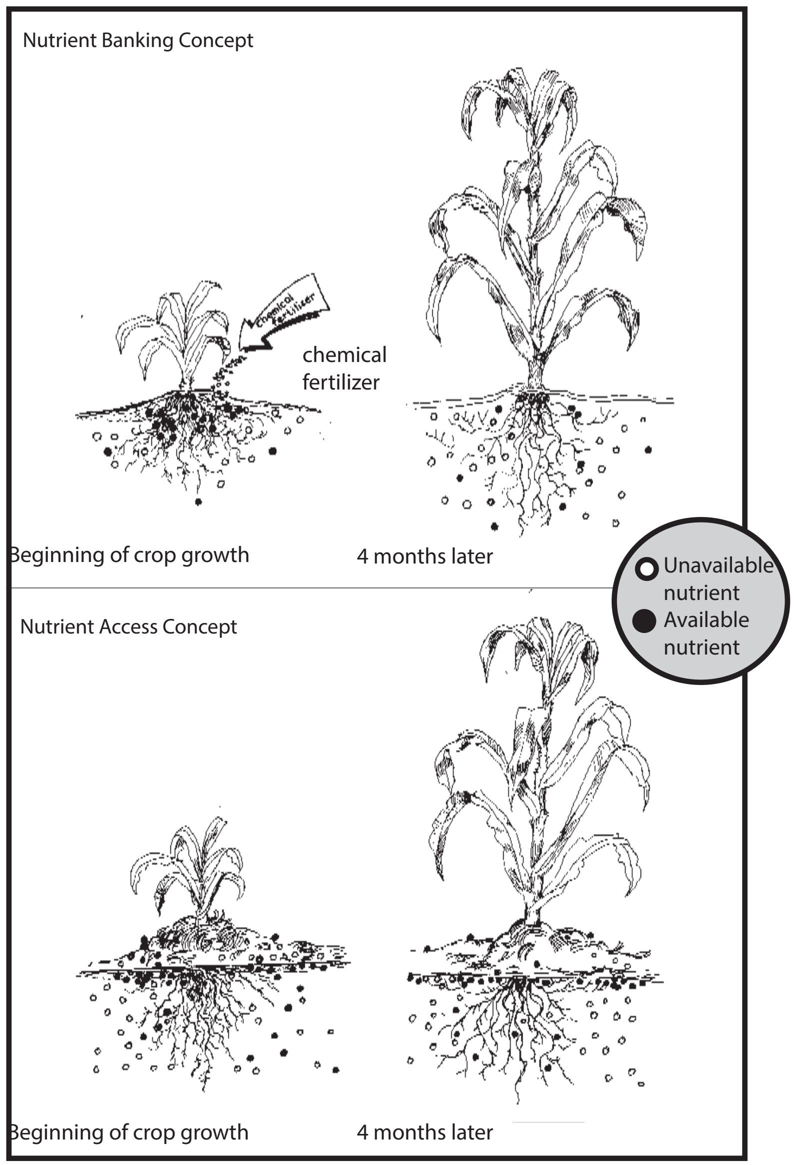
Given these and several other ways in which the banking concept cannot explain what is happening, it is time we found a different way to explain what is happening in our soils.

The Nutrient Access concept

An interesting experiment

Scientists have tried to find out how plants grow by experimenting with "hydroponics". In one experiment, maize plants were grown in each of four hydroponic solutions of the same volume. In the first solution, the scientists put an amount of nutrients considered by the banking idea to be sufficient for good plant growth. In the second solution, they put twice that amount, and in the third and fourth, they put only one fiftieth as many nutrients as in the first. As the maize grew, the nutrients used by the maize in the first three solutions were replaced every four days, while the nutrients used in the fourth solution were replaced every two days.

The plants in the second solution grew a little less than in the first. In the third solution, as the banking idea would predict, they grew 28% less than in the first. However, in the fourth solution, surprisingly, the maize plants grew a little better than in the first! That is, with only one fiftieth as many nutrients as in the first solution, the maize in the fourth solution grew better than the maize in the first, as long as the nutrients used up were replaced more frequently and the roots could access those nutrients.



Thus, assuming that the amount of nutrients is above an extremely low minimum, crop growth does not depend on the amount of nutrients in the soil. Building up a large bank account of nutrients in the soil has very little value. Rather, what is important is to maintain a constant, well-balanced supply of at least a minimum of nutrients, with unobstructed access of the crop roots to those nutrients.

A new concept of soil fertility

The new concept of soil fertility gives importance not to the over-all quantity of nutrients, but rather to the roots' access to the nutrients over time. Thus, we will call it the "nutrient access concept". The nutrient access concept of soil fertility states that:

Maximum plant growth can best and most inexpensively be achieved in the tropics by:

- the constant supply of soil nutrients (most inexpensively achieved with fairly low quantities)
- a healthy balance between the nutrients
- maximum access of plant roots to these nutrients (with, for instance, the maintenance of good soil structure and/or mulches)

This concept, of course, does not say that farmers in temperate climates cannot get good yields by using very large quantities of chemical fertilizer. What it does say is that farmers, especially those in the tropics, can also produce very good yields, even on very poor soils and at less cost, if they ensure that their crops have a constant source of nutrients that are highly accessible to their crops' roots.
So what difference does this new concept make for farmers practicing shifting agriculture? Very simply, this new concept gives us a tremendous new source of hope. It says that even though shifting agriculture farmers have very poor soils, they can produce very good yields. The nutrient access concept says that their situation is not hopeless just because they don't have enough money to buy ten sacks of chemical fertilizer per hectare every year. This idea says that shifting agriculture farmers in the tropics, even on very low CEC soils, can produce very good yields provided they produce enough organic matter, so that their crops can have a constant supply of nutrients.

This new idea says that shifting agriculture farmers can produce as well as any farmers in the tropics. It says that as long as the farmer's soil is still good enough that it could be recuperated by a 15-year fallow, it cannot be called a "low potential" soil. Therefore, governments could never again justify discriminating against shifting agriculture on the basis of the land's supposed low potential.

Furthermore, the nutrient access concept can explain every one of the situations that the banking concept could not:

- Green manure/cover crops and agroforestry systems increase farmers' yields by producing huge amounts of o.m., which then release their nutrients gradually from a litter layer on top of the soil. Thus, these nutrients are constantly available to the crop roots, in balanced amounts (assuming the o.m. is at least partly from legumes). Often, a great deal of nitrogen is fixed by these systems, and phosphorus is made more available to the plants because it is surrounded by o.m., rather than by poor, acidic soils (See A Proven Technology for Intensifying Shifting Agriculture: Green Manure/Cover Crop Experiences Around the World, pages 210-217).

- SRI rice produces dramatic yields in part because SRI techniques make the crop grow six times more roots per plant than do other rice-growing systems, thereby allowing the plant to access many more nutrients than other rice plants do.

- The nutrient access concept of soil fertility also gives us a different understanding of how both nature and shifting agriculture do such a good job of maintaining the soil's fertility for thousands of years. This ongoing fertility does not occur primarily because tremendous quantities of nutrients are washed down deep into the soil and then pumped back up, as the banking concept people claim (although nutrient pumping is a factor). Rather, the mechanism is much more complicated.

When a shifting agriculture farmer cuts the trees and burns them, much of a forest's o.m. is lost. Every time the farmer plants crops on the land, more organic matter is burned up and rotted away, and very little is returned to the soil. The nutrient cycle is cut. Without o.m., most of the earthworms and microorganisms in the soil die, the soil becomes hard, and the litter layer disappears, many of its nutrients washed down into the first half-meter of soil. There they change into forms that plants cannot access. So the crops' roots have difficulty penetrating the soil to reach the nutrients. Thus, the crops lose their access to a constant supply of nutrients. Yields drop to almost nothing.

But when the land is fallowed, the forest begins to grow again and the amount of o.m. gradually increases. A litter layer begins to form. With more o.m. on the soil, earthworms grow, microorganisms become numerous, the soil becomes softer, and the nutrients become more accessible. Nitrogen is fixed. In time, most of the nutrients that were sitting uselessly in the soil when the fallow started, are accessed by roots. Then the nutrients start circulating again from the roots, up to the branches and leaves, and down again to the litter layer, caught up anew in the age-old cycle of nutrients. Once again, the tropical forest is growing lush and green.

Contrary to the banking concept, the "low input" of a small number of nutrients constantly recycled, produces a "high output" of rapid forest growth.

- It is quite obvious that the research on slow-release chemical fertilizers is much more understandable based on the nutrient access concept than on the banking concept.

Of course, what happens in the soil is all a lot more complicated than what we have described here. But it is still true that the nutrient access concept gives us a much better idea of how it all works, in general, than does the banking concept. More information on putting the nutrient access idea into practice can be found under Putting the Nutrient Access Idea into Practice, pages 259-264.

Many of the major ideas in this paper were originally published in Ana Primavesi's El Manejo Ecológico del Suelo, which has not been translated into English.

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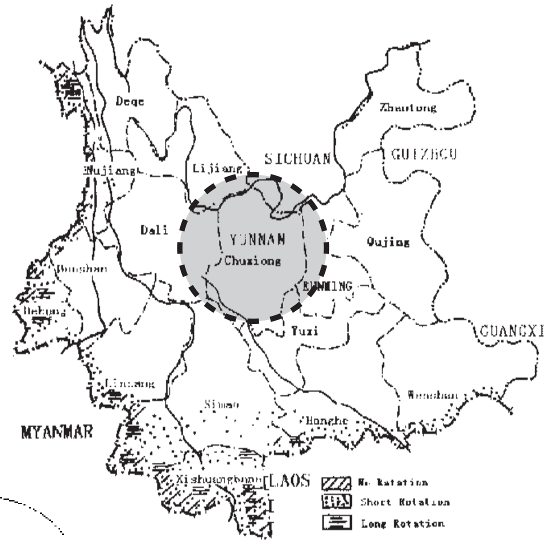
Prepared by
Roland Bunch

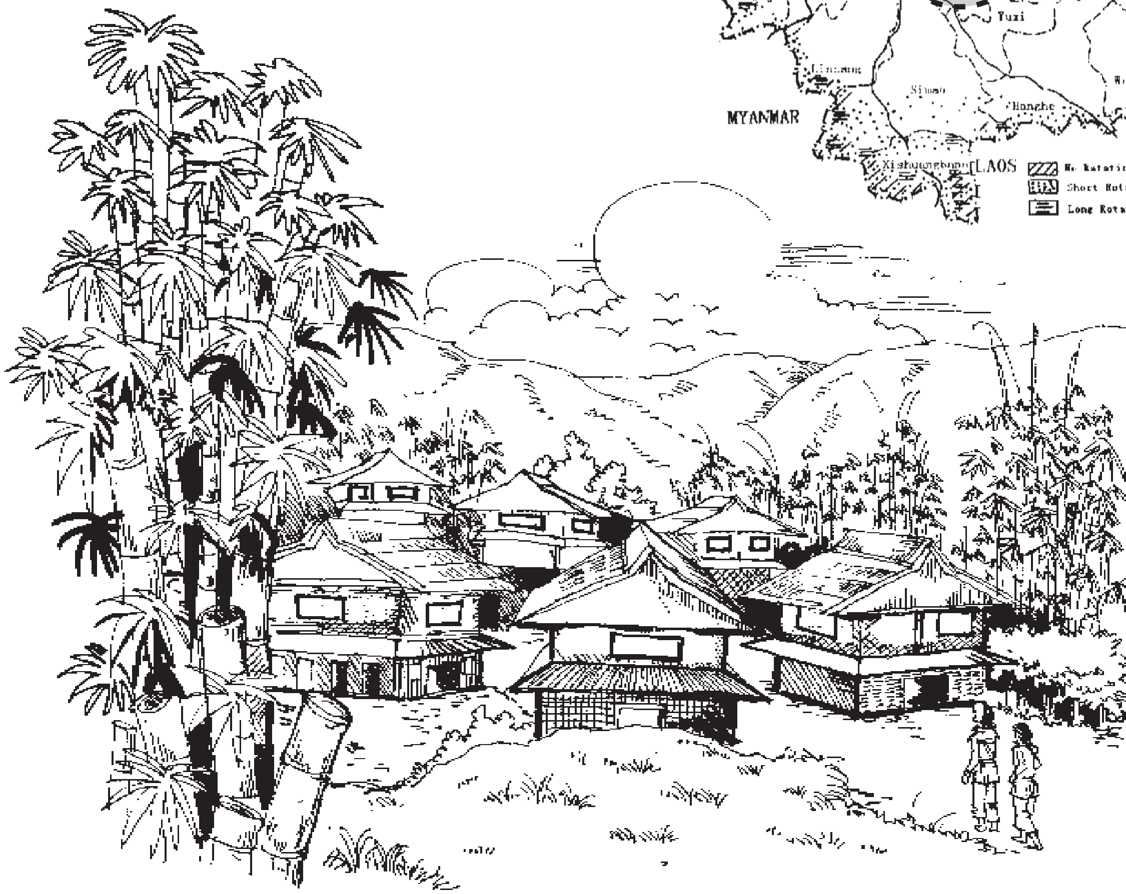
Resource book produced through a participatory writeshop organized by IFAD, IDRC, CIIFAD, ICRAF and IIRR.

Chapter Two

traditional shifting cultivation systems & practices

Sustainable Swidden Agroecosystems in Yunnan Upland, Southwest China





Yunnan is an inland and remote province in China. It is located in the southwest bordering Myanmar, Laos, and Vietnam. The province covers 39.4 million hectares, among which 84% are mountainous, 10% are plateaus, and 6% are plains or lowlands.

Yunnan is a multi-ethnic area composed of 26 different ethnic groups. Of these groups, 14 are engaged in shifting/swidden cultivation.

Problems encountered in shifting cultivation

- Diverse production systems due to the different ethnic groups in the region.
- Shorter fallow period due to population increase and movement.
- Degradation and depletion of natural resources due to over exploitation.

● Environmental degradation because of large-scale use of chemical pesticides and fertilizers.

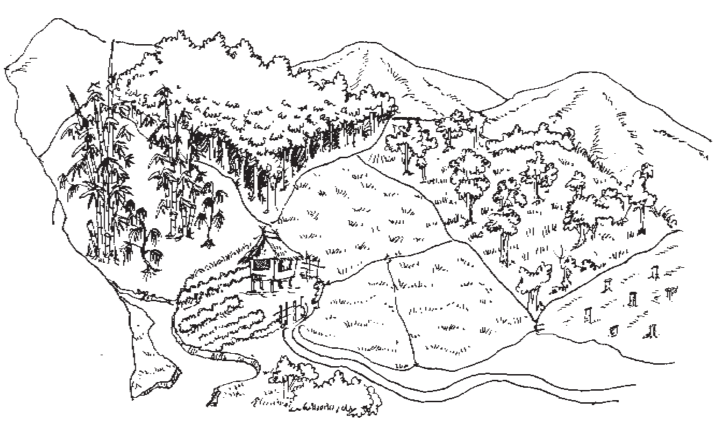
Types of shifting cultivation (based on elevation, plant species and geographical features)

■ No rotation. The land is cultivated only once during a period of seven to ten years. Some advantages of the no rotation system are:
1) It inhibits the growth of the weeds, thus, enabling the crops to grow well;
2) Destructive insects are lessened;
3) Soil erosion is minimized because the plants grow at once; and
4) A high yield is expected.

■ Short rotation. The land is cultivated continuously for two years and fallowed for a period of seven to ten years.

Types	Sub-types	Cult. Years	Rotation Years	Distribution[1]	Ethnic Groups[2]
Rotation Forms	No rotation	1	7-13	S. SW	BL, JP, JN
	Short rotation	2	7-12	S, SW	HN, W, KM
	Long rotation	3-5(-10)	10-20	NW, SW	DL,DA,LH
Fallowing Forms	Natural	1-5	> 10	S. SW	JN, Y, HN
	Afforestation	2-5	> 5-8	W, NW	DL, N, JP, etc.
Cultivated Crops	Broomcorn, Maize, etc.	3-5	8-16	S, SW	DL, N, LS
	Rice, Tea, cotton, etc.	2-4	8-12	W, NW	HN, M, LH
Migration Patterns	Random shift	2-3	Long-term	S, SW	Y, M, Yi, LH
	Linear shift	3-5	> 10	W, NW	DL, N, LS
	Cyclic shift	3-5(-8)	> 5-10	Most of place	BL, W, N,etc.

Note: 1. Distribution: NW – Northwest Yunnan, S – South Yunnan, SW – Southwest Yunnan, and W – West Yunnan;
2. Ethnic Nationalities / groups: BL – Bulang Nationality, DA – De'ang Nationality, DL – Dulong Nationality, HN – Hani Nationality, JN – Jinuo Nationality, JP – Jingpo Nationality, KM – Kemu groups, LH – Lahu Nationality, LS – Lisu Nationality, M- Miao Nationality, N – Nu Nationality, W – Wa Nationality, Y – Yao Nationality, and Yi – Yi Nationality.



■ Long rotation. The land is cultivated continuously for three to five years and then left uncultivated for the next 10-20 years.

Classification and Distribution of Swidden Cultivation in Yunnan

Sustainable swidden agroecosystems

The diverse geographic and ethnographic characteristics of Yunnan Province has led to the predominance of swidden systems.

However, the most common systems in Southwest Yunnan are: (1) the rattan-and-bamboo-based swidden; and (2) the Jinuo sustainable swidden. Both have been evolved by the communities in response to their needs, but in consonance with their culture and traditions, and in harmony with nature.

> Several rattan stems are provided each year to each Hani village for making swinging ropes for "Yeku" (traditional festival day of Hani people) which is observed in July.

Hani sustainable swidden system(rattan and bamboo-based)

Indigenous communities in Mengsong, a mountain community located in Southwest China, have unique knowledge systems for the sustainable utilization and conservation of natural resources, rattan and bamboo cultivation, utilization and conservation. These include the Abosuola and the Dongya.

The Abosoula refers to the local forest system which dictates the kind of product that are grown and can be harvested in a particular forest area. The different types of forests are: a) Sangpabawa (community rattan protected forest); b) Lieshugejio (building material forest); c) Naqiluogo (cash crop forest); d) Puchang (aesthetic forest); e)Nongbiong (graveyard forest;) and fuel wood forest.

Sangpabawa (community rattan protected forest)

Harvesting practices of Sangpabawa

- Farmers harvest large to medium –diameter rattan once every five years.
- Small-diameter rattans are harvested once every three years.
- Harvesting is mostly done during the dry season to prevent the rattan from rotting.

Forest management

- Cutting of old trees and heavy clearance is not allowed within the forest. The prevailing management practices do not permit the natural forest vegetation to be disturbed.
- Each household is allowed to collect some canes (weighing as much as 25 kg) for house construction.

Significance of Sangpabawa

- Assures the efficient conservation, reasonable utilization and stable output of rattan and bamboo resources;
- Ensures the sustainable uses of rattan;
- Selective harvesting does not disturb the rattan's root system, thus, enabling the rattan to continue growing, producing new shoots from the old rootstock. These new shoots on the old rootstock produce mature, harvestable canes faster than newly plantedrattan;
- Considered to be a useful model on the efficient and comprehensive utilization of natural resources and manmade resources; and
- Farmers obtain different modes of production from the two systems: (1) to satisfy their cash needs (i.e. harvesting and selling rattan, bamboo and fruit, etc.); and (2) to fulfill their basic needs (i.e. rice, medical plants, and other crops).

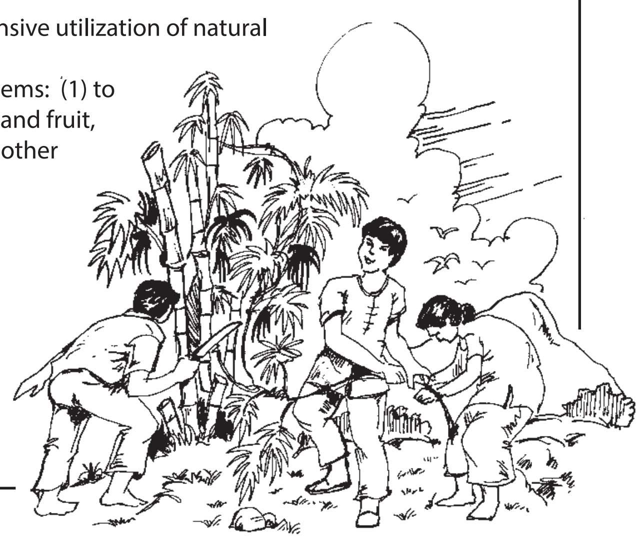
Effects of the system

- Biodiversity conservation

The Sangpabawa system not only protects the bamboo and rattan resources, but other plant resources as well.

- Water source

Sangpabawa serves as an important watershed area, providing precious water for irrigating paddy fields, drinking and other domestic or household needs.



The most common among these forests is the Sangpabawa. It is a protected forest established almost a hundred years ago. Sangpabawa belongs to the government, however, the forest management is overseen by the headman of the village. On the other hand, Dongya is a local term for swidden farming. It has four subsystems classified according to the type of crop system practiced. These are: a) Qeiya-Aneya (system of intercropping upland rice and rattan); b) Qeiya-Apeya (system of intercropping rice and bamboo); c) Aduya-Wunueya (maize and vegetables cropping system); and d) Leboya (tea planting system). Two of the most common subsystem in Yunnan, the Qeiya-Aneya and Qeiya-Apeya, are discussed in detail.

Qeiya-Aneya (indigenous rattan swidden cultivation)

Generally, rattan production is considered to be a minor forest product. However, it is highly valued in Mengsong. The local people have various indigenous practices in planting, managing, harvesting and conserving rattan.

Common rattan species cultivated

- Calamus nambariensis var. xishuangbannaensis (Dahong in Hani language, best quality);
- C. yunnanensis (Leileiniei, good quality);
- C. yunnanensis var. densiflorus (Leileixiu, good quality); and
- Plectocomia himalayana (Haji, medium quality).

Land preparation

- Slopes along streams in the swidden fields, boundary edges of

swidden cultivation fields, patches with bigger trees or tree stumps in the swidden field are considered suitable locations for planting rattans.

- After land allocation, the area is cleared of vegetation for upland rice growing.

Planting

r Seeds are collected from rattan forest or swidden fields while seedlings are prepared in the same swidden field.

r Seedlings are transplanted under shade trees or around big tree stumps when they reach the height of about 20 cm.

r Vegetative propagation (i.e. cuttage,layerage) is also used to develop rattan forest.

r Rattan seedlings are usually spaced about 10 to 20 meters apart.

Seed Processing

1. Crush the ripe fruit to remove its fleshy layer.
2. Soak the clean seeds in a can or any container with water for one to two days.
3. Treat the seeds with fungicide. Before sowing them, pre-treat the seeds with fungicide (0.5 1b of sodium pentachloro-phenate dissolved in 3 gallons of distilled water) to prevent any fungal infection.
4. Stratify the seeds in moist sawdust for about two weeks. This helps hasten the germination of seeds.
5. Germinate seeds under partial shade. Sow the seed at a distance of five to ten cm apart, pushing each one just below the soil surface. To avoid the retardation of seeds, the beds or boxes should be partly shaded, or the seeds can be covered with leaves. Water the seeds twice a day using a water sprinkler so as not to disturb the soil or leaf covering.
6. When the seedlings are about one month old, the first leaf is about 8 cm long and the roots are already well developed. The seedlings are ready for potting in perforated polyethylene bags.

Maintenance

r The rattan seedlings planted in the field are carefully protected from operations of cutting trees and burning the field.

Harvesting

r Harvesting starts from six to ten years after planting, or when the rattan's stem reaches 6-7 m in length).

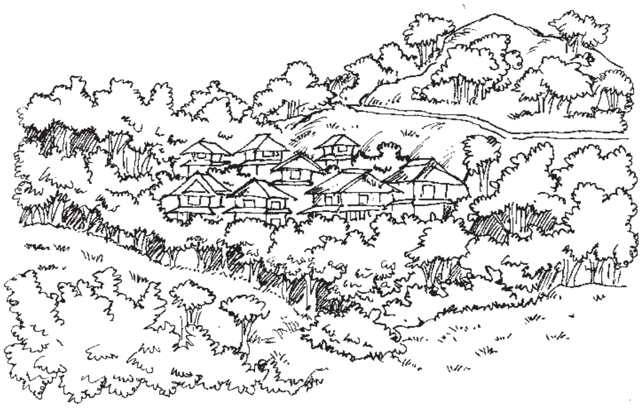
r Harvesting is done once every three or five years for small and large-diameter rattan.

Qeiya-Apeya (bamboo agroforestry)

- Bamboo clumps or forests belonging to a particular family are cut, managed, and conserved by the families themselves.

Common bamboo species selected

- Aqyul (Dendrocalamus hamiltonii) - best quality bamboo shoot and culm for weaving;
- Alhaq (Indosasa singulispicula) - commonly used bamboo shoot for fencing; and
- Aqpeel (Dendrocalamus giganteus) commonly used for construction and shoot production.



- Rattan is planted simultaneously with the bamboo clumps serving as climbing support for the rattan.
- Tobacco is intercropped with the bamboo clumps. Bamboo branches or culms are burned and the resulting ash is used to fertilize the tobacco plants.
- Bamboo is intercropped with maize, beans, pines, vegetables and other crops in the agroforestry system.

Jinuo sustainable swidden system

Like other ethnic groups in the mountainous regions of southern Yunnan, the Jinuos traditionally practice swidden cultivation. They do this simultaneously with hunting and gathering to provide them with supplementary food, fiber and other materials.

- Plant diversity

  The structure of plant distribution in swidden systems varies from one to several vertical layers. Strong interactions exist between agroecosystems including fallow and natural forest areas.

- Land-use pattern

  The land-use pattern is considered a key factor in sustaining the swidden system. For example, the land-use based on the long period of fallow rotation is a sustainable model.

Forest types

- sacred forest;
- burial ground forest;
- wind-and-fire-break forest;
- water-source forest;
- mountain-ridge firebreak forest; and
- rotation (swidden) forest;

It is important to note that the first five types are protected and are not cut by the people in the community.

- Forest management

  Preserved and protected tree species during burning by swiddeners can change the community structure and improve the vegetation regeneration during the fallow stage.

- Swidden cycle

  The fallow period for swidden fields is maintained more than 13 years in Jinuo communities and the vegetation cover of the land was observed to be better. For traditional swidden cultivation, Jinuo community divided their forest into more than 13 zones by quality. The swidden cultivators rotate their use of land so that each zone has a minimum 13-year fallow period. During the fallow stage, buffalos are allowed to enter the fallow field to fertilize the soil with their manure. After the fallow period, the swidden lands would already be covered with forest growth. The regenerated vegetation increases fertility of soil.

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Resource book produced through a participatory writeshop organized by IFAD, IDRC, CIIFAD, ICRAF and IIRR.

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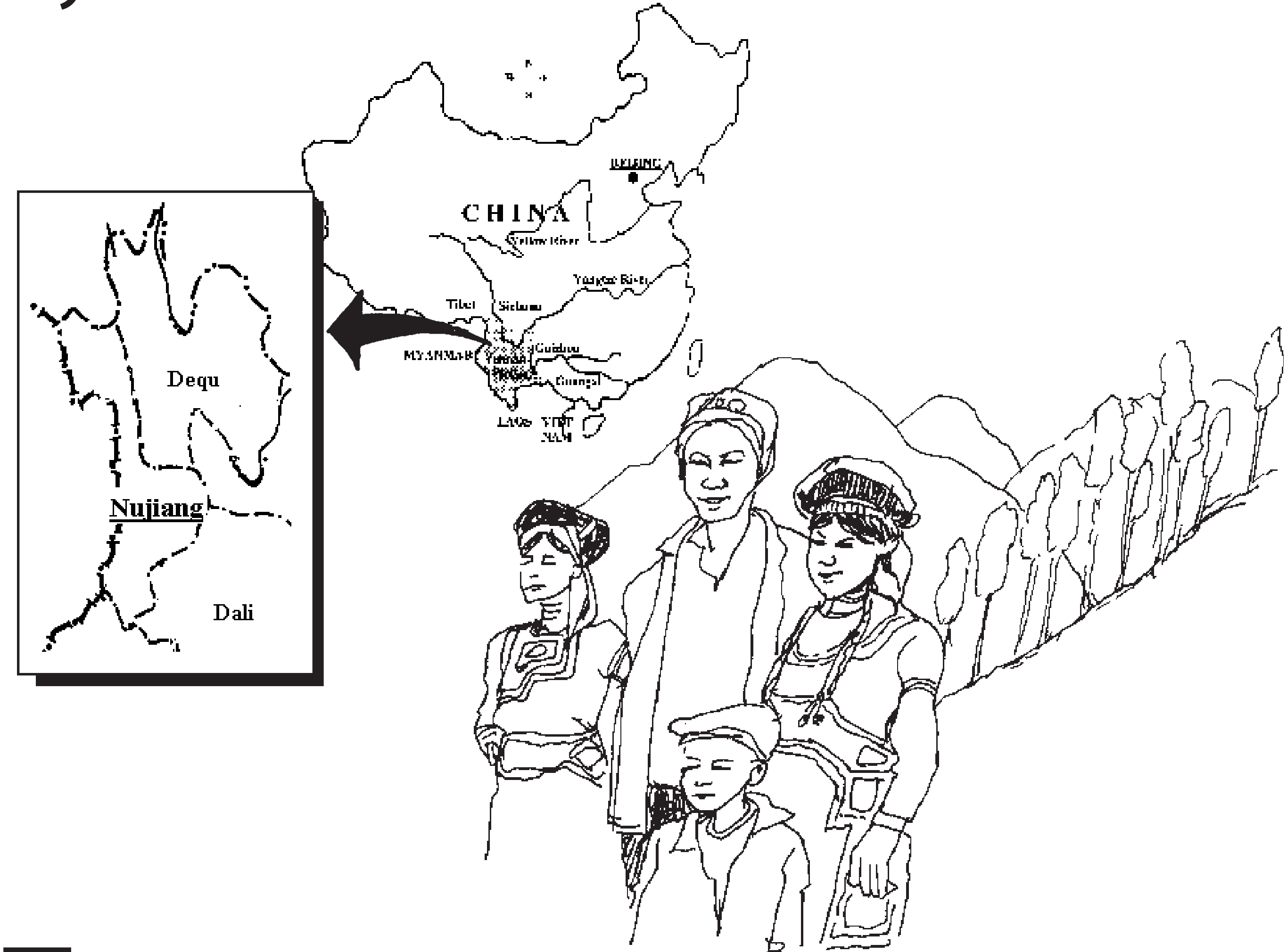
Lacquer Tree-based Swidden System in Southwest China



The Lemo group of shifting cultivators of the Bai ethnic group live in Lushui county, Nujiang Prefecture, Northwest Yunnan, China. In this area, vegetation includes forests of broad leaf evergreen, conifer, and bamboo (Fargesia and Yushania spp.), scrubs and grasslands. About 3,000 species of wild plants are found here including lacquer (Taxicodendron vernicifera Barkley). The Lemo practice a sustainable swidden farming system involving lacquer grown with annual crops or alder.

The lacquer tree is a traditional resin-producing plant in China. It is a fast-growing tree and is widely distributed in Southern China. Its resins are used for making lacquer. It also is known for its antiseptic and antirust qualities. The seeds contain oil and can be used for industrial purposes. Its timber is yellow and used in the construction of special furnitures.

Main Production Activities in Lemo Communities

- Swidden cultivation
- Paddy cultivation
- Timber and non-timber forest products
- Animal husbandry

The land used for cultivation of lacquer and alder is called kongji. The Lemo cultivate three types of swidden fields:

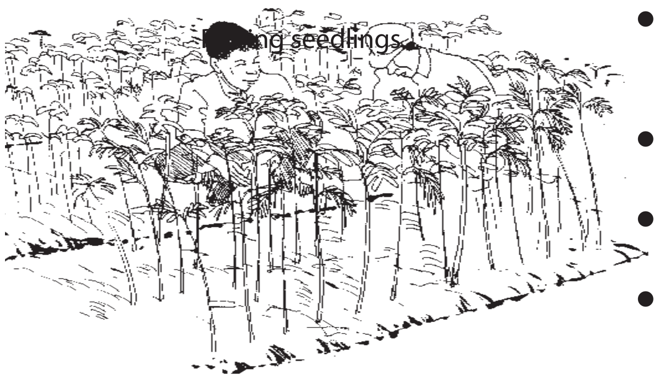
- Tongkong – the fallow land for reclaiming
- Shenji – land to be burnt
- Kongji – the land with cultivated lacquer and alder.

Slash and burn cultivation is practiced in shenji and kongji. A description of these types of swidden cultivation is given in the table below.

Swidden cultivation in Lemo communities

	Tongkong	Shenji	Kongji
Altitude (m)	800-1700	1700-1900	800-2300
Land preparation (Time)	digging (January - March) burning (March - April)	slashing (January) burning (April)	slashing (January) burning or digging (March)
Crops	corn, soybean, millet, pumpkin	corn, millet, pea	corn, millet or pumpkin
Farming duration	1 year but some farms until 15 years	1 year but some until 3 years	3-4 years
Fallow duration	3-4 years but some until 7 years	4-5 years but some until 10 years	7-16 years but some until 20 years
Tenure	common property	common property	private property
Fallow management	none	none	growing lacquer/ alder tree

Practices in cultivation and management of lacquer



- The nursery for lacquer seedlings is situated at high elevation (up to 2000 meters above sea level), and has very rich soil.
- During the winter, the area is cleared by cutting the trees, shrubs and grasses.
- Sowing is done in February or March at the rate of 30 seeds per square meter.
- The cut trees and other plants are burned and the ash is used to fertilize the nursery.

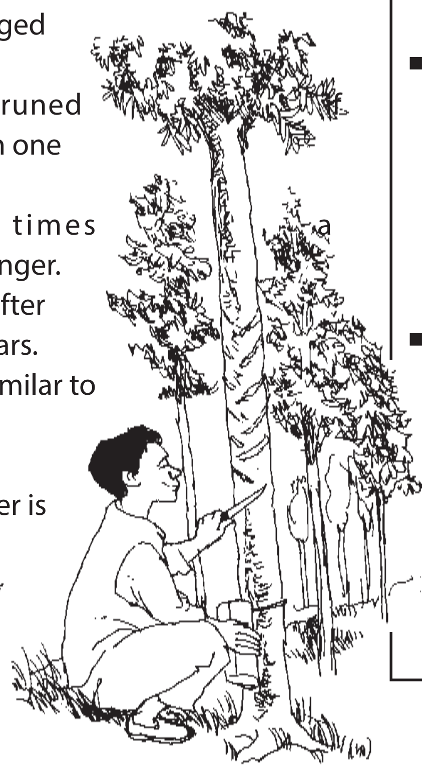
- The nursery bed is then irrigated slightly.

Transplanting seedlings

- After one year, the seedlings are about 50 cm high. Six hundred to eight hundred seedlings may be planted in one hectare if the land is fertile.
- One or two months later, food crops can be grown between the lacquer seedlings.
- Alder (Alnus nepalensis) + lacquer + crops system is a very common intercropping system.

Managing and harvesting

- The lacquer fields are managed by individual families.
- Some branches will be pruned too many branches grow on one tree.
- Weeding is done two times a year while the trees are younger.
- Harvesting of resin begins after the trees have reached 8 years. The harvesting method is similar to the collection of rubber.
- Only men do the tapping.
- The harvest period of lacquer is 7-10 years.
- Old trees are cut for timber.



Marketing

- The resin collected by the tappers in the village are pooled and sold to the factories.
- Good quality lacquer is sold at 7.4 Chinese yuan per kilogram (approximately US$0.90). The price has dropped because more users have shifted to using synthetic resin.

Farm-based Agroforestry Systems in China

- Crop-based agroforestry: crops + woody trees. Crops: vegetable, grains, legumes and other crops, and paulownia;
- Fruit-based agroforestry: fruit trees + herbaceous crops; Fruit trees: apple, orange, chestnut, peach, plum, longan, citrus, pear, grape, persimmon, jujube, pomelo, lychee, walnut.; Crops: beans, sweet potato, grains, legume, strawberry, vegetables, peanut, etc.
- Homegarden: bamboo, flowers, fruits, herbs, medicinal plants, ornamental trees, vegetable, other cash crops; Animals: pigs, chicken and ducks; mushrooms; etc.
- Tea-based agroforestry: Tea + fruit / timber trees + crops. Common trees: jujube, peach, pear, persimmon, plum, and other deciduous fruit trees; pine, Chinese fir, Chinese tallow tree, tung oil tree, paulownia, poplar and sassafras. Common crops: alfalfa, barley, Chinese milky vetch, corn, horse bean, pea, soybean and wheat. Animal and fish: chicken, duck, pig, and eel.
- Rubber-based agroforestry: rubber + tree species + herbaceous crops. Common woody perennials: coffee, tea, windbreak trees; Common crops: legumes, medicinal plants, pepper, sugarcane, etc. (See also Sustainable Swidden Agroecosystems in Yunnan Upland, Southwest China, page 75-80).

heng and Wu, 1995

Because of the distinct bio-physical environment of the area, it is difficult to introduce other cropping systems. There is a need to find ways to increase the productivity of the lacquer tree.

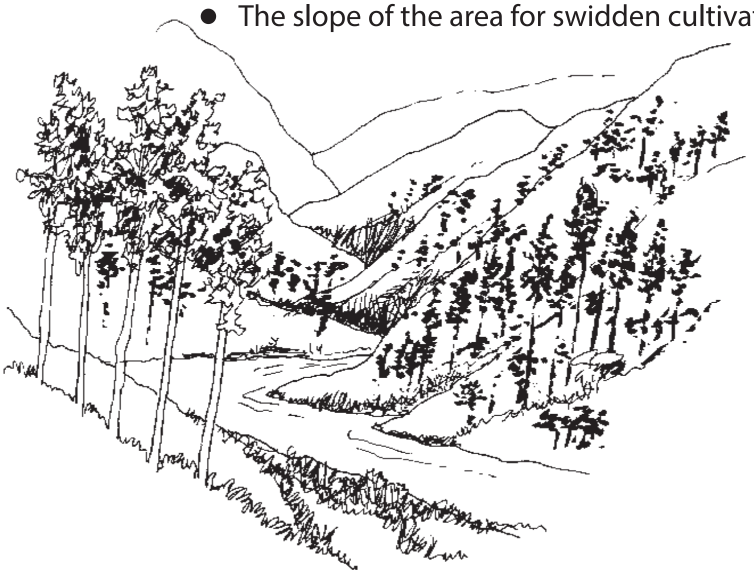
Benefits of growing lacquer trees

Economic benefits

- Lacquer is an important cash crop to the Lemo and accounts for about 70%-80% of the total cash income of a household;

- Each family manages about 1.2 ha of lacquer tree plantation. This field produces about 250 kg of lacquer resin in a year.

Environment
- The lacquer trees contribute to the beautiful scenery in the Lemo area.
- The multi-layer structure of lacquer vegetation is similar to a natural forest.
- Organic matter from lacquer or alder vegetation is used to fertilize the field.
- The slope of the area for swidden cultivation reaches 45^0. As a result, there is heavy soil erosion.



Kongji – A sustainable swidden system

Kongji is considered a sustainable swidden system. It is a highly-valued swidden agroecosystem in economic and environmental terms.

Some tenure features of a kongji are shown below:
- It is a private system of tenure resulting in efficient management, reasonable conservation and planned harvesting of lacquer trees; and

Component and Structure of Fallow Kongji

Layer	Height	Main component tree species
I	10-22 m	Toxicodendron vernicifera, Alnus nepalensis
II	3-10 m	Rhus chinensis, Castanopsis spp., and Eurya spp.
III	< 3 m	Musa acuminata, Pueraria peduncularis, Desmodium spp., and ferns

- Contracts are made between the local government and individual households that allow the use of land for 30-50 years.

This system is worthy of consideration in areas with similar conditions because of:

- the economic prospects of lacquer;
- the relative ease in growing it;
- the opportunity of maximizing land use by planting intercrops between the lacquer trees; and
- the ecological benefits derived.

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Forest-based Agroforestry Systems

- Timber tree-based agroforestry: timber trees + crops; common trees: Chinese fir, pine; common crops: beans, grains, green manure, legume and grass fodder, sweet potato, vegetables, watermelon, peanut; and animals: chicken, duck and pig.
- Timber and medicinal plants agroforestry: timber trees + medicinal plants. Common trees: paulownia, fir and bamboo; common crops: amur corktree, eucommia, ginseng magnolia, nackberry lily, white aster, and Villous amomum.

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Community-based Fire Management: Tools and Techniques of the Mizos in India

Fire plays an important role in shifting cultivation. However, since the period of burning usually coincides with the dry and windy months of the year, incidence of fire that often spreads beyond the boundaries of designated plots is frequent. In extreme cases, such fire even results in the burning of the entire villages or hamlets of the shifting cultivators.

Consequently, these experiences have led to the evolution of a more or less tribe-specific community-based fire management systems among the tribes of the northeastern region of India including the Mizos, the natives of Mizoram. These tribes predominantly practice shifting cultivation, which is locally known as jhum or jhumming.

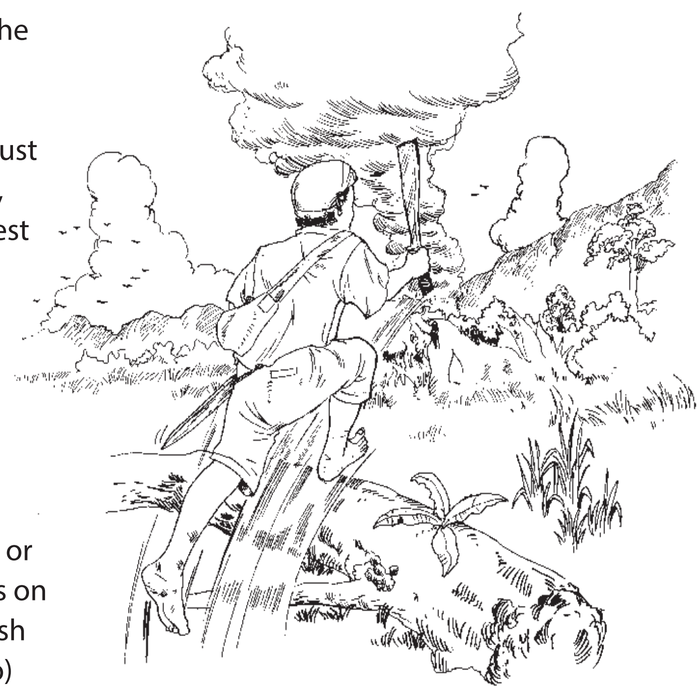
Role of traditional village institution

The control and management of forest or jhum fire is the responsibility of the individuals as well as the entire village community. This has been observed since the time the village was under the administration of the Village Chiefs, called Lal, and now replaced by the Village Council (through elected village democracy).

Similar fire management is practiced among the allied tribes of neighboring states such as the Darlongs of Tripura and the Hmars and Kukis of Manipur.

Village crier announces forest fire (left) and the community responds by extinguishing the fire (right).

Whenever forest fire happens, the Village Chief or the Village Council President immediately announces it to the public through the Village Crier (a village messenger). Whoever hears this announcement must immediately respond by dousing the fire. Similarly, when an individual or group of people notice a forest fire they are obliged to immediately report it to the Village Chief or the Village Council President.



Tools for community-based fire management

Modern fire extinguishers, buckets, spades, etc. are neither suitable nor preferred by the traditional communities, except those areas near the roadside or when the houses are on fire. Instead, the tribe relies on its community's strength and practices to extinguish the fires. The Mizo uses his long knife (chem or dao)

A Mizo person carries only a moderately long knife (locally called chem or dao) and a bottle of drinking water in his cloth bag. He prefers to be light weight, with simple cotton attire and barefoot so that he can quickly move and maneuver himself from place to place in the forest or even climb trees for cutting tree branches with his chem to beat off or douse off burning bushes. Occasionally he may even use his drinking water to extinguish the fire.

and at times, his bottled drinking water in putting out the burning logs or bushes. Occasionally, the tribe uses spades to dig out soil to cover burning logs and bushes due to unavailability of water in hilly areas. Buckets or any pots with water are generally used by the children to extinguish any burning objects falling on the thatch of the houses. The two other unusual tools used by women are the bamboo baskets and large water-storage tanks. The baskets are used to carry water containers, while the tanks are suitably placed near the houses. Village women use these tools to store sufficient water to prepare for any eventuality during the period of jhum burning.

Generally, modern fire fighting equipment is used only by the Government Fire Service Department.

Techniques and strategies for fire management

The techniques and strategies employed in community-based fire management are categorized into four measures, namely: Regulatory, Activity, Preventive, and Punitive.

1. Regulatory measures

Regulatory measure of community-based fire management is done by setting a particular jhum burning period as well as the time it will be conducted. Accordingly, the community set February 15 to March 15 as a period for all jhum burning activity to be completed. This measure is legally backed up by the Mizoram Rules (Prevention & Control of Fire in the Village Ram), 1983. Likewise, the Mizos conduct jhum burning in the afternoon when field is dry so that the burning will be completed by early evening.

2. Activity or organized role measures

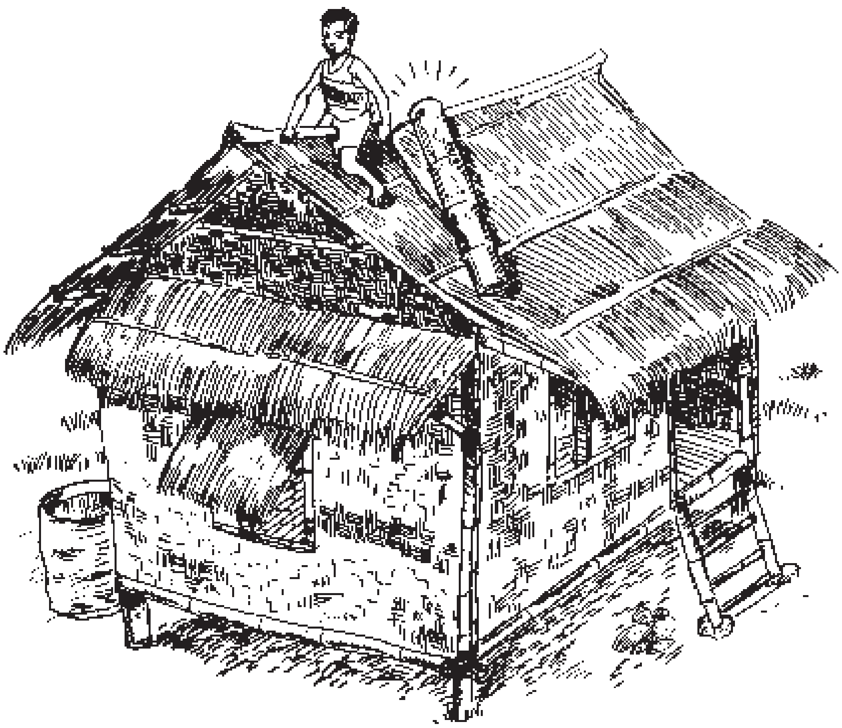
The Mizo community identifies the role of each family member with regards to jhum burning activities. Likewise, the entire village community is organized and assigned respective roles in the event of large-scale forest fire due to jhum burning.

Role of adult male members

- Notify or inform village authorities and immediate neighbors, as well as those who have jhum fields adjoining to his fields, about the date and probable time of jhum burning.
- The male members go to the jhum field to set the fire in the jhum. Usually, they stay in the field until the burning is completed. Likewise, they should be watchful for any forest fire, or spread of jhum fire in the vicinity (particularly of forests) or the adjoining forest areas.

Role of adult female members

- Store water in the household to be used in case the fire comes close to the house or when the house burns.



- Be watchful for any burning objects or wind-borne hot ashes that might fall on the thatch of the house.

Role of children and younger members of the family

- Stay alert on the roof top of houses, particularly those roofed with thatch grasses and help, through the use of a container full of water, in dousing fire that may be caused by wind-borne hot ashes from the burning jhum.
- Alert elders in case a fire is noticed.

Community roles and actions in the event of forest fire

Jhum burning season is the time when every able-bodied member of the village is expected to be available and to remain alert for any eventuality. Traditionally, the entire community is involved in burning processes of the jhum fields as well as in controlling and dousing forest fire, if there is any event.

Correspondingly, in case of forest fire, the Village Chief or Village Council President alerts and directs all the village members through the Village Crier to the location of the forest fire. All able-bodied male members of the village are required to immediately respond to the call and proceed towards the fire and help put off the fire in whatever means they have. Meanwhile, the women usually remain in the village to keep watch on their houses and alert the men when the fire spreads in the village. In some cases, the Village Authority also seeks the help of the local government Fire Fighting Authority to control the forest fire. Subsequently, the Village Authority and/or the Government conducts investigation to determine the causes of the forest fire and penalize whoever caused the fire, if any.

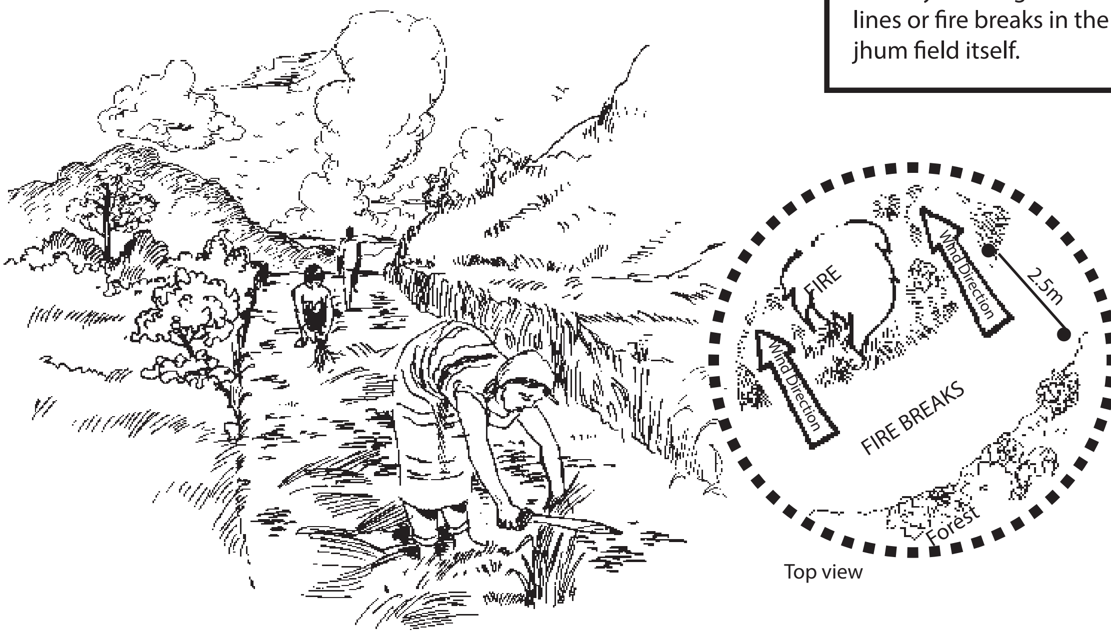
Village Forest Fire Prevention Committee

Since the introduction of the Mizoram (Prevention & Control of Fire in the Village Ram) Rules 1983, every village in Mizoram is encouraged to set up a Village Forest Fire Prevention Committee. Every year the Committee designates volunteers among its members, known as 'Fire Watchers'. The 'Fire Watchers' remain active particularly from February 15 to April 15 of each year, which is the peak period of jhum burning. The Village Forest Fire Prevention Committee is expected to always liaise with the Forest Fire Prevention Committees at the District and State level.

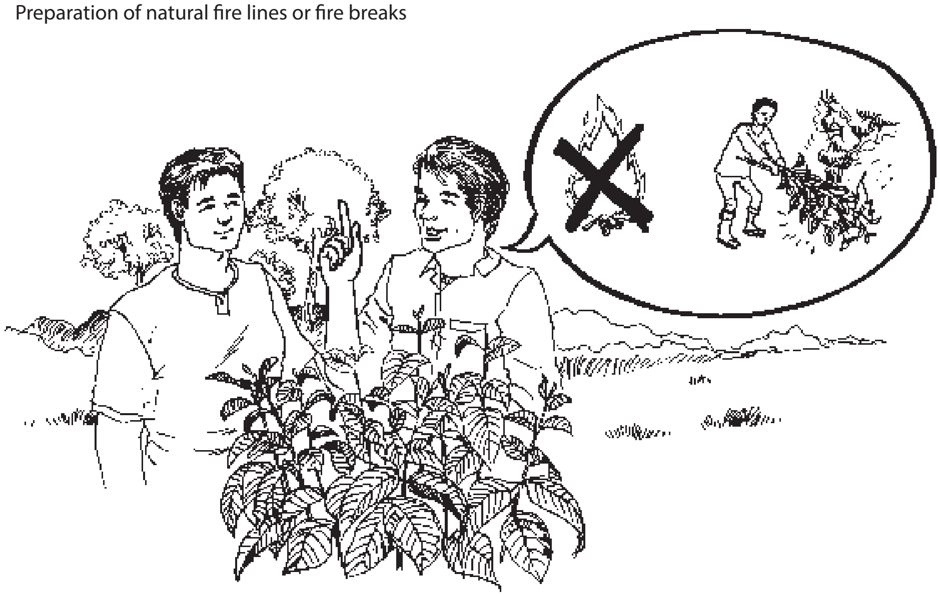
3. Preventive measures

- Wide cleared space between the slashed vegetation and the adjoining forests are left to create natural fire lines/breaks.
- Slashed vegetation should not be contiguous to adjoining forest floor. This system automatically acts as natural fire breaks at the time of jhum burning, thereby preventing spread of fire to adjoining forest areas.

At the time of slashing the vegetation for shifting cultivation, the Mizo leaves wide cleared space between the slashed vegetation and the adjoining forests, thereby creating natural fire lines or fire breaks in the jhum field itself.



Preparation of natural fire lines or fire breaks

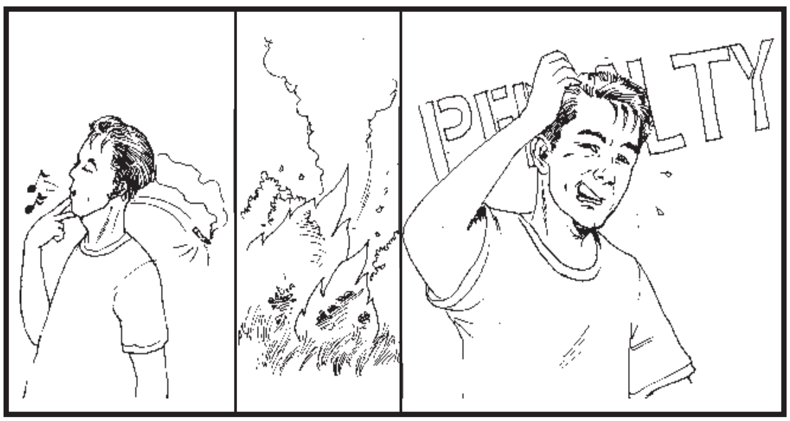


Prevention of removal of leafy trees

The people are generally discouraged to remove leafy trees or tree bushes at the boundary of jhum fields or adjoining forests areas. The branches are used to quickly control and douse off the fire in the event of forest fire.

Prior inspection of jhum fields before burning

Individual land owner or group of land owners having contiguous jhum fields conduct careful 'field excursion' to inspect the natural fire lines, assess wind direction from where fire might spread, and plan strategies to prevent or arrest forest fire incident.



4. Punitive measures

Penalties are imposed to individual(s) or to the entire village community, who deliberately or accidentally caused forest fire.

Individual punitive measures

- Fines are imposed and collected by the Village Authority.
- Penalty varies as follows:
  - deliberately done = Rs 5000 (US $116)
  - accidental = about Rs 2500 (half of the amount)
- Fines go to the Village Welfare Fund

Collective punitive measures

- Collective penalty is imposed when the village community caused large-scale forest fire or when they did not attempt to control forest fire.
- An average penalty amounts to Rs 50,000 (US $1163) depending on the assessment of the cause of fire, villagers' collective efforts in putting out the fire, and the intensity of damages.

Recent interventions and the role of government in fire management

The various fire prevention committees in Mizoram

- Village Forest Fire Prevention Committee (headed by the Village Council President)
- District Level Forest Fire Prevention Committee (headed by the Deputy Commissioner)
- State Level Sub-Committee for Forest Fire Prevention (headed by the Adviser to the Chief Minister)
- State Level Forest Fire Prevention Committee (headed by the Chief Minister).

State Government Role

- Notify Mizoram (Prevention and Control of Fire in the Village Ram) Rules, 1983.
- Establish various fire prevention committees at the village, district, and state level.
- Notify names of the committee members.
- Follow-up activities/actions of every committee.
- Provide trainings on fire prevention and management to village level committees, particularly the "fire watchers" or fire volunteers.
- Liaise with Central Government specifically for funding assistance.

Fire protection schemes/programs:

- controlled periodic burning
- fire line cutting/preparation
- cutting/clearing and burning of fire hazard roadside bushes, plantation areas, etc.
- awareness programs through seminars/workshops, posters, mass media, etc.
- purchase of fire-fighting equipment, special clothes for fire fighters, vehicles for deployment of fire fighters, wireless communication equipment, etc.

Central Government Role

The Central Government (in the Ministry of Environment & Forests) provides funds to the State Government to undertake different fire protection programs. It also disseminates information on experiences of other states in prevention and control/management of forest fires.

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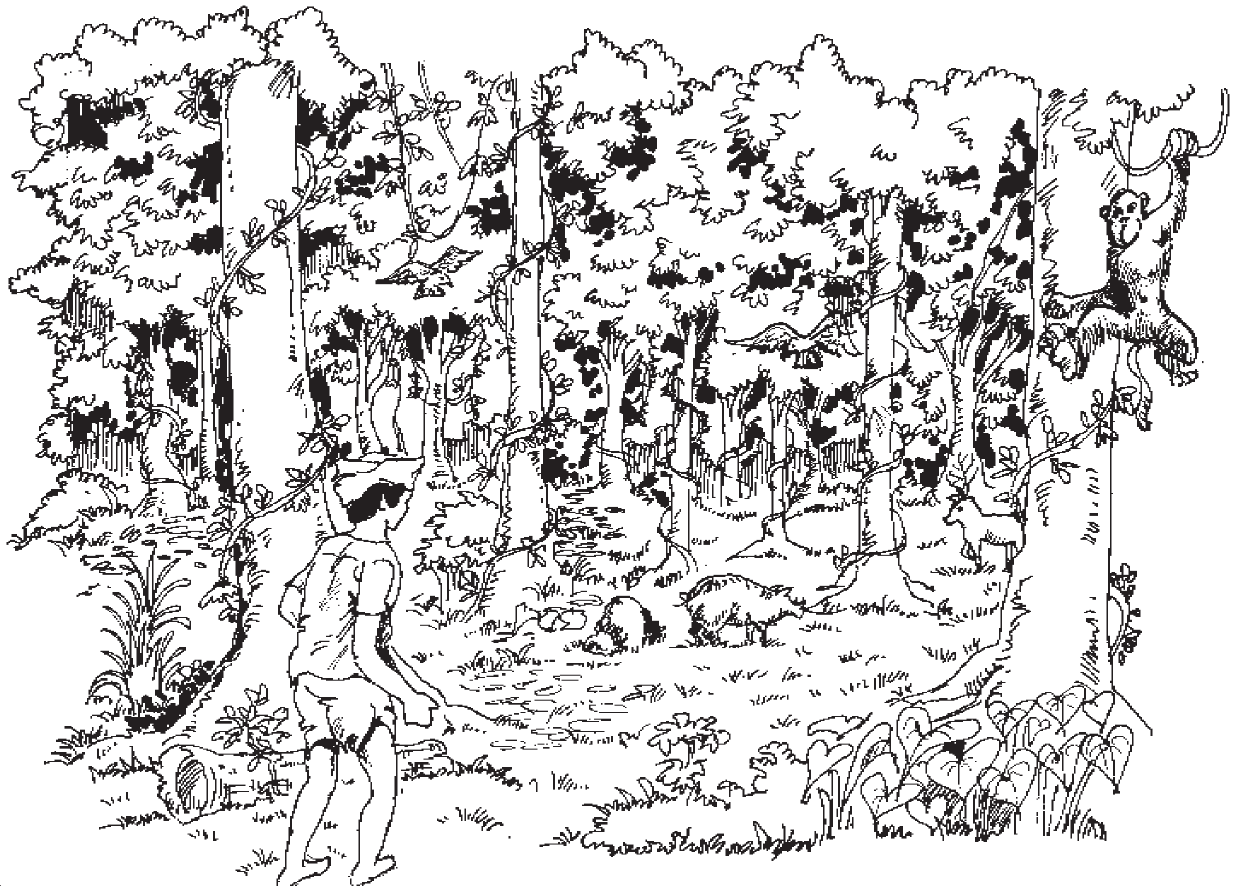
Resource book produced through a participatory writeshop organized by IFAD, IDRC, CIIFAD, ICRAF and IIRR.

Biodiversity Values in Fallow Areas of Northeast India

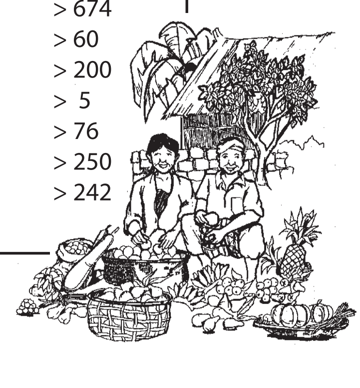


Most communities practicing shifting cultivation in northeast India do not have a single specific word for biodiversity'. Instead, they identify their "surrounding" environment, i.e., the plants and animals that are useful to them, and those connected with their legends/folktales/beliefs/rituals, as well as those plants needed by their domestic animals. Their 'surrounding' (environment) that gives them their biodiversity needs include their jhum fields, fallow lands and the forests. They also include the turtles and fishes of the rivers and streams, as also all the animals that drink water from the rivers and streams.

This article is an attempt to capture the meaning and values of plant diversity of fallow lands as perceived by the shifting cultivators.

Crop germplasm varieties in shifting cultivation fields of northeast India.

Upland rice	:	> 298+
Brinjal	:	> 37
Ginger	:	> 60
Chillis	:	> 68
Maize	:	> 674
Turmeric	:	> 60
Grain legumes	:	> 200
Sweet potato	:	> 5
Cucurbits	:	> 76
Taros	:	> 250
Yams	:	> 242



Biodiversity values: perceptions of the shifting cultivators

Developing the fallow lands into a good forest (vegetation) is the primary goal of fallowing the land. For the people, fallow lands with all their biodiversity are as important for their livelihood as the other forests.

Food security

To the traditional shifting cultivators, food comes from the jhum fields, fallow lands, nearby forests, rivers and streams. The varieties of crops grown in a year has a tremendous impact on the food security of their households and domestic animals.

Construction materials

Perception of biodiversity includes all the timbers, bamboo, canes, thatch grasses, etc. needed to construct their houses, as well as shelters for their domestic animals (cattle as domestic animals by most traditional shifting cultivators is generally a recent adoption).

Fiber

Traditional shifting cultivators living in remote areas still largely depend on their home grown cotton for their fiber needs, such as puanri (a kind of cotton-padded winter blanket specially made and carried as a prized item by a newly married girl to her husband's house among the Darlongs of Tripura). Cotton fiber is used for clothing while the bark of a wild plant is used to make rope (used in harnessing cattle).

Culture

The perception of traditional shifting cultivators on biodiversity also includes those plants and animals connected to their beliefs (animistic religion or nature worship) and traditional rituals. Some plants and animal parts have special uses related to their culture: e.g., a particular bamboo species used for bamboo dance, a species of small bamboo with long internodes used for drinking/sucking rice beer from common pot, feathers of hornbill/wild red fowl, skin of black bear, teeth of wild male boar, etc.). They also relate certain trees (e.g, Ficus) as the dwelling place of spirit.

Fodder

These are the plant species (grasses, leaves of bamboo and trees, creepers) which are extensively foraged by their domestic animals, such as cattle and mithun. Traditionally, the mithuns (Bos frontalis) were exchanged as bride price among many of the shifting cultivator communities.

Medicine

The traditional shifting cultivators normally have cures (made from combinations of plants, or plants and animal parts) for almost all kinds of ailments. The medicinal plants come from their fallow lands and nearby forest areas. Many communities also carefully nurture and grow such plants near their dwelling places (such as Centella asiatica, a kind of creeper used for heart and stomach ailments by the Khasis of Meghalaya). They also value plants which are used for treating domestic animals, such as for deworming of dogs, etc.

Household utility items

Traditional shifting cultivators generally depend on the biodiversity of their forests and fallow lands for all their household needs, all of which are valued. These include bamboos, canes and fiber trees. In fact, bamboo is used by traditional shifting cultivators from cradle to grave (eg., bamboo knife is used to cut the umbilical cord at the time of birth, bamboo mats are used for wrapping the body at the time of burial, etc.).

Dye and resins/gums

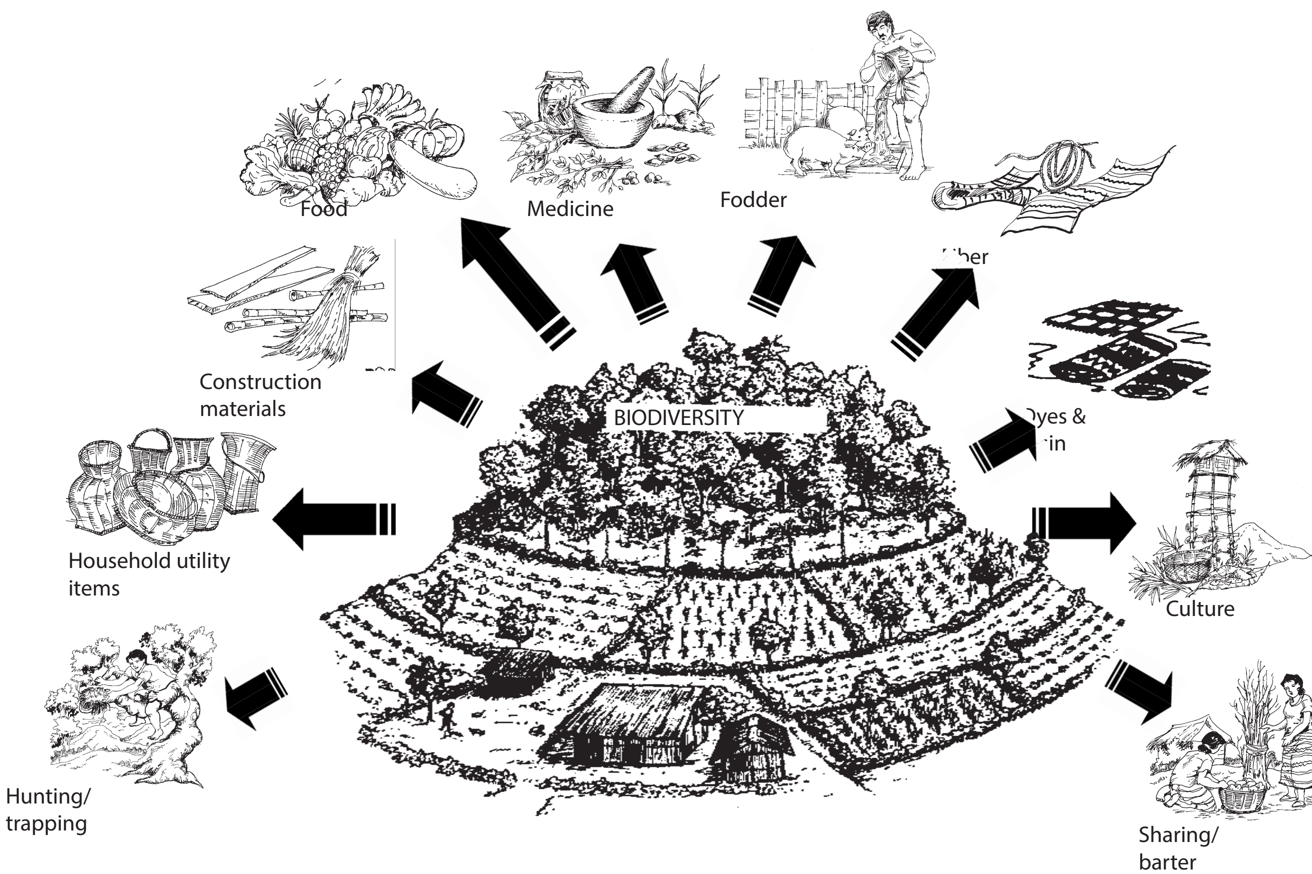
Plants are used to dye their cotton fabrics, whereas the gums extracted from trees are generally used for trapping birds. Resins are used for rituals and as insect repellents. Communities carefully preserve plants from which dyes, resins and gums are extracted.

Hunting and trapping

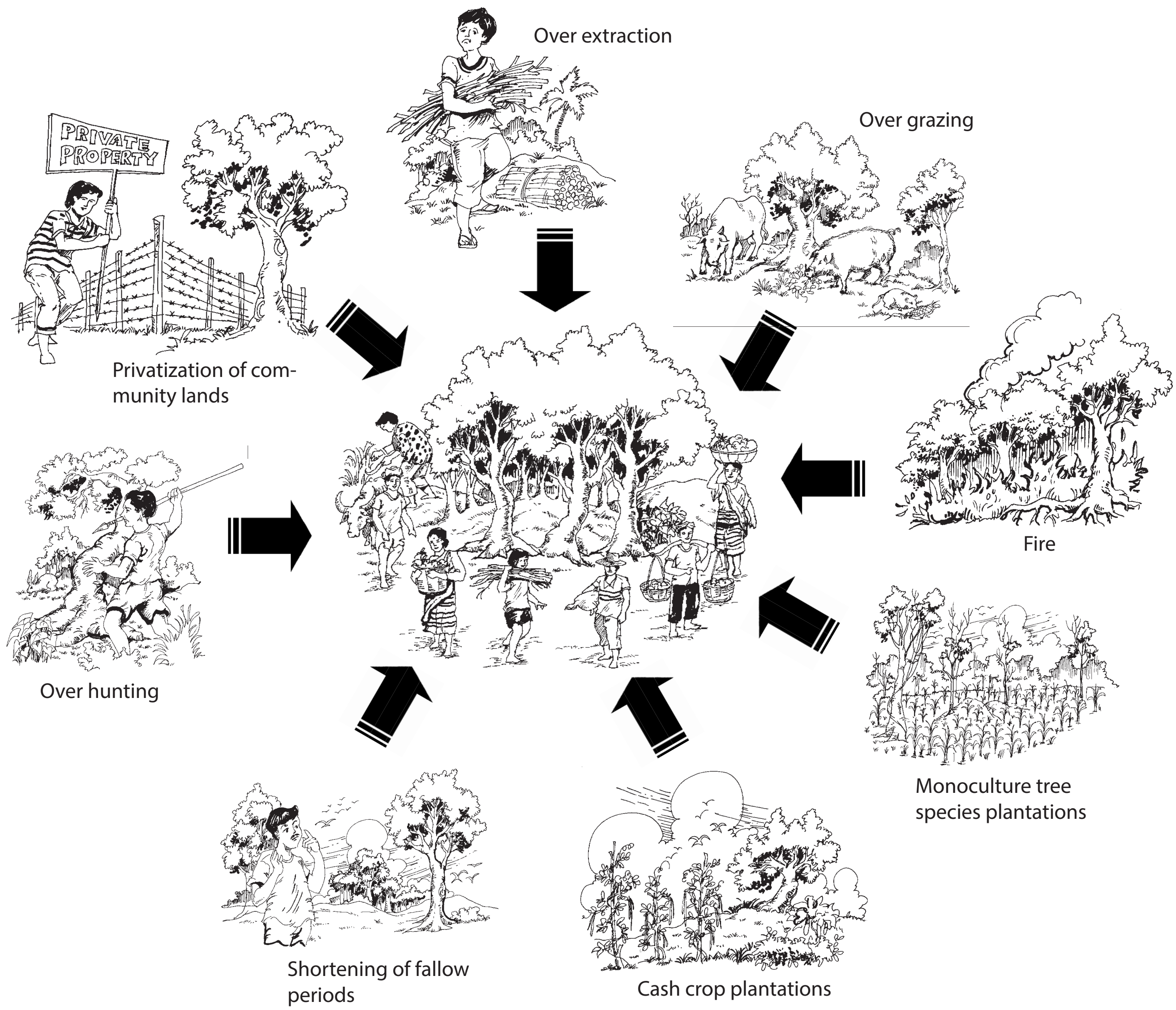
The communities also relate to animals and birds that they generally hunt and trap as important components of biodiversity. Bamboo and canes are used also to make bows and arrows, bamboo spears, fishing rods, etc.).

Sharing/barter among community members

Generally, women collect food and materials from the forest and these items are shared or bartered with their neighboring families. The neighbor reciprocates this in the next occasion.

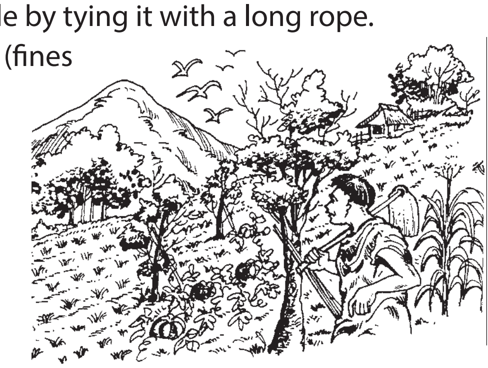


Threats to biodiversity of fallow lands in northeast India



Management of fallow biodiversity in some communities in northeast India

- Free grazing is not allowed in the fallow lands for one to two years. The household that had done cropping in the preceding year is allowed to graze his cattle by tying it with a long rope.
- Strong regulation for accidental fire prevention is imposed (fines are collected among Tangkhul Nagas of Manipur);
- Only trapping of small game animals is allowed.
- No cultivation is allowed until the Traditional Village Institution decides otherwise.



Women and biodiversity of fallow lands

- Fallow lands are often 'social sites' for women where they gather together and collect firewood and wild vegetables.

Community bonds are renewed in doing these activities.

- Women collect crop vegetables from previous years (one to two years fallow) and wild vegetables from subsequent fallows. They also collect root crops (ginger, Colocasia, Dioscorea, sweet potato).
- Khasi women collect tubers of wild herbs having medicinal properties, generally chewed with betel nuts.
- In some communities, the women exclusively manage the planting and propagation of plants used in shifting cultivation-associated rituals.

See Gender and Agrobiodiversity Management Among the Lepchas in Sikkim, India, pages 110-116, for more discussion on gender and natural resources management.

A case study

The study was conducted in the Karbi-Anglong district of Assam, inhabited by a hill tribe known as the Karbis, who are predominantly shifting cultivators. In recent years, the fallow period in this area has reduced to five years on an average.

The number of plant species recorded in different shifting cultivation landscape elements are presented in Table I. There was progressive increase in the number of plant species according to the age of fallows. Although the number of species was observed to be 60-98 species in the fallow lands from one to five years, the total number of species found in all the fallows was134. Of these number, 55 species were economically valuable to the local community either as medicinal plants, edible plants, fodder, fuelwood and miscellaneous construction materials.

There is a low percentage of the common species between forest and fallows compared with the number of plant species in the forest alone, and in the jhum fallows because the study site is a secondary forest with repeated cycles of shifting cultivation.

Number of economically important plant species of fallow lands (Karbi Anglong, Assam, India).

- Medicine 17
- Edible plants 12
- Fodder 9
- Fuel wood 5
- Construction materials 12

Table I. Plant species occurring in fallow lands, adjacent forest and crop fields.

No of plant species in the forest	No. of plant species in the jhum fallows (1-5 years)	% of common species between forest and fallows
160	134	18

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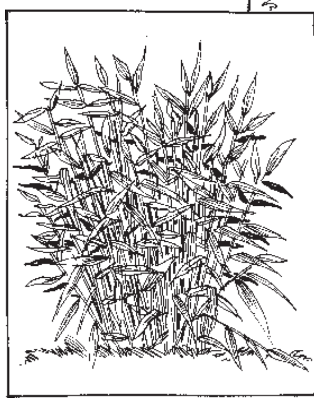
Resource book produced through a participatory writeshop organized by IFAD, IDRC, CIIFAD, ICRAF and IIRR.

Domestication of Three Non-Traditional Species by Shifting Cultivators of Northeast India

Northeast India


Livistonia Jenkinsiana


Aleurites spp.

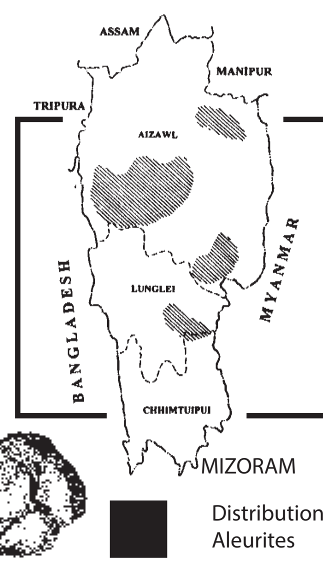

Thysanolaena maxima

In their quest for a better crop and land use, many shifting cultivators of northeast India have started the cultivation and domestication of some non-traditional crops. These non-traditional crops came from neighbouring countries e.g. Aleurites spp. (Tung), and from the wilds e.g. Livistona jenkinsiana (Toko) and Thysanolaena maxima (Broom Grass).

Cultivation of Aleurites spp. in Mizoram

The plant

Aleurites, which is locally known as "Tung", comprises five species belonging to the family Euphorbiacceae. It is a tree which bears monoecious flowers, cordate leaves and has a life span of about 30 years. "Tung" is profusely branched and may grow up to six to ten meters high.




Fruits of Aleurites

The most productive plant part of Aleurites is its nut, which yields drying oil that is principally used for industrial purposes. Two species of Aleurites, A. fordii and A. montana, have been successfully domesticated in Mizoram. They are also broadly distributed in the tropical and sub-tropical regions of eastern Asia and Malaysia.

Extent of adoption

In 1935, the British introduced Tung cultivation in Mizoram. But private plantation of this tree got momentum only in the year 1990 onwards. Since then, farmers have standardized the agronomic practices and processing, while marketing facilities are developing. Within ten years of its adoption, more than 7,000 hectares have already been covered by Tung and its annual dry seed yield is estimated to be over 5,000 tons.

Table 1. Cost and return (Rs) analysis for Aleurites (per ha).

PARTICULARS		YEARS 1st	2nd	3rd	4th	5th	6th	TOTAL
Revenue	750	0	0	7000	17500	35000	60250	
1. Site clearance	750						750	
2. Selling of Fruits					7000	17500	35000	59500
Production Cost	6100	2520	2520	1050	1400	1750	15340	
Labor								
1. Site Clearance	1750						1750	
2. Pit digging and sowing		750						750
3. Weeding		1170	840	840				2850
		840	840	840				2520
		840	840	840				2520
4. Harvesting					1050	1400	1750	4200
Materials								
1. Small Tools & Implements		500						500
2. Seed		250						250
Net Income		-5350	-2520	-2520	5950	16100	33250	44910

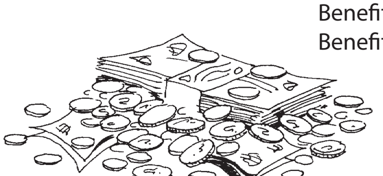
Benefit Cost Ratio at 10% AIR = 2.98

Benefit Cost Ratio at 15% AIR = 2.61

Benefit Cost Ratio at 20% AIR = 2.29

*Annual Interest Rate = AIR

US $ = Rs. 45



Earn more !

Intercropping can further enhance the productivity of the Tung plantation. Rice can be raised along with Tung during the first two years and ginger, tumeric and other shade-loving crops can be grown after the 2nd year of plantation.

Economics of Tung cultivation

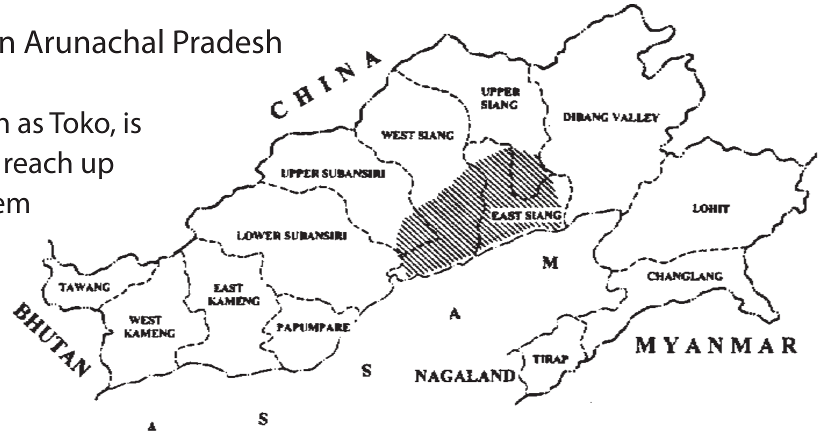
For the determination of costs and benefits of Tung cultivation, data on one to six-year old plantations were collected.

Table 1 indicates that on its sixth year, a Tung plantation can generate a net profit of Rs. 7485 yearly per hectare. After the sixth year, the labor expense (which will only be incurred on harvesting) will be minimal, while further increase in yield will be observed, hence, profit will be significantly higher than in the previous years.

Cultivation of Livistona jenkinsiana in Arunachal Pradesh

The plant

Livistona jenkinsiana, commonly known as Toko, is an unbranched graceful palm that may reach up to 20-30 meters high at maturity. Its stem is comparatively slender with 30-40 cm diameter at breast height, with a globose crown borne at the tip of the solitary stem. This plant grows naturally in the tropical evergreen and sub-tropical broad-leaved forests up to an elevation of 1,100 m. The Adi and Nishi tribes of Arunachal Pradesh, India have been using the leaf, fibre and fruits of Toko for ages. At present, it is considered an endangered plant included in the IUCN's red data book of Indian plants.



Distribution of Livistona jenkin-

Uses of Livistona jenkinsiana:

Leaves

- Roofing material for local houses
- Top cover of palanquins and boats
- Raw material for hats and hand fans
- Overhead shade for nursery

Midrib of the leaf

- Raw material for broom

Fibrous sheaths

- Raw material for rope-making

Pericarp of ripe fruits

- May be eaten raw or used for making salad

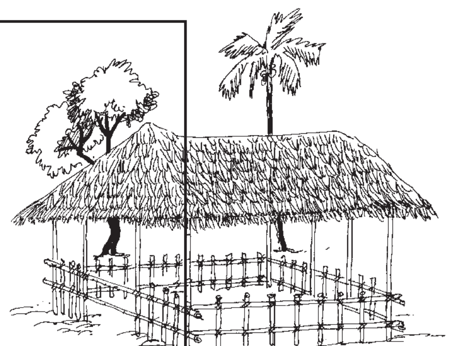
Nut

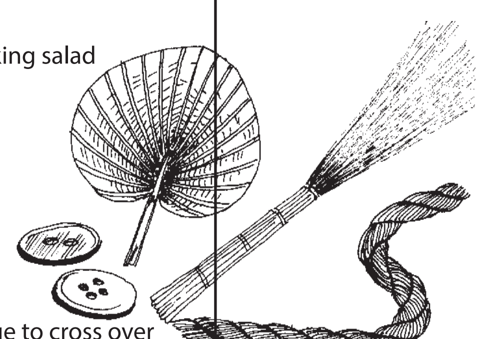
- May be eaten raw as a substitute for areca nut
- Used for making buttons

New soft shoots

- May be eaten as vegetable
- Stem used as temporary log bridge to cross over village streams
- Used as posts for temporary structures

The plant itself is planted as an ornamental and peripheral plant. The principal marketable produce, however, is the leaf which has a high demand in Arunachal Pradesh.





Economics of Toko cultivation

The use of tin roofs and concrete structures are not that popular among local tribes. Even those who can afford modern housing prefer to go for a thatch house. Toko leaves are usually used as roofing of these houses and have to be changed every four years. Thus, there is a good and growing market for Toko leaves. Though Toko production is still inadequate, the domestication of this plant has improved the economic well being of its growers. The spread of Toko also helps in the sedentarization of shifting cultivators, thus reducing soil erosion and preserving biodiversity by taking off the pressure on forests.

Table 2. Cost and Return (Rs) Analysis for Livistona jenkinsiana (per ha).

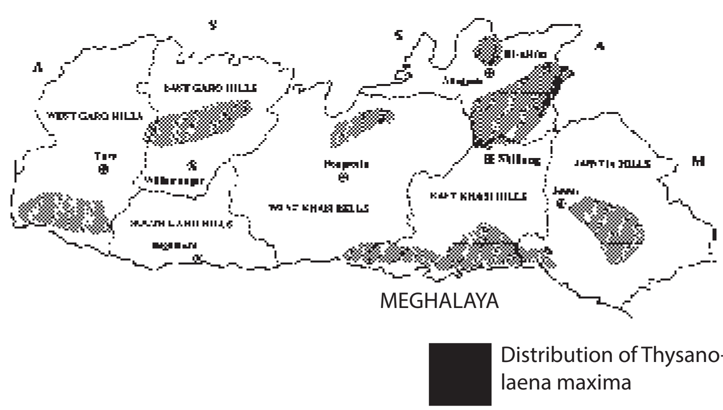
PARTICULARS		YEAR 1st	2nd	3rd	4th	5th	6th	TOTAL
Revenue	500	0	0	11250	15000	18750	45500	
1. Site clearance	500						500	
2. Selling of Fruits					11250	15000	18750	45000
Production Cost	2750	2000	2000	4400	4450	3000	18600	
Labor								
1. Site Clearance	2000						2000	
2. Weeding			2000	2000	2000	2000		8000
3. Harvesting and processing of leaves					2000	2000	2500	6500
4. Transport to the Godown					400	450	500	1350
Materials								
1. Small tools and implements		500						500
2. Seed		250						250
Net Income		-2250	-2000	-2000	6850	10550	15750	26900

Benefit Cost Ratio at 10% AIR = 2.16
Benefit Cost Ratio at 15% AIR = 2.03
Benefit Cost Ratio at 20% AIR = 1.91

Table 2 shows that in six years, a farmer earns a yearly profit of Rs 4480 per hectare. Like Tung, after six years, the expenses are reduced and production increases. Furthermore, the other plant parts like fruits, leaf sheaths and leaf midrib can also be utilized , hence, providing extra income to the farmers (which have not been accounted). Thus, the total income will be more than the amount recorded in this study. The cultivation of this species is economically viable but only for small-scale production as the demand for this plant outside Arunachal Pradesh is not very significant.

Cultivation of Thysanolaena maxima in Meghalaya

Thysanolaena maxima, commonly known as broom grass, grows naturally in degraded forests and abandoned wastelands of the hilly regions of northeast India. The plant is a huge tufted grass that grows in tussocks that could reach a height of up to 3.5 meters. Broom grass grows



in almost all parts of South and Southeast Asia up to an elevation of 1,600 m.

Economics of Thysanolaena maxima cultivation

The yield of broom mainly depends upon the quality of planting materials, fertility of land and cultural practices adopted. The yield differs according to the age of the plant. The highest yield of inflorescence is obtained from three and four-year old plants. From the one-year old plant 0.5 kg of broom is obtained. The yield then begins to decline, and on the fifth year, the average yield is 1.5 kg while on the sixth, only 0.5 kg of produce per plant is obtained.

In most places, there is no categorization of the produce. In some places, particularly where plantations of different ages are available, grading of broom (inflorescence) is carried out based on the size of the inflorescence. Class I, consisting small inflorescence, fetches the highest price. This is procured from the one to three year old plants. Class II, the medium variety, is produced from the four to five year-old plants. Class III, the large inflorescence obtained from the six year-old plants, fetches the least price. The maximum quantity of produce comes from three to four year-old plants (Table 3).

Uses of Thysanolaena maxima:

The inflorescence of the plant is used in making brooms, which are quite popular in India and fetch good price. These brooms have a ready market in northeast India and they are also exported to other parts of the country in large quantities.

Leaves
- Used as fodder and fuel during lean period

Grass Stems
- Used as raw materials for paper-making
- Used for making mats in small-scale cottage industry

Roots
- Prevents soil erosion as it binds the soil particles

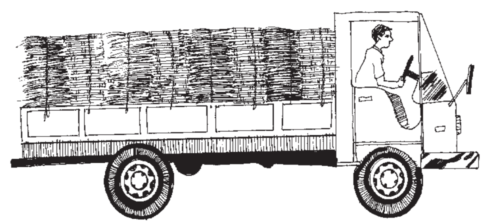


Table 3. Cost and return (Rs) analysis for Thysanolaena maxima (per ha).

PARTICULARS		YEAR 1st	2nd	3rd	4th	5th	6th	TOTAL
Revenue	3000	5200	9570	12350	4500	900	35520	
Production Cost	3700	1400	1550	1550	850	400	9450	
Labor								
1. Site Clearance	1000						1000	
2. Weeding (2x per year)	1200	1200	1200	1200	650	250	5700	
3. Harvesting (once/year)								
4. Pit digging and Rhizome planting		800						800
5. Transportation to godown		200	200	350	350	200	150	1450
Materials								
1. Small tools and implements		500						500
Net Income		-700	3800	8020	10800	3650	500	26070

Benefit Cost Ratio at 10% AIR = 3.46
Benefit Cost Ratio at 15% AIR = 3.32
Benefit Cost Ratio at 20% AIR = 3.19

Depending on soil fertility, plant density and maintenance, the yield varies between 400 - 1,000 kg of inflorescence per hectare.

It is clear that from a six year-old plantation, a cultivator can earn, on the average, a yearly net profit of Rs. 3,328 per hectare. An extra income can also be generated from the sale of stem, and the leaves can be used as fodder. Brooms have sufficient demand throughout the country and marketing is not a problem. The traders come to the village and buy the produce from the growers at prevailing rates.

Summary and conclusion

The economics of the three plantation crops is summarized in Table 4.

Aleurites spp.

- Aleurites spp cultivation gives good economic returns. However, the end product of this crop is an oil which is particularly used in industries. Therefore, it is highly dependent on external market forces. At present, most requirement of this oil is met from imports. This also necessitates that the cost of production should be minimal to warrant a competitive price.
- Poor infrastructure and hilly terrain puts these traditional farmers at a disadvantage vis-à-vis their counter parts elsewhere.
- Still, Aleurites spp. has a good economic potential and support from the government can provide the required impetus to the cultivation of this crop. It can provide an alternative livelihood to shifting cultivators not only in Mizoram but in other states as well where agroclimatic conditions favor the growth of this tree.

Livistona jenkinsiana

- At present, the produce has a small market which can possibly expand in terms of its demand. However, large market expansion is impossible as the leaves must to compete with modern house building materials. Thus, it can provide an alternative to shifting cultivation only to a limited extent. Intervention in terms of value addition and market expansion is desirable.

Thysanolaena maxima

- Thysanolaena maxima, on the other hand, has a high benefit-cost ratio and very good market, processing and value addition facilities have also come up in nearby low land trading centers. As a result, Thysanolaena maxima cultivation is expanding rapidly. Even without any external intervention, the farmers are getting good returns. In villages where the farmers have taken up the cultivation of this crop, within ten to fifteen years it has almost completely occupied all the lands previously used for shifting cultivation.

Table 4. Comparative statement of expenditure and return (Rs per ha) from a six year old plantation of Aleurites spp, Livistona jenkinsiana and Thysanolaena maxima at 15% annual interest rate.

Particulars	Aleurites spp	Livistona jenkinsiana	Thysanolaena maxima
Total production cost (Rs)	25,258	25,551	15,657
Total revenue (Rs)	65,891	51,884	52,092
Net profit (Rs)	44,910	26,900	26,070
Profit per rupee spent (Re)	2.61	2.03	3.32
Pay back period (years)	1.5	2.8	2.6

Table 5. Net income of the three species over six years.

	YEAR 1st	2nd	3rd	4th	5th	6th	TOTAL
Aleurites spp.	-5350	-2520	-2520	5950	16100	33250	44910
Livistona Jenkinsiana	-2250	-2000	-2000	6850	10550	15750	26900
Thysanolaena maxima	-700	3800	8020	10800	3655	500	26070

These non-traditional crops have helped the subsistence farmers improve their livelihood. The replication of these success stories elsewhere is possible. However, it needs be promoted after careful study of forward linkages as except Aleurites, the produce are bulk and perishable products.Table 5 indicates that Thysanolaena maxima had low starting cost and quick returns (on the second year). The other two species have high cost on the first three years. In particular, Aluerites can give the highest income over six years.

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Prepared by
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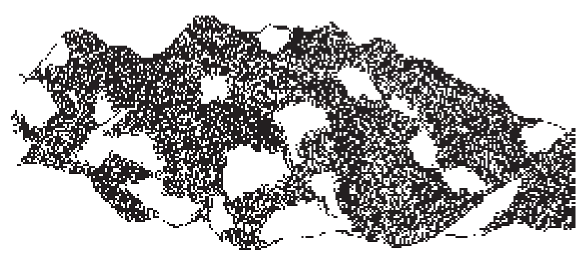
Resource book produced through a participatory writeshop organized by IFAD, IDRC, CIIFAD, ICRAF and IIRR.

Ecological and Socio-economic Impacts of Modified Shifting Cultivation in Northeast India

Traditional shifting cultivation is an agricultural system characterized by a rotation of fields, rather than crops, by a short period of cropping alternating with long fallow periods, and by clearing by means of slash and burn. It is an age-old land use system practiced by over 300-500 million people in the tropical regions of the world.

On the average, the cropping period ranged from one to three years, and the fallow period from 15 to 20 years.

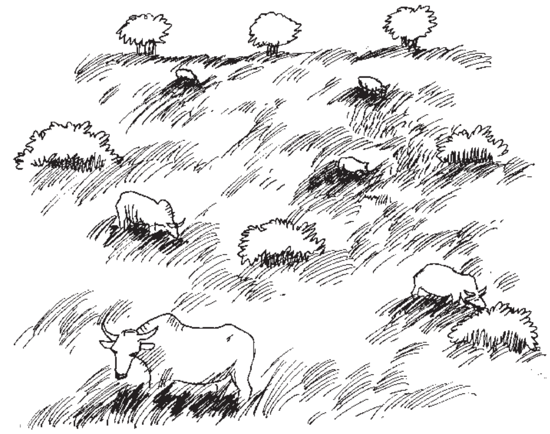
This period is long enough to rejuvenate the soil and restore its fertility. Thus, this type of shifting cultivation continued to be a sustainable farming system. This was the practice of the hill farmers of humid tropics for a thousand years now.
However, due to increased population, the fallow period in most areas in northeast India has been remarkably reduced to more or less three to five years. This modified shifting cultivation allots inadequate time for soil regeneration and vegetation development. In effect,



Shifting cultivation (THEN)

Shifting cultivation (NOW)

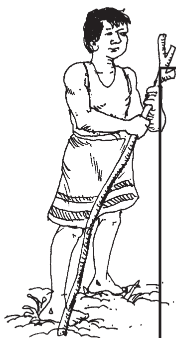
it degrades and depletes the soil, water and genetic resources and has siginificant ecological and socio-economic implications.



Ecological considerations

Animal grazing in fallow lands

A fallow land that is abandoned for a long period or managed properly can regenerate and regain its fertility status. However, in many areas, these fallow lands are subjected to intense grazing by domesticated cattle and goats. The grazers hamper the growth of vegetation and reduce water percolation due to soil compaction, thus, increasing runoff that accelerates soil erosion.



Proper Management of Fallow Lands

- Protect from fire by cutting fire lines
- Protect from intense grazing
- Maintain fresh sprouts of biennial and perenial food crops
- Sustain collection of wild, leafy vegetables, tubers, herbs, bamboo shoots, mushrooms, etc.
- Limit the collection of dry wood and sticks for firewood.
- Collect bamboo and thatch grass for construction of dwellings.

To address this concern, a part of the community land may be converted into grasslands for community grazing. Certain species of grass, or grass and legume combination, can be planted to increase grass yield as well as nutritive forage. The distribution of grasslands interspersed with the cultivated fields in a mosaic fashion enables checking of soil erosion, as part of the sediment, and dislodged nutrients from cultivated fields are retained in the grasslands.

Fire in fallow lands

In some parts of northeast India where livestock population is high, the fallow lands are invariably subjected to accidental or deliberate burning in the months of February and March. This is carried out to produce new shoots that are more palatable to the livestock and to get rid of unwanted vegetation. Frequent burning of vegetation evidently results to loss of vegetation, soil organic matters and most surface soil organisms. It also causes drastic change in the species composition of fallow lands. In extreme cases, such fallow lands continue to deteriorate and recovery of soil fertility needed for cultivation of agricultural crops would be difficult. Such lands are abandoned permanently and join the category of uncultivable wastelands, which particularly abound the Khasi hills of northeast India (see also Sustainable Agriculture Systems in the North Mountain Regions of VietNam, pages 191-195 for another example).

Crop diversity

Customarily, the hill people in India grew as many as 35 different plants in their shifting cultivation plots. With the shortening of fallow period and advent of sedentary cultivation, the number of crops is reduced (generally less than five). In some places, a monoculture system replaces the mixed culture.

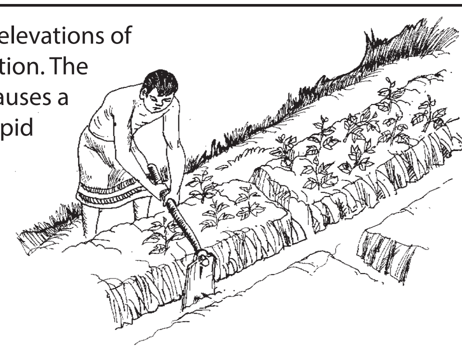
Ecologically, the traditional mixed crop cultivation represents, structurally and functionally, a more complex ecosystem than do the single or few crop systems. Also, for hill slope agriculture, the traditional system has greater ecological stability than the monoculture of grains.

Plants that can be grown in crop fields:

- Grains: rice, maize and millet
- Vegetables and fruit crops: pumpkin, watermelon, mustard brassicas, brinjal, lady's finger, gourds, cucumbers, beans, chillis, squash, Cucumis, Momordica and banana
- Tuber crops: cassava, yam, taro, sweetpotato
- Economic Plants and spices: cotton, cardamom, ginger, Hibiscus, pepper
- Others: Sesamum, cotton, castor

Multistoried crop canopy with perennial crops:
Top Layer: cassava, banana and castor
Middle Layer: cereals
Bottom Layer: cucurbits and legumes

A number of shifting cultivators at high elevations of Meghalaya have adopted potato cultivation. The preparation of ridges along hill slopes causes a large-scale loss of topsoil, resulting to rapid depletion of soil fertility. The produce has a ready market and fetches good income. Some industrious farmers take two crops of potato every year. While others go for a rotation of potatoes and cauliflowers.



Socio-economic considerations

Impact of cash crops

Shifting cultivation does not provide enough income to support the family of a shifting cultivator. To remedy this, farmers have opted to plant cash crops. True enough, this shift to cash crops significantly improved the livelihood of the cultivators. Although some cash crops are more ecologically sustainable as they provide soil cover that reduces erosion losses, nevertheless, the introduction of cash crops in shifting cultivation areas tends to redirect resources from social sectors to mercantile sectors, and from domestic to export needs. As a result, it exposes the shifting cultivators to the vagaries of market forces.

Field observations suggest that the shift from food crops to cash crops, particularly in the case of

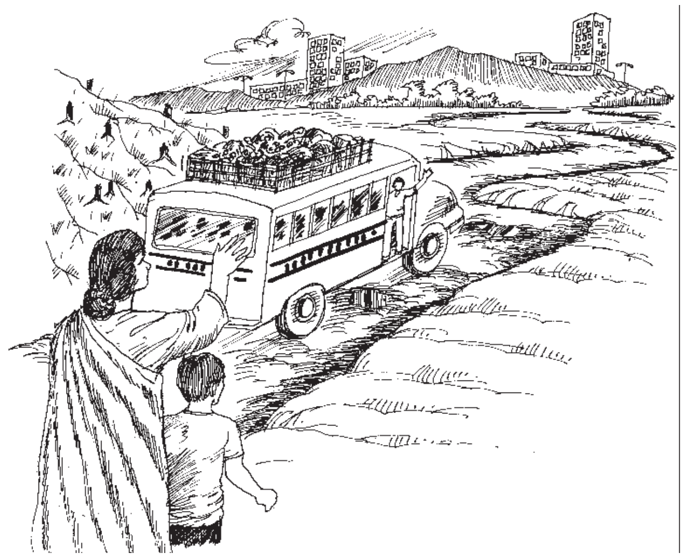
Cash crops grown include:
pineapple, cashewnut, banana, betel nut, tea, coffee, rubber, bamboo, ginger, cardamom and potato.

small holders, adversely affects the food security and the health of women and children living in the rural areas. Cash crops also depend heavily on storage facilities and transport network, which are poorly developed in this region, so growers cannot warrant a commensurate price for their produce. In addition, small farmers quite often get entrapped in the clutches of moneylenders and businessmen. By and large, comparatively well-to-do farmers have adopted the cash crops and the poorer ones have not benefited much.

Development of road networks, rural credit and marketing facilities is desirable for making the cash crops as alternative livelihood for the resource-constrained shifting cultivators of the interiors of northeast India.

Migration to urban centers

Repeated cultivation of land under the modified shifting cultivation degrades the land. This land degradation causes low productivity which consequently reduces the farmers' income. Severe soil erosion causes a total collapse of agriculture, hence, the migration of people to urban areas to seek employment. In such case, the fields are left to the care of the elderly and young children. As a result, rural societies become more and more dependent on cash remittances from urban employment.



Diet and nutrition

The modified shifting cultivation likewise affects the diet and nutrition of rural poor. Traditionally, the shifting cultivators of this region obtain meat by hunting and trapping), fruits (generally obtained from naturally growing plants), rice, leafy vegetables and tuberous crops comprise the traditional food of shifting cultivators of the region. All these foodstuffs taken together provide a fairly well balanced diet to rural populations.

Recently, however, meat, leafy vegetables and wild fruits have become scarce due to the shortening of fallow period and large-scale deforestation. Furthermore, the advent of market-based economy causes these items to be sold at high prices due to the great demand in urban areas. This lures the rural poor to sell whatever produce they have and the money will be used to purchase consumer items. The purchase of consumer items then becomes the priority over the provision of nutritional food for the family.

Most shifting cultivators of the region are quite acquainted with the skill of livestock rearing. However, this has remained to be a household activity and, therefore, less productive and least remunerative. Promotion of these activities are required for supplementing their diet, as well as creating avenues for earning extra income.

The modified shifting cultivation practice, clearly, brings along with it ecological and socio-economic considerations that should be properly addressed. Any strategy to be employed must be supplemented with modern input of conservation techniques. Although this should be done with caution so that the new system causes minimum changes in the customs and traditions of the local people.

Traditional shifting cultivation, with long fallow period and large interstitial lands covered by forests, is probably the best land use option for the hill slope agriculture in humid tropics in general, and northeastern India in particular. Wherever possible, such as in places where population pressure is low, the traditional shifting cultivation should continue or may even be promoted with suitable modifications by way of providing technological and managerial inputs. The modified shifting cultivation, with reduced fallow period and low crop diversity, is, however, not sustainable and therefore needs to be discouraged or further modified. The total population dependent on shifting cultivation need to be reduced by way of providing alternative livelihood, so as to keep more and more areas under pasture and tree cover. In so doing, the land will be more productive and sustainable.

Possible remedies and management practices to offset improper shifting cultivation practices:

- Popularization and continued operation of traditional mixed cultivation of multiple canopy crops at higher densities and leaving crop residues on the fields as protective mulch for the following crop cycle. In this way, the cropping period can be extended.
- Raising of pastures for community grazing.
- Development of biomass (viz., bamboo, cane etc.) based handicraft and village industry for employment generation.
- Afforestation of hill slopes with fodder, fuel and fruit trees near human habitations to check destruction of forests around shifting cultivation lands.
- Timber tree plantation on wastelands and uplands.
- Educating people about the benefits of conservation and evolving a mass conservation movement.
- Providing better facilities for family welfare and child care in order to check population growth.
- Creating awareness and providing better education for making the shifting cultivators less dependent on land-based activity and expose them to avenues and opportunities available elsewhere.

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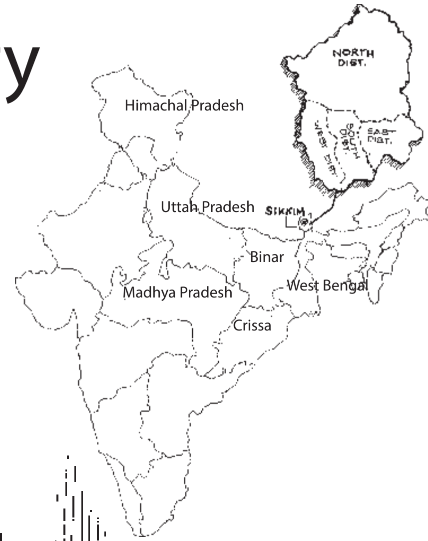
Gender and Agrobiodiversity Management among the Lepchas in Sikkim, India

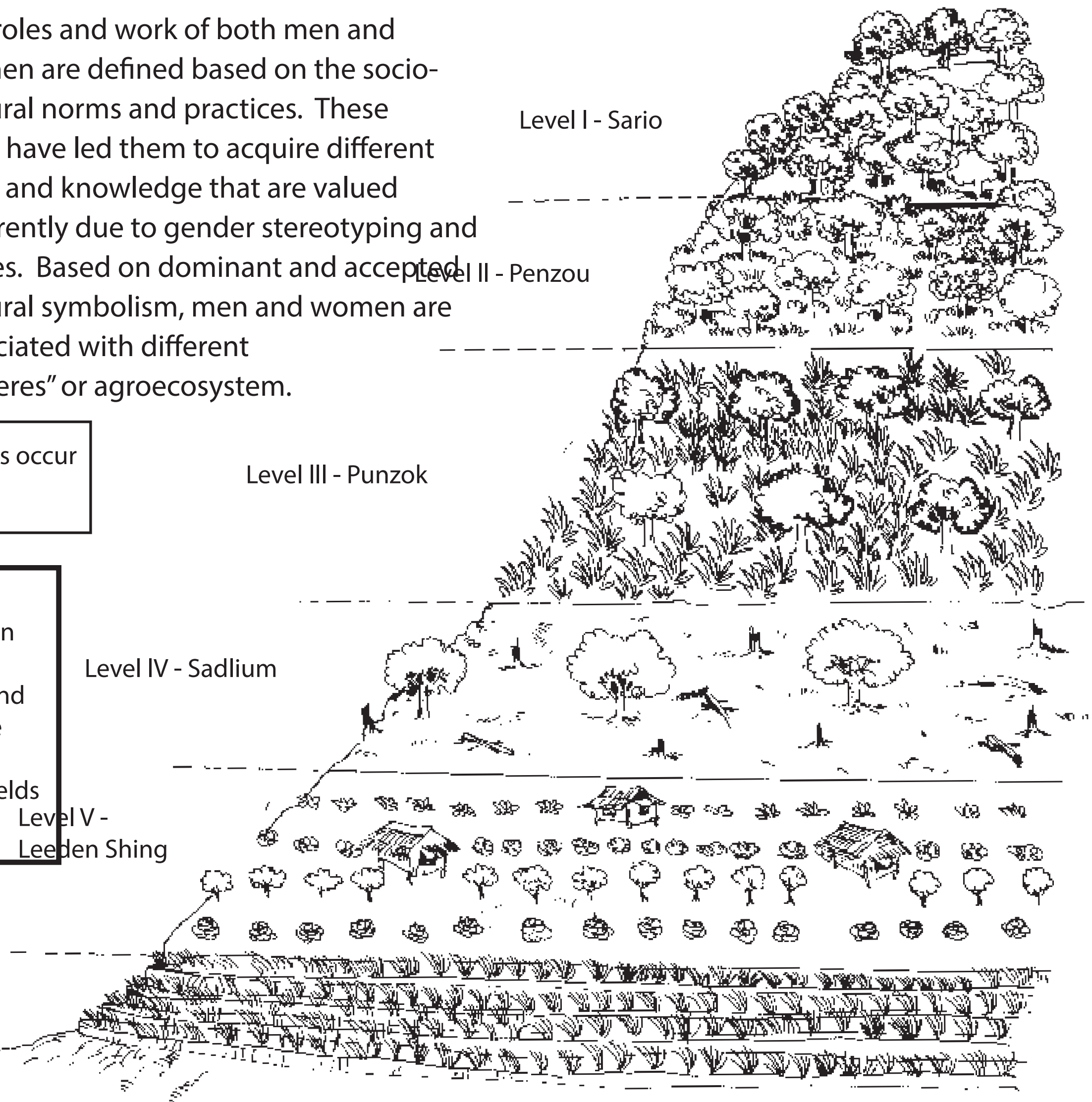


Sikkim is a small state of the Indian Union, situated in the inner mountain ranges of the eastern Himalayas. Agriculture is the mainstay of the state and 80% of the people are dependent on it. The climate and the seasons are conducive for growing a large number of high value cash crops like cardamom, ginger, potato and other horticultural crops. In general, the areas in lower elevation grow rice, wheat and oranges whereas the higher areas grow maize, potatoes and ginger.

Two types of agriculture are practiced in Sikkim: permanent terrace agriculture and shifting agriculture (slash-and-burn). The former method is widely practiced while the latter is practiced only in the secondary forest areas and steep lands in parts of North and West Sikkim. The farmers have a large diversity of crop species and varieties. They maintain this diversity because of their heavy dependence on agriculture.

This paper addresses the issues of the spheres, roles/work, knowledge, and the value of work and knowledge of men and women in the management of the agrobiodiversity (See also Importance of Gender Analysis in Shifting Cultivation, pages 61-64).

The roles and work of both men and women are defined based on the socio-cultural norms and practices. These roles have led them to acquire different skills and knowledge that are valued differently due to gender stereotyping and biases. Based on dominant and accepted cultural symbolism, men and women are associated with different "spheres" or agroecosystem.



Classification of Land (idealized)

Gender division of spheres and roles in the different levels of agrobiodiversity

Agrobiodiversity occurs at three levels: agroecosystem level, species level and the genetic level. At all three levels, some type and degree of gender division of spheres, roles and knowledge is formed.

Agroecosystem level

Based on gender stereotyping, the different agroecosystems are divided into "men's sphere" and "women's sphere". Punzok is solely "men's sphere" as men are directly involved in the cultivation of cardamom, which is a cash crop. Men do all the work -- planting, weeding, harvesting, postharvesting, selling and selecting new shoots for replanting. Women are rarely involved and only serve as helpers when there is a shortage of male workers. Two reasons are associated with these role assignments.

First, as heads of the family and providers, men have the right to control the major resources, and cardamom being a cash crop, automatically falls under "men's sphere". Secondly, men have traditionally been closely related to working in the forests due to their hunting work. Hence, it was a natural transition for men to be directly involved in this area, as cardamom is cultivated in the forests.

Sadlium, on the other hand, is women's sphere mainly because they have been involved in cultivating this area since time immemorial when swidden was the only form of agriculture. However, now men are involved more in this area -- they not only cut and lop trees and big branches but also share the work of burning, hoeing and harvesting along with women.

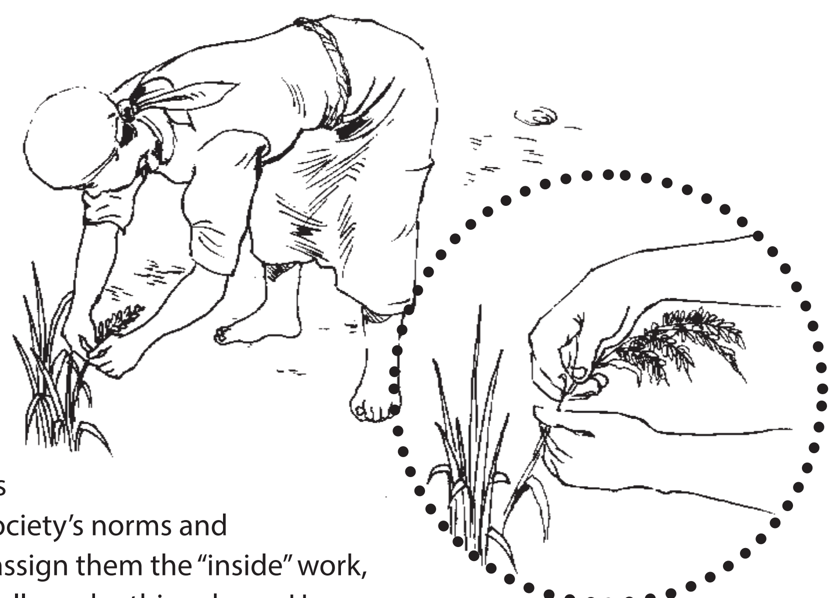
- Gender stereotyping is a result of socio-cultural norms and values.
- Due to this gender stereotyping:
  - Work and knowledge of men and women have different values
  - Men and women have defined spheres in terms of agroecosystems and crop species

Leeden Shing or home gardens are regarded as "women' sphere". Women do all the work with men acting as helpers in times of emergency or when they wish.

Ari/Yong is associated more with men despite the fact that women contribute the same amount of work or at times do more work than men. The main reason for this being men's sphere is because major crops, which are also considered "men's sphere" are grown here.

Species level

Based on gender stereotyping, men and women are closely associated with different types of crops. Among the Lepchas, men are associated more with the production of major crops and cash crop (cardamom), while women are related to minor crops and vegetables. In terms of preference, men prefer cash crop whereas women have equal preference to both cash crop and rice, which is the staple food of the family.



Genetic level

Women do the actual seed selection of all major and minor crops excluding cardamom, which is principally produced for cash. This division of labor is legitimized in the culture as women are regarded as symbols of fertility and as caretakers and managers of genetic resources. In addition, the society's norms and customs curtail women's mobility and assign them the "inside" work, and the work of genetic management falls under this sphere. However, when there is a shortage of women, men do this work but it is done under the guidance of a knowledgeable woman. Nevertheless, although women do the actual seed selection,

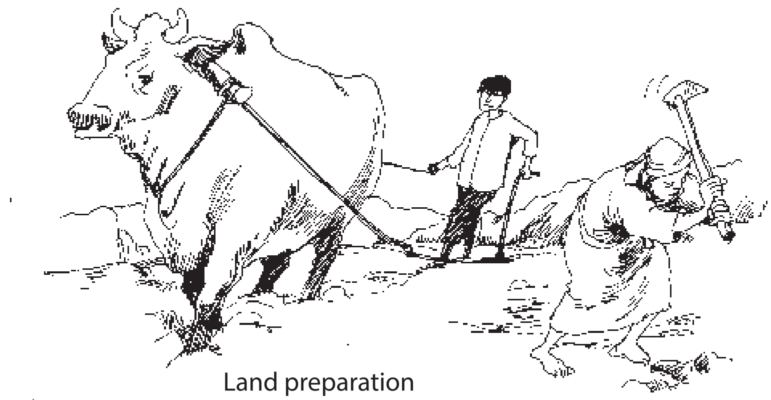
Land preparation:

In swidden fields

- Cutting and lopping - 100% Male
- Clearing undergrowth - 100% Female
- Burning - 50% Male & 50% Female

In terraced fields

- Plowing - 100% Male
- Digging and hoeing - 50% Male & 50% Female



Land preparation
(see top-left box)

Making and laying bamboo pipes- 75% male

Sowing - 100% female

Transplanting - 80% female

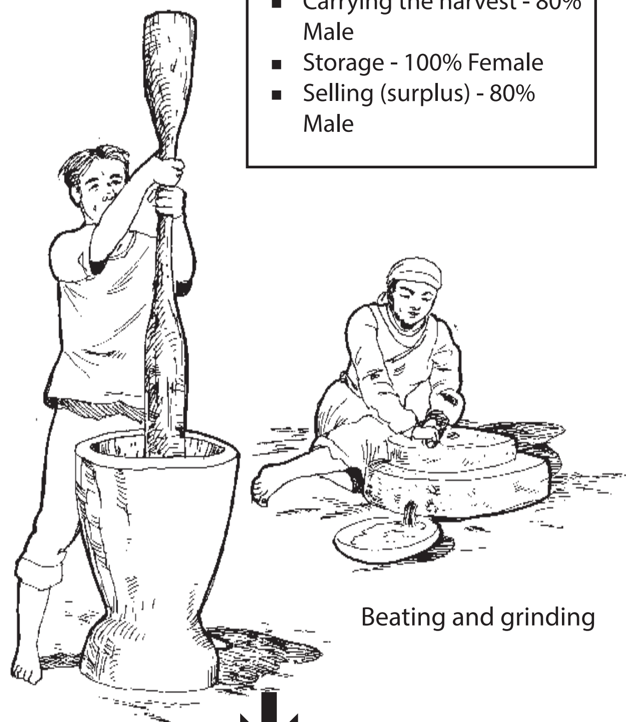
Weeding - 85% female

Harvesting - 50% male and 50% female

Post-harvest work:

- Threshing, husking and winnowing - 80% Female
- Beating and grinding - 75% Female
- Carrying the harvest - 80% Male
- Storage - 100% Female
- Selling (surplus) - 80% Male

Threshing, husking and winnowing - 80% female



Beating and grinding

Transporting the harvest - 80% male

Storage - 100% female

Selling of surplus - 80% male

	Sphere	Work	Knowledge
Agroecosystems			
■ Punzok	M	M	M
■ Sadlium	F	F+m	F+m
■ Ari/Yong	M	F+m	F+m
■ Leeden Shing	F	F	F
Species level			
■ Cash crop	M	M	M
■ Major crops	M	F+m	F+m
■ Minor crops	F	F	F
Genetic Level			
■ Cash crop	M	M	M
■ Major crops	M	F	F
■ Minor crops	F	F	F

Note: M - means work is solely performed by male
F - means work is solely performed by female
m - means lesser work performed by male
f - means lesser work performed by female

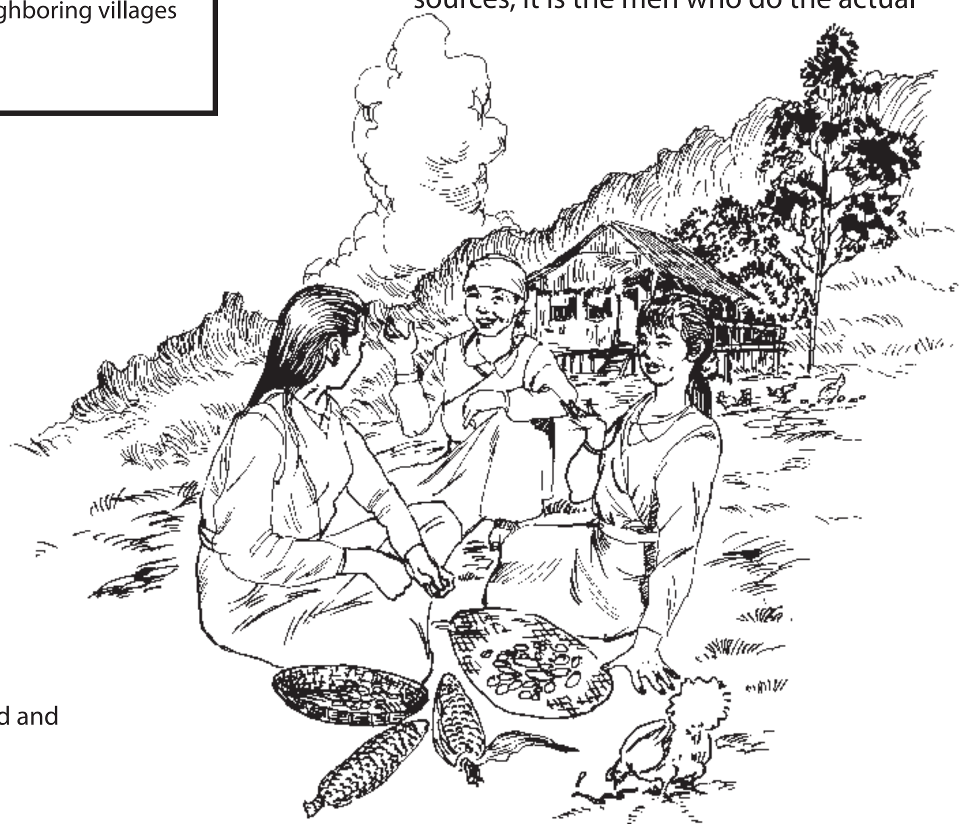
Even though farmers rely on their own seeds they are also involved in a seed exchange network. Four sources of seed were identified:

- neighbors from their own village
- relatives and friends from neighboring villages
- the market
- government sources

men's preference is also taken into consideration, which is evident in the varieties cultivated in the fields.

Seed exchange networks

Seed exchange within the village is preferred by the farmers in order to retain the quality of their seeds. Within village exchange is an important means by which seed is retained within communities. Women exchange views and information regarding seeds exchanged at this level. This information covers how seed is selected and what varieties and seed quality others have. In this way, they serve as seed conservers in the sense that they know who has what seeds and whether that seed is good. Due to this role, when it comes to exchanging seeds within the village, either the women do it themselves or the men do it under the guidance of women. However, in the case of seed exchange or purchase from outside sources, it is the men who do the actual



Women exchanging seed and information.

exchanging or buying because their role as providers responsible for "outside work" give them wider mobility. Women hardly have any control over these external seed sources.

As holders of this valuable knowledge, not only is the family and community dependent on women for their livelihood, but the conservation of agrobiodiversity too is dependent on them. However, neither the men nor the women give much importance to this invaluable role of women. Although it is accepted that only women have this knowledge, it is not considered as important as men's work. Women too undervalue their own knowledge and work and label it as 'work to be done while sitting around'.

A Case Report

Although the women primarily do seed selection and exchange, this particular case in one of the villages in Sikkim is an exception. A handicapped man, he could not do the usual heavy work of carrying harvesting, and plowing done by a man. He did the selection and exchange of seeds. He had acquired this knowledge from his mother. His role as a man gave him wider mobility whereby he could go out and get new varieties and more information. Besides, being a man, he was free from household chores, thus giving him the time to experiment in the agricultural fields with the new varieties. As a result, he had introduced new varieties of maize, rice and some vegetables in the village. This had acquired him the position of a seed expert, thus giving him prestige.

Although they realize that this knowledge and work are important, gender roles are such that women's work is automatically regarded of lesser importance and value.

This case shows how cultural and social customs and norms create biases against women in the society. It also raises a vital question: Does a change in roles affect the gender relations and the position of the person concerned?

Prepared by
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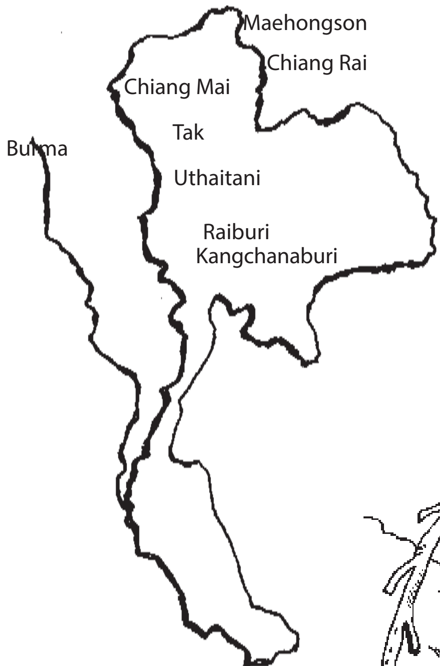
Resource book produced through a participatory writeshop organized by IFAD, IDRC, CIIFAD, ICRAF and IIRR.

The Traditional Rotational Farming System of the Karen People in Thailand



The Karen people (P'ga k'nyau) are perhaps one of the better-known indigenous groups in the Southeast Asian region particularly in Burma and Thailand. Recent unofficial estimates put the Karen population in Southeast Asia at around 3,000,000, of whom 402,095, live in Thailand.

The present day situation of the Karen people in Thailand is one in which they occupy a socially, economically and politically disadvantaged position within the Thai society. The impact of outside cultures and influences has resulted in the Karen people's lifestyles undergoing many changes, some to their benefit, while some have led to a worsening situation. A majority of the Karen people live in the forested areas. This has led to conflicts with the Thai authorities over natural resources, environmental management, land ownership, and citizenship. An atmosphere of uncertainty and insecurity resulted, not only for the Karen people, but also for the entire indigenous and tribal population in Thailand.

There are four types of shifting cultivation practices observed in Thailand: (a) short cultivation and short fallow system used by the lowland Thais; (b) long cultivation and very long fallow or abandonment system practiced by previous opium producers migrants from China (c) permanent field tree crops system done by both the lowland Thais and some tribal groups; and (d) the short cultivation and long fallow system (rotational farming system) observed by the Karen and Lua peoples.

The Karen people's life today revolves around the practices of gathering and hunting, rotational slash and burning agriculture, rice terracing, livestock raising, improve kitchen gardening and horticultural gardening.

Rotational farming activities

New cropping season

Hti hpai (February)
- Community gather to join in the Nesau-hko (New Year) celebration and mutually assist in preparing the new cultivation cycle.
- Preferred month for weddings.
- Plants harvested include: Nwai, Nwaihse, cassava, luffa, yam, pumpkin

Land preparation

Hti hkoo (March)
- Time designated to slash the undergrowth in the fields.
- Branches of trees in the fields are lopped to a high level.
- The stumps are left in the field to allow them to regenerate.
- Plants harvested include: Nwai, Nwaihse, cassava, luffa, yam, pumpkin

La-se (April)
- The "burning period"
- The community members come together to build fire-breaks around the settlement and cultivation areas.
- The building of fire-breaks involves the strict observance of taboos to ensure that fire-breaks are of the best quality in safe-

guarding the community. This method of burning controls the spread of fire

- The women prepare seeds for planting early in the morning. Planting starts after the burning period.
- A fence is built around the field for protection.
- A small hut is built at the center of the field for storage purposes.
- Plants harvested include: Nwai, Nwaihse, cassava, luffa, yam, pumpkin

Planting

Dei nya (May)

- Time for planting rice.
- The entire community assists in one field at a time while the owner of the field prepares meals for them.
- Time for celebration and courting for the young people.
- Plants harvested include: small cabbage and bamboo shoots luhkeidou

Weeding

La-nwi (June)

- Time for weeding done mainly by the women (continued until before harvesting).
- Plants harvested include: pumpkin, taro, tomato, chili, eggplant, cucumber

Mid-season ceremony

La-qau (July)

- Bgau qu (upland rice ceremonies), are conducted.
    - Luta (sacrificial ceremony to the spirits) is done to ask the spirits of the field for good produce and good health for the community.
    - T'mau (sacrifices to the Bumopga, mother of rice spirit) is done for good, disease-free and plentiful seeds and products.
    - Lu mei (sacrificial ceremony to the spirit of fire) is performed to apologize to the ecosystem for the need to burn the fields.
    - Hka kai ta involves protection symbols (i.e. guns, swords, spears and slings) placed at the entrance of the cultivation fields. This is to protect the field and its crops.
- Plants harvested include: peibo, sihpodei, hau-wau, corn, cabbage, cucumber

Lahkoo (August)

- Every family makes rice beer. Family members tie their wrists with white thread to receive blessings (Lahkoo ceremony).
- Homage and thanksgiving is paid to the Supreme Being.
- Plants harvested include: cucumber, corn, pumpkins, chilis, beans, lady's finger, vegetable herbs, etc.

Pre-harvest ceremony

Hsimu (September)

- Preparations for harvest are done:
    - Religious strings are tied on the wrists.
    - Hands of children are washed with chicken blood. They are the first to start the harvest.
- The community partakes of seasoned hswai (sticky rice).
- Plants harvested include: hku, luhkeidau, hsai.

Harvesting

Hsihsa (October)

- Harvest time.
- Young people blow horns to call the people in the community to harvest.
- Harvesting is done by couples (men cut the rice while the women tie it in bundles).
- Plants harvested include big cucumbers.

Threshing and drying

Lanau (November)

- Time for threshing.
- Sesame seeds are collected from the fields.
- Plants harvested include: sesame seeds, diff. kinds of beans, cucumber, pumpkin, hau wau.

End of cropping season

La plu (December)

- Community members harvest rice and make rice whisky.
- Rice whisky is shared with neighbors as evidence that the year's harvest is completed.
- Funeral ceremony is done for the people who died during the working season.
- Plants harvested include: Nwai, Nwai hse, Hkiu, S'beihkli.

T'lei (January)

- Houses are built.
- Women weave and dye cloths.
- Instruments for cultivation are prepared.
- Plants harvested include: Nwai, Nwaihse, cassava, luffa, yam, pumpkin

It is apparent that the Karen people's agricultural system is based on a philosophy of harmonious co-existence between humans and forests. This is exemplified in the Karen proverb Au ti kertaw ti, au kaw kertaw kaw (Live with the water, care for the river - Live with the trees, care for the forest). This rule has been followed by the Karen people for centuries, and forms the underlying direction of relationships between humans and nature. It has enabled the Karen people to practice the rotational farming system for generations as a sustainable and ecologically sound cultivation method.

Main features

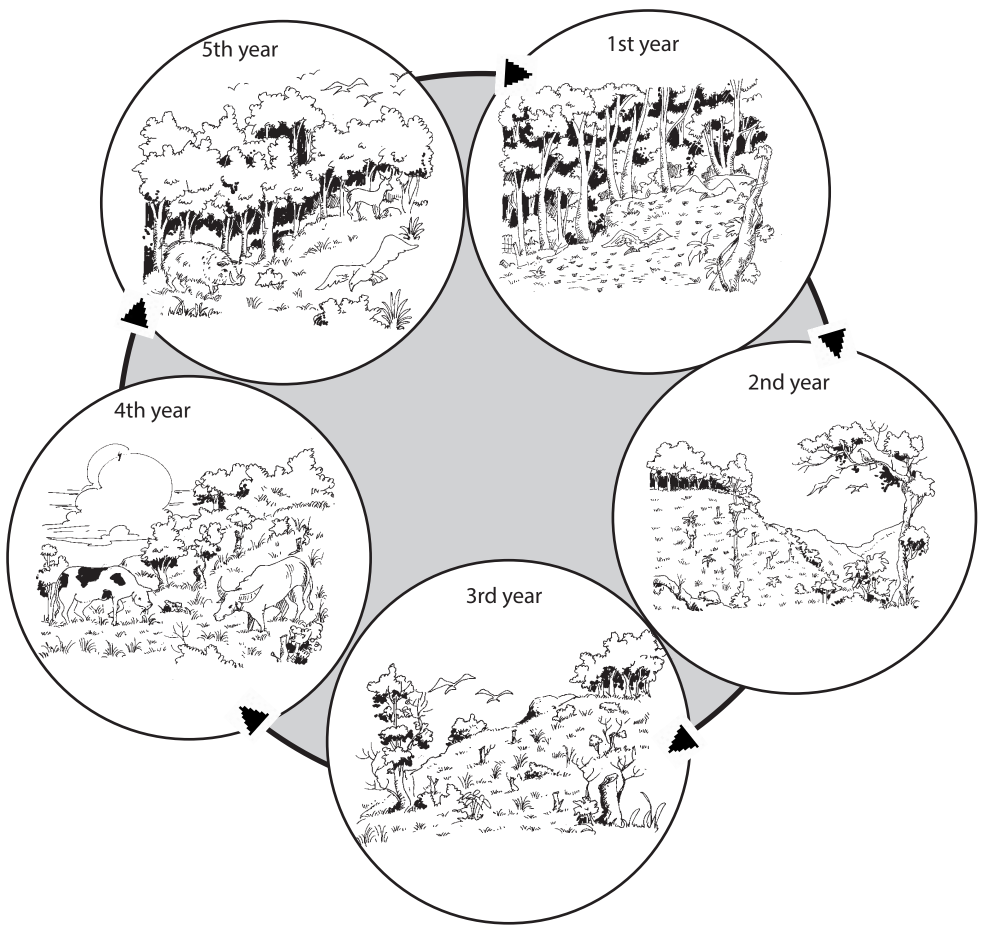
- The Karen people have a holistic view of the rotational farming system. It is not only a means of production for them, but an immense social and cultural importance in their lifestyles, as well. Ceremonies are an integral part of each step in the cultivation cycle. It is apparent from these ceremonies that the Karen people hold much respect for the land and forests they use.

- The ceremonies performed in the rotational farming cycle have developed a community spiritual life based on the use and care of nature. This cultivation system is of extensive importance in the spiritual life of the community members.

- Traditional taboo beliefs, besides having moral values, have important practical reasons. They are underlying concepts for the use and management of nature in a sustainable and renewable manner. The main concept underlying the rotational farming of the Karen people is of biodiversity management-based conservation. The role of humans in relation with nature should be one of respect and protection.

- The rotational farming processes create cultural events in the community, such as the times when people come together to join in farming activities or in related ceremonies as an entire community. These gatherings become a cultural space of informal relationships that create social cohesion amongst the community members.

- The fallow period of the rotational farming fields is also an active time. By tradition, it usually lasts for 7-10 years. While the forest is regenerating and the soil is replenishing, the wildlife is able to make the fields their habitats; the community's livestock is able to graze in the fallow fields; wild plants grow; and seeds are collected for a multitude of uses.



Advantages

1st to 4th year
- firewood collection
- source of food for humans and animals

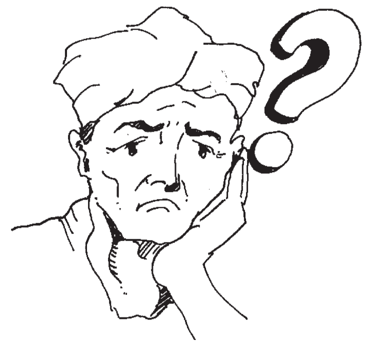
3rd to 4th year
- collection of medicinal plants
- food source for cattle, buffalo, rabbits, barking deer

5th to 6th year
- serves as hiding and resting place for wild animals
- start of soil regeneration

7th year
- land ready for planting

Fallow system cycle

- The lands for rotational farming are a common property for the community. On the other hand, the terrace paddies are considered private property.



Challenges and issues

- The experience of indigenous and tribal peoples, especially in Thailand, is one of long-term domination of the idea that rai lu'an loy (shifting cultivation) destroys the forests. Thus, there is a negative stereotype of rotational farming held by the general public and the government.

- The Forest Enclosure Policy of the Thai Government has forced the Karen people to work on smaller cultivation plots. It is believed that this method will conserve the forest. However, this policy has caused the Karen people to engage in unsustainable practices by shortening their fallow period in order to produce enough food on a smaller amount of land.

- Outsiders view that fallow areas, in the process of regeneration, must not be touched again. This is based on western concepts of forest management. However, it is not understood that the Karen people's system of land and forest management is effective and that it really helps the soil to rejuvenate for long term continued use.

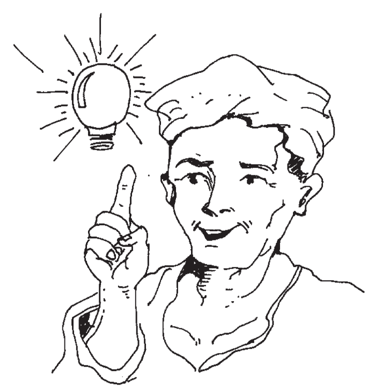
- The Karen people today in Thailand are forced to practice unsustainable and ecologically damaging practices in order to survive because of the restrictions imposed on shifting cultivation. These practices violate the traditions, values and ethics of the Karen people. However, in their marginal position in the Thai society, they are left with no choices.

Reaction to the stopping of rotational farming

It is believed that there is a need for more discussion with the people concerned about the current crisis situation. This will enable the authorities to recognize the positive aspects of rotational farming.

Proposed solutions

- The government, together with international agencies should recognize rotational farming, as practised by the Karen people, as a sustainable cultivation.
- There should be coordination among people concerned to know each other's ideas and situations.
- The community forest law needs to include rotational farming system as a legal practice.
- Empower the people to make their own decision with regards to their lands and natural resources.



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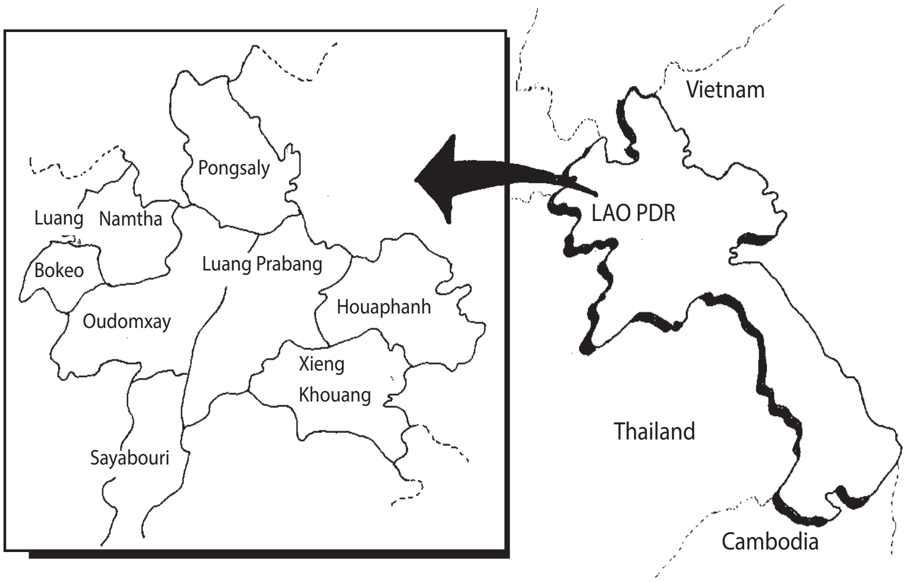
Ethnic Groups and Land Use in Northern Lao PDR



Lao PDR has more than 60 ethnic groups. Based on ethnicity, linguistics, and geographical characteristics, the ethnic groups are divided into three broad categories: Lao Loum (Lao of the lowlands), Lao Theung (Lao of the mountain slopes), and Lao Sung (Lao of the mountain summits). This classification is widely used by government and non-government agencies and individuals at international, national and regional levels when describing the Lao ethnic groups. It also strongly reinforces the bias that the farmers of the "slope" and the "mountain summit" dwellers are responsible for the destruction of the forests.

In reality, all ethnic groups, at one time, had been engaged in slash-and-burn agriculture. Some ethnic groups may have been traditional slash-and-burn farmers, while others may have been pushed from the lowlands into the hills because of increasing population. More recent immigrants, largely members of the Lao Sung category, simply did not have any choice but to settle in the more remote, hilly areas.

Customarily, all the blame for environmental problems in the hills and their downstream effects is linked to the hill population, or segments of it. Hill farmers are often at a serious disadvantage when compared with populations of farmers living in adjacent lowland areas. Furthermore, populations in remote hill areas frequently belong to ethnic minorities, and the problems associated with cultural differences further magnify the socioeconomic constraints related to geography.

The rice-fallow system is the common land use system by the Lao farmers in the upland (See also Sustainable Upland Rice-based Agriculture in Lao PDR: Production Constraints, pages 133-136). On the average, Lao Loum, Lao Theung and Lao Sung families of Nan district, Luang Prabang province cultivate 0.32, 0.14 and 0.10 hectare of lowland rice, respectively. For upland rice, their average hectarage is 0.77 ha (Lao Loum), 0.67 ha (Lao Theung) and 0.65 ha (Lao Sung).

- Several authors who described the swidden system of Lao Sung or Hmong as ecologically harmful and the system of the Lao Theung as ecologically sound admitted that:
  - ✓ They did not see differences in land use among the ethnic categories in the field
  - ✓ There was insufficient information available on the upland systems in Laos
- The generalized description of land use systems for the different ethnic groups initially based on references from Thailand is not consistent with the actual situation in Northern Laos.

The biases

There is a strong bias towards labeling the Hmong or Lao Sung system of agriculture as a distinctly harmful land use system. In contrast, the agricultural system of the Lao Theung is widely accepted to be ecologically sound.

Based on the relationship between cultivation and fallow periods, a classification describing the systems used in Northern Thailand was developed by Kunstadter and Chapman in 1978. The categories were: (a) short cultivation-short fallow, exemplified by the Northern Thai; (b) short cultivation – long fallow exemplified by the Karen; and
(c) long cultivation-very long fallow exemplified by the Hmong.

While a caution was raised against associating land use with ethnic categories, many observers of the Lao upland agriculture system have apparently mistaken the "Kunstadter and Chapman classification" as a classification of Lao Loum, Lao Theung, and Lao Sung agriculture. Repeated citing of the reference without follow-up in the field resulted in the widespread acceptance of a preconceived but largely unrealistic association of land use with ethnic categories.

Recent surveys conducted in the Luang Prabang Province and other selected areas in Northern Laos revealed the prevailing land use practices among the ethnic groups. The results also showed indications that tend to discredit some of these biases.

Dependence on shifting cultivation and traditional land use

- In the early 1960s, some groups of Lao Theung used shifting cultivation only. However, increased population pressure may have caused them to change their practices.
- Survey data from four districts of the Luang Prabang province do not support the generalizations that (1) Lao Loum use slash and burn only as a supplementary form of production and (2) that other ethnic groups practice upland agriculture exclusively.

Choice of altitude, slope and soil type

- The Hmong and Yao, both Lao Sung, settled in remote villages at higher elevation. However, many Hmong villages are also located at altitudes well below 1000 m. Likewise, there is no evidence that the Hmong cultivate steeper areas compared to the other groups.
- The Hmong, Yao (both Lao Sung) and Khammu (Lao Theung) do prefer limestone soils for their corn fields. The Hmong generally select rich limestone soils for poppy fields which are located on or just below the limestone outcroppings.

Land clearing practices

- No discernible differences existed among the ethnic groups in terms of land clearing practices.
- The proportion of farmers retaining trees in their fields at the time of slashing was 58%, 63% and 83% for Lao Lum, Lao Theung, and Lao Sung, respectively.
- The three ethnic groups practice similar wild fire prevention measures.

Cropping/Fallow cycles and system sustainability

- Some Lao Sung may use longer cropping periods for their upland rice fields but the length of fallow period was not influenced by ethnic categories.
- There is no major difference in land use practices observed among the different ethnic categories, thus, no difference in system sustainability would be expected. The sustainability of the existing land use system depends largely on whether the land carrying capacity has been exceeded.
- The faster decline of upland rice yield observed for Lao Loum and Lao Theung when compared to Lao Sung indicates a faster ecological deterioration of the production system for the two former categories.

Overall observations on land use practices

- Recent surveys do not support the association of certain positive or negative land use practices to specific ethnic categories. Variations in land use practices within the same ethnic category are generally larger than between ethnic groups.
- Land use practices used today are mainly a function of land capability, climate, population pressure and past political events. Further changes in land use by all ethnic groups will more likely be made based on economic incentives rather than ecological concern by the individual farmers. Thus, economic incentives need to be created which promote ecological sustainability.

Lessons learned

- For the development worker, be wary of bias and prejudices of any form. Maintain a healthy skepticism and keep an open mind. Test and seek evidence before making generalizations.
- Cultural practices are neither good nor bad. They may just be inappropriate if the context of the situation is considered.
- Consider the customs, culture and religious beliefs of the people in the preparation and implementation of projects.
- Get the farmers involved in the development process.
- It may be better to aim development efforts towards modifying the system rather than replacing it entirely.

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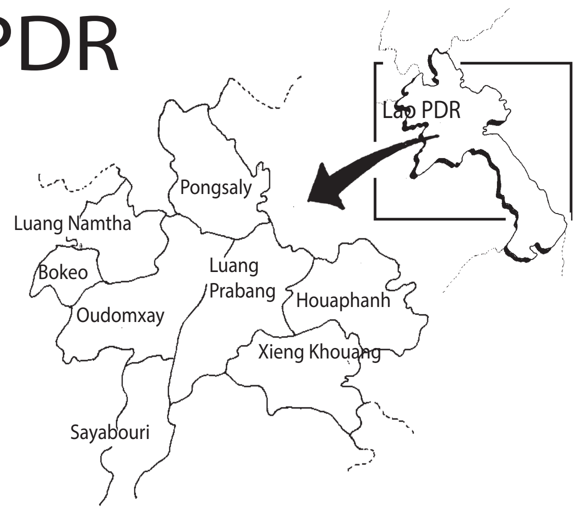
Crop-Animal Systems in the Hilly Regions of Lao PDR



Traditional Lao upland farming system integrates agriculture, animal husbandry and forestry. The production is largely for the consumption of the farmer's family. Only a few selected items ever reach the market. Wherever possible, plains and valleys are used for lowland rice production. Generally such fields are fertile because of the continuous addition of nutrients and topsoil lost from the surrounding slopes.

In the hilly area, farmers are highly dependent on upland agriculture. Rice is the major upland crop, followed by corn, vegetables and tuber crops. Slash and burn farming is the major agricultural production system used in upland environments.

Land use systems are dynamic. They change over time and are influenced by numerous factors such as: availability of land, type of land, population pressure, climate, availability of labor, need for cash, market facilities, past practices, food preferences, ethnic group government policies etc.

Livestock is by far the most important source of cash income for the hill farmers. The average cash income for the families surveyed was about US $150 per year. Of this, livestock accounts for 44%. Upland agriculture does not depend on animals for draft or manure and many families have only small animals such as pigs, chicken and ducks.

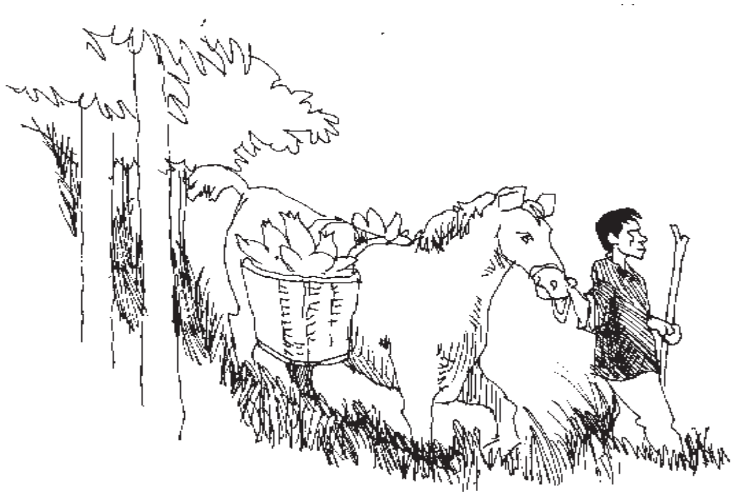
Generally, livestock is the best investment opportunity and the main source of emergency funds for most farmers. Cows, pigs and poultry are major sources of protein. In addition, animals are also used as sacrifices during rituals and feasts. The role of livestock and forage management in Lao PDR's shifting cultivation is further discussed under The Role of Livestock and Forage Management in Stabilizing Shifting Cultivation in Lao PDR, pages 244-247.

Table 1: Population and livestock figures for selected provinces of Northern Lao PDR

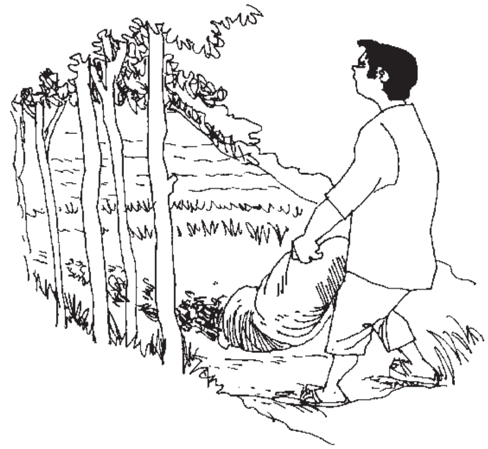
Province	Population (1000)	Buffalo (1000)	Cattle (1000)	Pigs (1000)	L/F[1] (no./hh)
Luang Prabang	355	58	28	149.7	1.6
Oudomxay	188	58	35	145.6	3.2
Houaphanh	232	52	26	139.6	2.5
Xieng Khouang	191	44	58	77.6	3.7
Luang Namtha	125	18	175	65	1.9
Pongsaly	149	29	2.0	57	1.2
Vientiane	321	98	99.1	122	4.3

[1]Number of buffalo and cattle combined per household

Source: State Statistical Center 1991

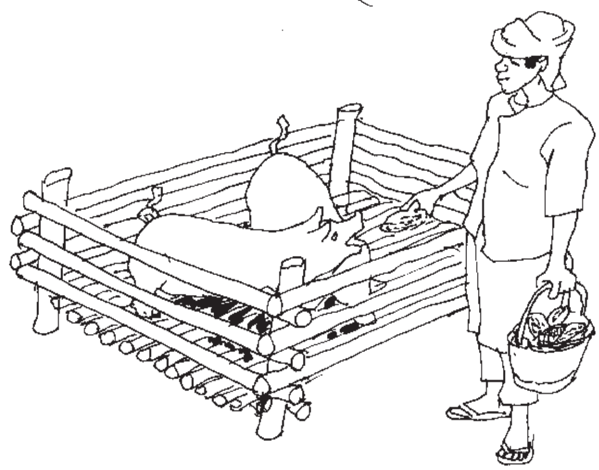


There is a strong disparity in average livestock numbers per household between provinces, with Luang Namtha, Luang Prabang and Pongsaly far below most other provinces (Table 1). If livestock is a true indicator of wealth then one would expect that the farmers in these provinces would be the poorest of the country.



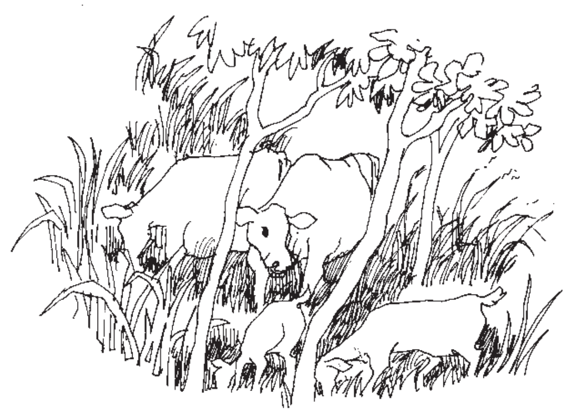
Crop-animal interaction

Livestock-crop interactions occur at various levels and to varying degrees of importance.



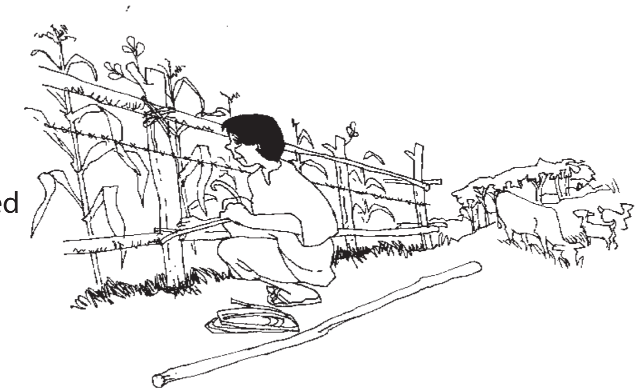
Draft power and transportation

Buffaloes are used as draft animals in lowland rice cultivation while cows are sometimes used by Lao Loum farmers for transportation of farm products. In the hill areas, horses are often used by the Lao Sung to bring down rice, corn and other harvests.



Manure

Manure is sometimes used for lowland rice nurseries and paddies, vegetable plots and selected trees. Eighty-six percent of the lowland farmers in three districts of Luang Prabang Province occasionally use manure in the rice fields. However, the average quantity used was less than one ton per hectare.



Feed crops

Corn and cassava are often planted specifically for the production of feed for pigs. The size of corn areas showed strong correlation with the number of pigs owned. The animals are often penned in simple structures near the farmer's house.

The LAO-IRRI Project

The overall objective of the research activities of the Lao-IRRI project is to improve the lives of small, resource-poor farmers who are largely dependent on slash-and-burn rice production.

The major thrust of the research is concentrated on the replacement of the fallow vegetation with multi-purpose plants of native or exotic origin, the introduction of rotation systems with fodder plants (ley systems), and the replacement of weeds in plantation crops (specially teak) with fodder plants.

Techniques generated or adapted should result in:

1. Weed suppression in rice systems and plantations through the grazing of animals
2. Accelerated nutrient cycling in rice systems through the grazing of animals
3. Increased availability of fodder to allow increased animal production
4. Rice production systems where field preparation is possible without the need for burning. This is essential if perennials (fruit trees, timbers etc.) are incorporated into the system. Plant residues if not burned would also contribute substantially to improved water and soil conservation.

Grazing on fallow land

Buffalo, cattle, and goat are generally allowed to roam freely in the forest and on wasteland or fallow land surrounding the villages. The upland fields are valuable grazing areas immediately after rice harvest. With the gradual succession of the fallow vegetation from annuals to perennials, fodder production from the fallow land declines.

Fencing requirement

Like in most Asian countries, ruminants are left to graze freely and the farmer has to protect his crop by putting up a fence. With the introduction of new crops and cropping systems, this approach has led to concerns such as limited common grazing land, bigger requirement for fencing materials, and social problems like conflicts between the planters and the owners of the grazing animals.

Upland rice systems and plantations

The highest potential for increased benefits from animal-crop interactions is expected in the upland ecosystem. By replacing fallow vegetation in rice-fallow rotation systems and plantations with fodder plants, fodder availability and livestock production would be increased tremendously. At the same time, the combined effect of the fodder species and the grazing animal may help to accelerate nutrient cycling and reduce weed problems.

The feed requirement of chicken and swine production provides incentives for the acceptance of rotation crops such as cowpea and pigeon pea. Draft animals contribute to the control of weeds in rice and other upland crops provided that suitable systems would be identified. Then, manure is an important input for fruit trees and other plantation crops.

The major limitation to increased production of crop-animal systems in the uplands is the topography. Many of the areas presently used in slash-and-burn agriculture are not suited for grazing.

The high labor requirement of upland rice production coupled with government intervention puts heavy pressure on the slash-and-burn farmers to change to other systems. If they are ready for change and find the system profitable for them, the farmers may shift to a more intensive land use system.

Achieving and maintaining a better living standard for the farming population remains the overall objective of future research activities. Some important points, however, have to be considered.

Chromolaena odorata

- Replacement of fallow vegetation with fodder crops could greatly increase livestock production and may help in reducing weed pressure and accelerate nutrient cycling

- Perennials should be the main focus in any development activity.

- Changing from slash-and-burn methods to systems using field preparations without burning is essential to allow the combination of annual crops with perennials and to conserve moisture.

- The traditional system used by farmers is a "non-tillage" system. Although tillage could help to minimize weeds and provide short-term fertility boosts, it should not be considered as an alternative because of its negative effect on soil conservation.

- Generally, a farmer may cultivate a field for 5-10 years and only plant perennials when the productivity has declined and conditions for tree growth are far from optimal. Any system (grass strip or alley cropping) that helps the farmer postpone the planting of perennials is potentially very harmful to his long-term interest.

- Chromolaena odorata is a good fallow plant because of its large seed production, fast establishment, suppression of grasses, high biomass production, and ease of elimination by hand weeding. In future studies involving improved fallow systems, this plant should be included as control treatment.

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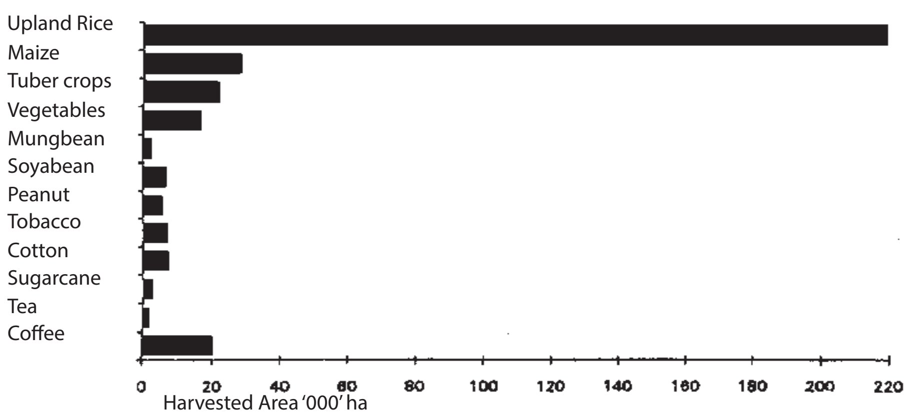
Resource book produced through a participatory writeshop organized by IFAD, IDRC, CIIFAD, ICRAF and IIRR.

Sustainable Upland Rice-based Agriculture in Lao PDR: Production Constraints

Rice is the most important upland crop grown in the Lao Peoples' Democratic Republic grown in the 'slash and burn' shifting cultivation system. In 1995, upland rice was planted on an area of 179,000 ha producing 296,000 tons or 21% of the total annual rice production.



Relative area of upland crops
(Source: Ministry of Agriculture and Forestry, 1994)

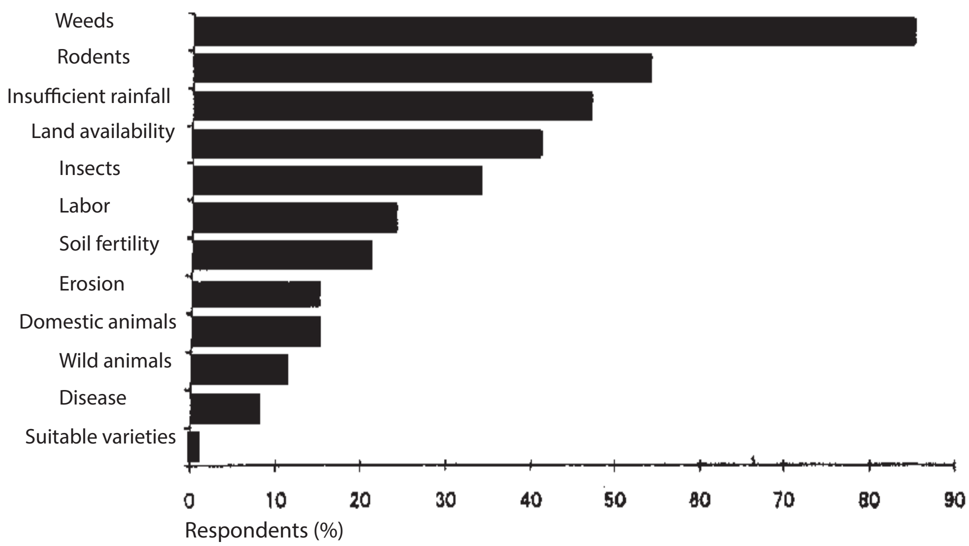
FACTS

- 2.09 million ha or about 8.8% of the national area is used in shifting cultivation, in a slash and burn system.
- 380,000 ha is believed to be cleared for annual upland cropping
- 31% of the rice area is under upland rice cultivation
- More than 80% of the area under 'slash and burn' is planted with upland rice
- Between 250,000 - 300,000 families are dependent on upland production systems (See Etnic Groups and Land-use in Northern Lao PDR, page 124-127).

Upland rice production system in Lao PDR

The production systems of rice, in the uplands of Lao PDR, are varied. Many factors influence the systems including population pressure, land accessibility, labor availability, economic need, soil and topographic characteristics, food preferences and market opportunities, ethnic group and government policies.

In most situations, a single wet season crop is followed by a period of fallow. The length of this fallow is critical to the stability of the system due to population and land availability. Occasionally, two crops are grown before moving to another site. In some instances, a single rice crop might be followed by a non-rice crop in the second year. Rice is rarely monocropped, a range of grain and other vegetable crops are usually being mixed with the rice. Maize, cassava and forest products are used as substitutes in periods of rice deficit. In some provinces, such as Luang Prabang, where fallow periods of two and three years are not uncommon, the productivity of the system has been severely reduced; at the same time, labor input requirements have markedly increased.



Major constraints to upland rice production.
(Source: Lao PDR-IRRI, 1992)

General Practices of Upland Rice Production:

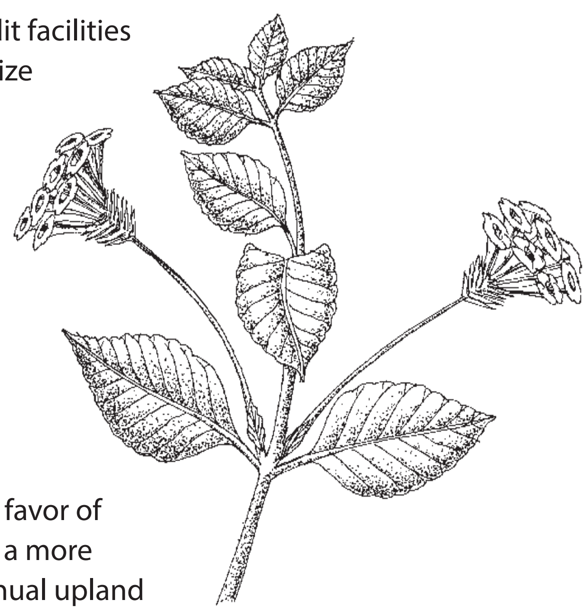
- Land preparation consists of slashing the existing vegetation (secondary forest and shrub) in January and February and burning in March.
- There is no tillage.
- Weed control is the single most important labor requirement.
- The use of early, medium, and late maturing rice varieties staggers harvesting dates and spreads labor requirements for harvesting as well as risk (weather and pest).
- Crop production is almost all for home consumption.
- A single crop of rice followed by fallow periods of two to ten years, which are now shortening.
- Soil erosion of rice is minimal at this stage.

Some recommendations for improving upland rice agriculture in Lao PDR

- The government, in its commitment to the development of the uplands, should seriously address the problems of land tenure, market availability, access to education, alternative employment opportunities and population planning.
- The overall objective of the agriculture development should be the improvement of the living standard of the farming population rather than merely rice production. Farmers need to have the means to purchase food, clothes, medicine and other essential items when required. They should also have access to better education.
- Perennials (fruit trees, timbers, spices, fodder) should be the main focus in any development activities.
- Changing from slash and burn methods to systems using field preparations without burning is essential to allow the combination of annual crops with perennials and to conserve moisture.
- The traditional system used by farmers is a 'non-tillage' system. Although tillage could help reduce weed pressure and may provide some short term fertility boosts, it should not be considered as an alternative because of its negative effect on soil conservation.
- It is often found, that a farmer may cultivate a field for periods of five to ten years and only plant perennials when the productivity has declined. At this stage the conditions for tree growth are far from optimal. Any system, (grass strips or alley cropping) that helps the farmer to postpone the planting of perennials is potentially very harmful to his long term interests.
- Cash income should be generated in a diversified system to minimize market risks. Systems introduced should remain flexible to allow for rapid adjustment to market changes.
- Laos' comparative advantage in agriculture, lies in its large land reserves and the comparatively low population density. Production systems requiring large areas but moderate labor inputs are expected to be more competitive. Livestock and timber production are therefore have high potential.
- Fallow cycles of three to five years or rotation cycles of the same period would require at least 20 years of monitoring to evaluate whether a system would maintain or improve the existing resource potential.
- Vaccination programs to protect the livestock and credit facilities to allow farmers to buy livestock and help them to capitalize on their plantations will be extremely important.
- Chromolaena odorata has various properties of a good fallow plant such as large seed production, fast establishment, suppression of grass weed, high biomass production and its ease of elimination from the rice fields by hand weeding.

The Lao government's strategy towards shifting cultivation

The Lao Government recognizes shifting cultivation as an unsustainable land use practice. By year 2000, the government intends to stabilize shifting cultivation in favor of a more stable and productive agricultural methods, using a more sustainable land use system. Also, about 80,000 ha of annual upland



Chromolaena odorata

The Lao government's strategy for stabilizing shifting cultivation is:

1) Sedentarization of agriculture in upland areas through farming systems diversification and agro-forestry development;
2) Opening market access through feeder road development and market information delivery;
3) Land use zoning based on slope and land capability
4) Rural savings mobilization and credit extension; and
5) Land allocation and land use occupancy entitlement.

rice area and around 100,000 families are to be stabilized. This is to be achieved by increasing the rainfed lowland area and the provision of alternative off-farm and/or on-farm economic activities.

There have been some limited trials of integrated agroforestry under the more recent development projects in Lao PDR, but adoption rate have been generally low, probably due to unfamiliar species, techniques, unavailability of markets, and farmer's perception of greater labor inputs.

References:

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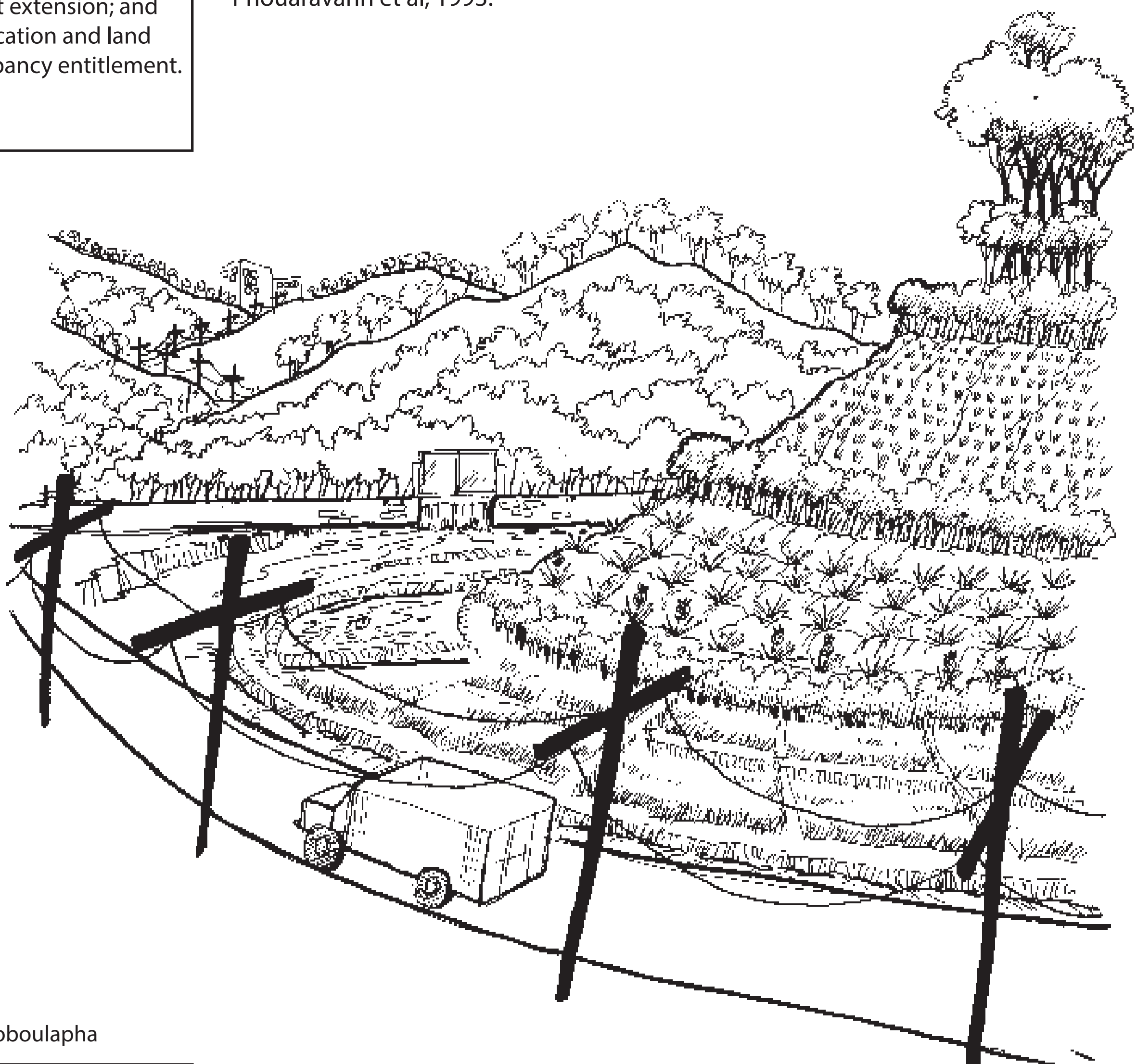

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On-Farm Management of Biodiversity and Genetic Resources

Today, there is a global awareness of the urgency and importance of the preservation of biodiversity and genetic resources and their roles in the survival of the human species in general, and food security in particular.

In shifting cultivation (SC), farmers traditionally maintain a wide range of crop species for two strong reasons: (a) food crops that consist of a wide range of species and varieties, will face much less risks from pest and disease attacks, and (b) a wider variety of food products provides a healthier diet for home consumption.

To maintain this desired biodiversity in the SC farm, farmers often employ two strategies: (i) deliberately widening the range of crop species introduced and planted during the SC cropping phase, and (ii) avoid interfering with the natural emergence of a broad range of pioneer species during the fallow period and, if necessary, plant additional tree species to improve the fallow. The natural growth of numerous woody species in the SC farms contribute significantly to the genetic conservation and add more species to the gene pools in SC areas.

Preserving genetic resources at the farm level –potentials and limitations

A typical hill farmer depends on a wide number of plant and animal species and their interactions (Table 1). The best approaches to conserve these resources vary with species . The preservation of genetic resources in the original environment, or in situ preservation has received considerable support over the last decades. Supporters of in situ preservation argue that gene banks retard the evolution of plants. Most discussions are however, limited to plant genetic resources and specifically to the so-called "land races" of annual crops. Although the debate on in situ preservation of major annual crops may have resulted in a better understanding of the possibilities and limitations of this form of preservation, it is unfortunate that other genetic resources were often left out in these discussions. Most scientists do agree that in situ preservation of perennials multiplied through vegetation such as fruit trees and plantation crops is the most practical approach. Domesticated animals may require a combination of gene bank and in situ preservation to ensure the survival of traditional breeds.

In situ conservation – known as on-farm conservation in which genetic resources are maintained and conserved on the farm under "normal conditions"

Ex situ conservation – the genetic resources are maintained or conserved under "conditioned" land, usually not on the actual farm but on agricultural fields and laboratories. This is mostly done by agricultural scientists or professional breeders.

Pragmatic considerations of in situ preservation:

The in situ preservation of crop species has intrinsic worth, but at certain times its application may be unrealistic due to the following reasons

- Survival of resources in any system mostly will depend on people
- Task and cost of monitoring farmers and administering a subsidy system may be impossible (imagine how it would be possible to maintain over 1000 rice varieties in Nepal, or 10,000 varieties in Laos)
- In spite of subsidies, farmers may not be motivated to maintain the "museum landraces"
- Maintenance of low-yielding traditional varieties may further reduce the food availability in countries with high population density (Bangladesh)
- The material would not be readily available for the breeder.

Source: Pluckett, et al (1987)

Table 1. Components of Biodiversity in Hill Farming Systems[1]

Category	Major properties	Major threat to diversity	Methods of conservation	
			In situ	Ex-situ
Plant species Annual Crops	■ Major source of food ■ Wide range of varying population for individual species	■ New varieties	Complementary	Main
Perennial crops	■ Often multiplied vegetatively ■ Difficult to maintain in long-term storage facilities	■ New varieties ■ Market demand ■ Disease problems of old varieties	Main	Complementary
Semi-domesticated	■ Genetics poorly understood ■ Often only of limited local importance	■ Change in farming system ■ Deterioration of resource	Main	Few species
Wild	■ Selection process without human intervention	■ Shift in vegetation by erosion ■ introduction of new species ■ conversion to agricultural land	Main	Relatives of major crop species
Animal species Domesticated	■ Farmer in direct control in the selection process ■ Problems of in-breeding	■ New breeds ■ Narrow population base	Main	Complementary
Wild	■ Many species	■ Extinction of species	Main	

[1]Refers only to species and varieties used by farmers (wild species mostly from gazing and fallow land).

According to Brush (1991), in situ conservation of crop resources will only work if it complements ex situ methods. Also, it should be accepted by scientists, conservationists, farmers, consumers and government officials and be politically viable.

> Introduction of new varieties of annual and perennial crops could be a threat to biodiversity because: (a) they tend to displace and eliminate older species especially if these are not as productive as the new ones, and (b) with better qualities (productivity and eating quality, for instance), new varieties would be in greater demand in the market and may thus be adopted more by producers and planters.

Strategies to maintain biodiversity and preserve genetic resources at the farm level

The most important factors that motivated farmers to maintain high biodiversity in the past include the following:

> **Suggestions for improving on-farm genetic resource conservation:**
>
> 1. On-farm conservation cannot be achieved through subsidies and "museum" strategies; and
> 2. Some strategies that may enhance the success of on-farm conservation. These include:
>   a) Pathogen elimination in traditional varieties (potato, fruit trees)
>   b) Stimulation of marketing (green marketing of specialty crops)
>   c) Price incentives

- Need for high self-sufficiency levels due to communication problems
- Reduce risk exposure
- Labor considerations
- Unavailability of suitable "improved varieties"
- Market fluctuations
- Traditional food preferences
- Special requirement for ceremonies/ rituals

Depending on the pace of development, the same considerations will remain important in many remote hill areas. Yet many people may argue that subsistence farming systems and the absence of high-yielding food crops will perpetuate poverty, dependence on food imports and the general backwardness associated with hilly regions. Therefore, most governments give subsidies in one form or another as incentives to farmers aimed at introducing new crop species/ varieties, new livestock breeds or adapting "improved" techniques. In other words, the activities of most national extension programs, if successful, may in fact be the main cause for the loss in biodiversity.

Most conservationists agree that systems that rely on subsidies and/or resulting in low production levels will not be successful in preserving existing biodiversity and genetic resources at the farm level. Factors that will contribute to success will likely include:

- Policies that enhance soil conservation
- Policies that favor the maintenance of traditional systems
- Policies that facilitate changes in farming systems but are cautious not to

overemphasize the need to replace existing species, varieties and/or techniques with improved, or scientific varieties or techniques

- Maintain awareness of the importance of biodiversity and genetic resource conservation
- Respect for traditional crops and food habits
- Support to maintain traditional germplasm (eliminate virus from vegetatively multiplied species)
- Develop market opportunities for traditional crops and varieties

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Agroforests in Indonesia

Map of the location of agroforests in Indonesia[1]

In Indonesia, agroforests are usually composed of small (up to 2 hectares) individually-managed parcels of land. Many of these agroforests have been created by swiddeners. Agroforest development and shifting cultivation are, therefore, closely interwoven. They have evolved from transformations of the original fallow vegetation through natural vegetation management and tree planting, into forest-like structures. As such, shifting cultivators have made essential contributions to sustaining a forest cover while making a living at the same time.

Agroforests are definitely part of the world of smallholders' tree-crop plantation agriculture. Like coffee or cocoa smallholder plantations, agroforests are established and managed by rural households for short-, medium- and long-term sources of income.

Agroforests provide:

- 80% of the rubber latex consumed and exported by Indonesia
- roughly 95% of the various fruits marketed in the country
- 75% to 80% of the Dipterocarp damar resins traded in and outside the country
- Most of the rattan, bamboo, firewood, medicinal plants and handicraft material.
- Food

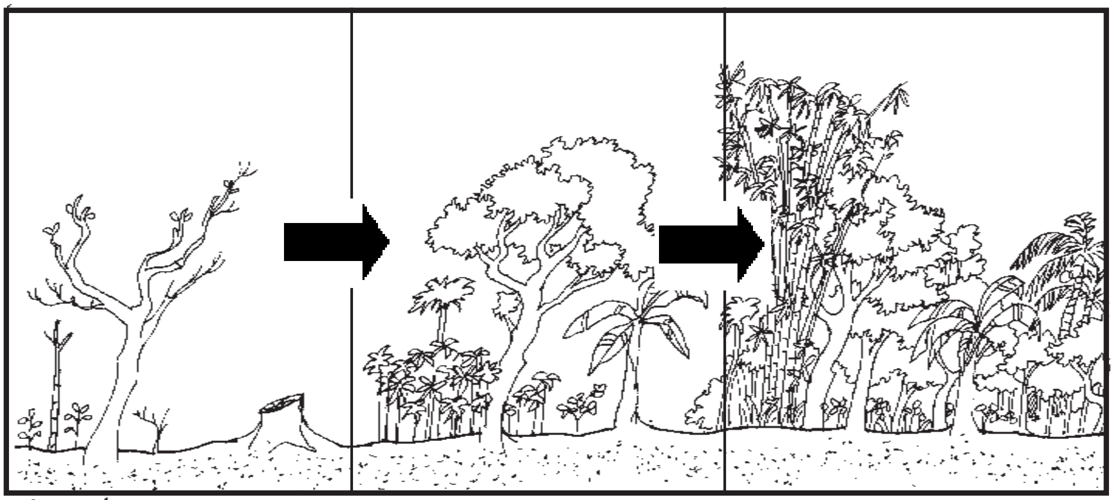
[1]Agroforests can be found in all parts of the archipelago. Shaded areas indicate the location of the examples detailed in the text.

Agroforestry systems in Indonesia

On the island of Java, four main agroforestry systems can be distinguished:

Taungya is a system to create tree plantations where the villagers can grow crops during the establishment phase of the trees.

1. "Tumpangsari". This Indonesian version of the taungya system was first developed in the beginning of this century by the forestry service in Java to improve the management of state-owned teak plantations. Households were allowed to grow food crops during the establishment phase of the teak trees.
2. "Pekarangan". This is the Javanese tree-homegarden, which is often described as one of the most sophisticated homegarden systems in the world.



Development of Talun/Kebun

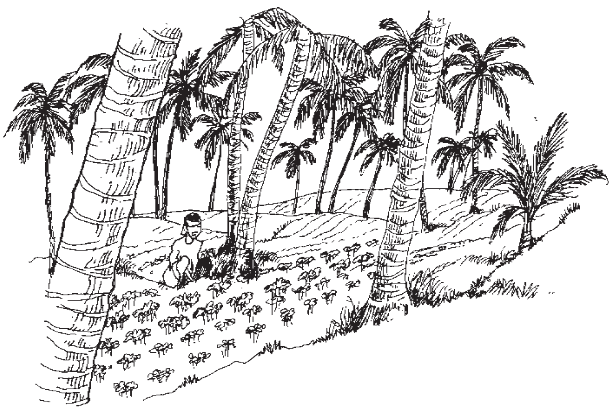
3. "Talun/Kebun". A system mainly found in West Java, this system shows a combination of a succession of native species (bamboo, fast-growing timber trees, fruit trees, which form the "talun" phase) with a mixture of annual crops and seedlings of perennials.
4. "Ladang" or dryland farming involving tree management practices implemented by farmers in Java.

What is a tree-dominated homegarden?

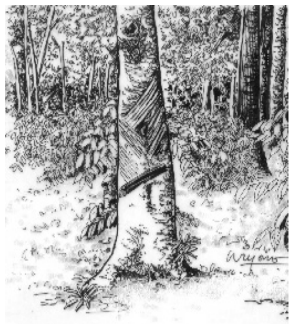
A tree-dominated home garden is a type of complex agroforestry that is located near the house and is usually small in area (0.1 to 0.3 ha). Homegardens benefit from intensive and cultural activities (e.g., manure application, tree pruning, weeding)

For a long time, almost no information was available about agroforestry practices in the islands outside Java. One of the reasons was the general thought that fallow only existed to restore soil fertility. Only recently was it understood that the fallow vegetation has, in many cases, been managed and converted into highly productive agroforests, providing the household with cash, food, fodder, construction materials and the like. Depending on practices, needs and aspirations of the household, agroforests can be either permanent or cyclical agroforests (where trees are cut and rejuvenated). Both types are comprised of a variation of systems, ranging from simple to complex, mutually related to the production of the staple crop.

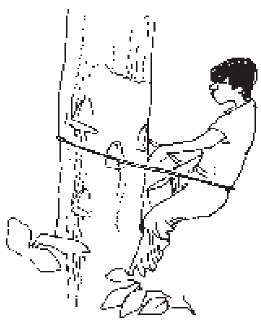
Since complex agroforests often resemble natural forest-like systems, some examples are given here.

<table>
<tr><th>Simple Agroforestry System</th><th>Complex Agroforestry System</th></tr>
<tr><td></td><td></td></tr>
<tr><td>■ Characteristics
- A piece of land planted with perennial and annual crops.
•One tree species and 1-3 annuals or short-cycle crops
•Trees as main crop with short-cycle crops in between
• Trees used as live fences or borders of crop fields
- A planned combination of 1-3 trees and shrubs</td><td>■ Succession of vegetation leading to a forest-like system
■ Characteristics (mature phase)
• Complex vegetation structure
• Many components (trees, seedlings, shrubs, lianas, herbs)
• An ecology similar to natural forests in terms of nutrient cycling, dissemination, regeneration processes, etc.
• Emphasis on perennial crops</td></tr>
</table>

Examples of complex agroforests outside Java



Example 1. In the hills and lowlands of Kalimantan and eastern Sumatra where the last tracks of mixed Dipterocarp forests are being logged and rapidly converted, smallholder "jungle rubber" agroforests cover an estimated area of 2.5 million hectares. In these systems, rubber trees grow among many wild and cultivated tree species, complementing either irrigated or dry rice cultivation (See Rubber in Sumatra: From Jungle Rubber to Rubber Agroforest, page 149-153).



Example 2. In the south western coast of Sumatra, an impressive model of an agroforest based on Shorea javanica (damar) is exploited for its resin. It has been developed by villagers more than a century ago and now covers some 50,000 hectares.

Example 3. In the Moluccas, agroforests grow fruit and nut trees with traditional spice, clove and nutmeg.

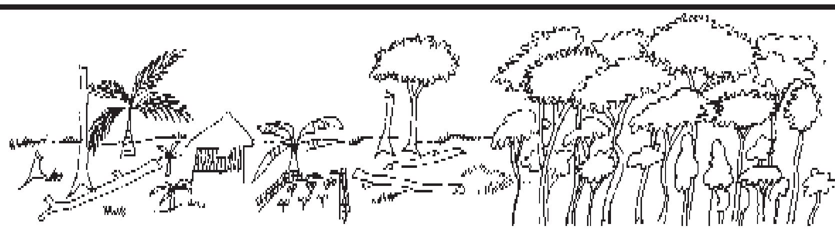
Case study: A damar agroforest in Krui

In the western tip of Lampung province in Sumatra near the Barisan Selatan National Park, 50,000 hectares of land opened by shifting cultivators is have been converted to a unique management system based on the cultivation of a resin-producing dipterocarp (Shorea javanica or damar mata-kucing in Indonesian language).

How a damar agroforest is established can be seen in the next page. Damar trees grow alongside various fruit and timber tree species, palms, bamboo, and many self-established species originating from the neighboring primary and secondary forests. Patterns of species diversity and structural complexity are similar to those of natural forest ecosystems — with a high tree canopy, several layers of smaller trees, and an herbaceous ensemble dominated by species characteristic of forest undergrowth. The establishment of this complex agroforest imitates the succession phases of shifting cultivation into a forest fallow.

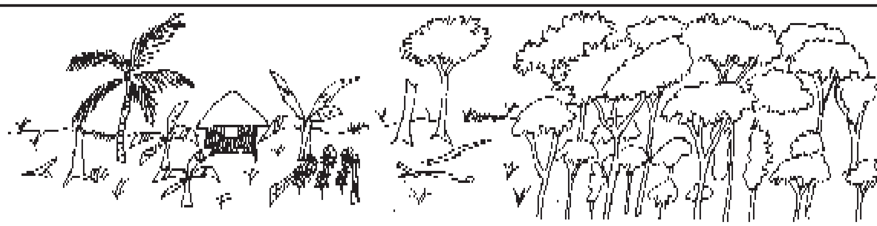
How damar agroforests are developed

A



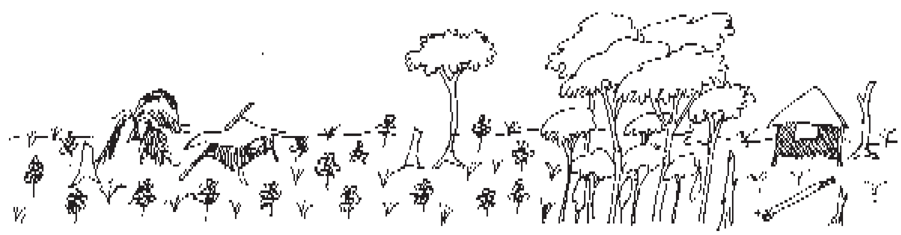
Year 1. Initial vegetation is felled and burned. The land is planted to rice and pepper.

B



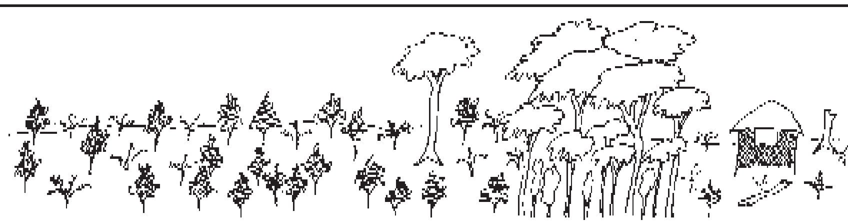
Year 2-3. Damar (Shorea javanica) is grown in the farmers' nurseries.

C



Year 4. Damar is transplanted into the field. Harvesting of pepper begins.

D

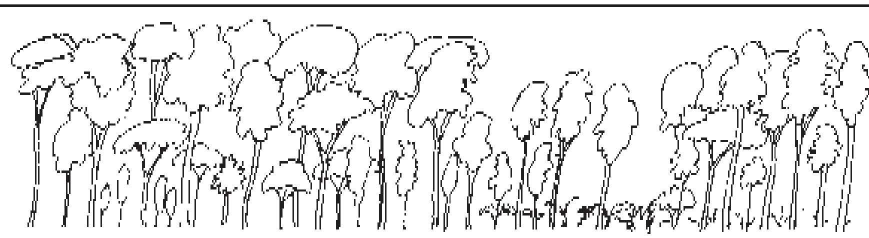


Year 8-10. Pepper plants are no longer productive and are abandoned. Planted damar grow alongside natural regrowth. Intensive competition between planted trees and pioneer vegetation occur.

E

Year 25. Damar enters productive stage. Area is weeded but useful spontaneous species are preserved.

F



Beyond year 25. Fields and fallow areas are replaced with permanent forest cover, the "damar agroforest".

Common problems related to the establishment and maintenance of dipterocarp plantations (irregular seed supply, lack of seed dormancy, difficult mycorrhizeal symbiosis, conditions of establishment) have been solved by damar agroforesters with simple technologies.

- Instead of a seed bank, farmers keep a 'seedling bank'.
- Replanting "wild seedlings" or "wildlings" closely together in agroforest conditions ensures mycorrhization and makes seedlings readily available.
- Under the shade of mature trees, seedlings remain viable for over five years and thus the problem of irregular seed supply is overcome.

Because of their potential qualities, agroforests could serve as models for "community level" reforestation strategies. These would not only provide multiple social, economic and environmental functions, but also support rural development and rebuild biodiversity-rich patches in agricultural landscapes. Technical, social, economic, institutional and, in particular, legislative issues need to be addressed to foster this development. Below is an example.

Policy breakthrough in Indonesia

In January 1998, Djamaloedin Soeryohadikoesoemo, Indonesia's Minister of Forestry, signed a decree that recognizes the legitimacy of community-managed agroforests in the State Forest Land. The decree also recognizes the environmental and social benefits of an indigenous land use system (damar agroforests), the role of indigenous institutions in ensuring the sustainability of this natural resource management system, and the rights of the smallholders to limited harvesting and marketing of timber and other products from the trees they planted.

The decree is based on the minister's concept for a distinctive forest-use classification, 'Kawasan dengan Tujuan Istimewa' (KdTI). The first KdTI area declared is in the Krui damar agroforest in Lampung Province on the island of Sumatra.

Example from India

In the past, the king of Sikkim (Chogyal) leased state forest areas to farmers for them to cultivate cardamom, a major traditional cash crop of the province. In return, the farmers paid a stipulated amount to the Crown. When Sikkim became part of India, the government continued the practice of leasing out the land. The farmers then had to pay one-fourth of the total produce to the government. Today, it is the Joint Forest Management and Protection Committee that continues this operation.

By allowing forest dwellers to plant, the forest is maintained and conserved by the farmer as he has his own interest in the arrangement and gets his income from the land. Conversely, the Committee earns from the lease money. Thus, if the practice is continued and remains free of corruption by officers and politicians, it can be a model for other areas to replicate.

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Booklet

Agroforests. Examples from Indonesia. Published by ICRAF, ORSTOM, CIRAD-CP and the FORD Foundation.

Prepared by
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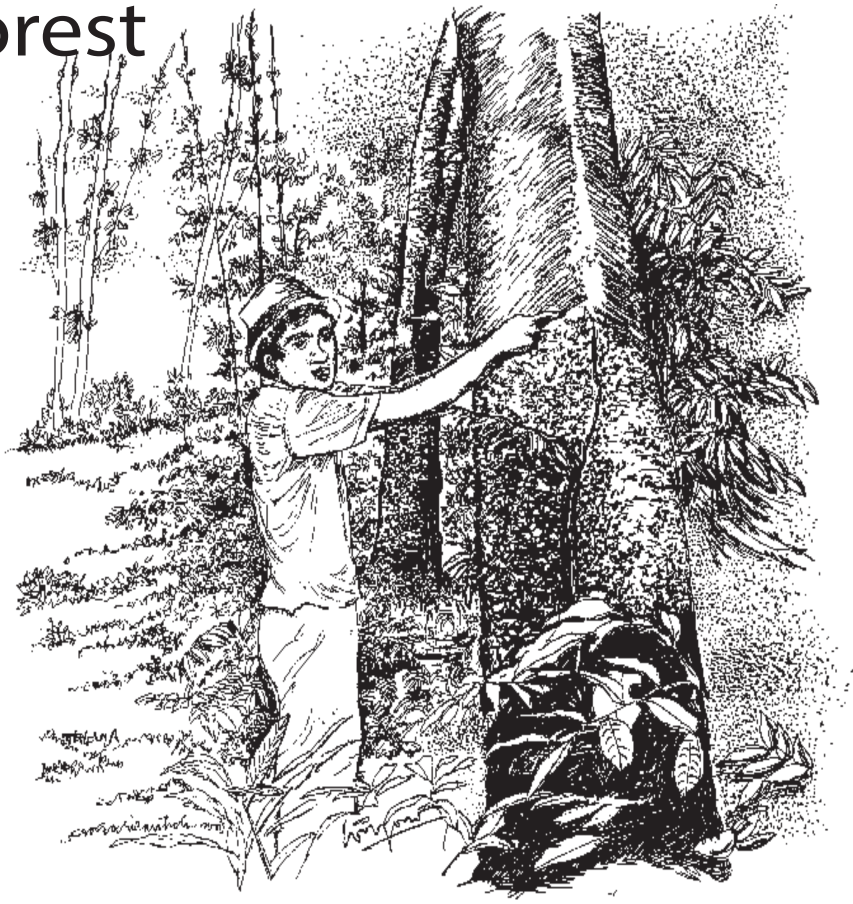
Resource book produced through a participatory writeshop organized by IFAD, IDRC, CIIFAD, ICRAF and IIRR.

Rubber in Sumatra From Jungle Rubber to Rubber Agroforest



Rubber (Havea brasiliensis) was introduced in North Sumatra, Indonesia, at the end of the 19th century. It was originally produced in private estates. The nearby small-scale farmers practiced shifting cultivation, involving slash and burn of primary forest or old secondary forest. After one or two years of upland rice cropping, a fallow of up to 30 years would ensue.

When rubber was introduced in the estates, the smallholders saw immediately the opportunity for rubber production and started to collect seeds. They judged that rubber could be grown in the fallow. With its life cycle, which coincides with the length of the fallow, rubber trees could easily be incorporated into the secondary fallow vegetation.

Since the rubber tree is basically a forest species originating from South America, it adapted well to the forest-like structure in the fallow vegetation of North Sumatra, Indonesia. To compensate for later rubber tree losses due to competition within the fallow

Some factors in the rapid adoption of rubber by farmers include:

- widespread availability of rubber seeds from estates;
- good adaptability of rubber as an enrichment species in secondary forest fallow vegetation; and
- planting rubber trees as a tool to acquire land.

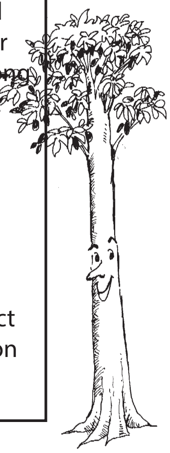
vegetation, the farmers used higher planting densities in the forests than in the estates.

The enrichment planting system of economic valuable rubber trees is often referred to by the Indonesian farmers as jungle rubber (hutan karet). Jungle rubber has a number of advantages for the small-scale farmers:

- A low-input system;
- Rubber grows with the fallow vegetation;
- Requires little labor to establish and maintain; and
- A major source for a cash income.

Jungle rubber and biodiversity

After an area is cleared by slashing and burning, rice is planted for the first year or two. After that, rubber is planted along with a variety of other useful trees that produce fruits, nuts and timber. Since rubber can grow in a jungle rubber system, the mix of planted species is augmented by natural regeneration of forest species. This jungle rubber may approximate a number of forest functions, although they are not perfect substitutes for biodiversity conservation in natural forests.



Through a fallow enrichment process, the shifting cultivators in Sumatra have gradually changed into rubber planters and rubber farmers. With a decrease in fallow length, farmers started to set aside land for rubber trees, ultimately developing into rubber agroforestry systems. Nowadays, more than two thirds of the households still grow "jungle rubber" in an extensive system, either with or without the rotation of rice.

The third stage of improvement started as an endogenous development. Farmers started to collect new clonal material from the estates, which had replaced most of the trees with high-yielding varieties. Also, they started to plant the rubber trees more in lines to facilitate more intensive tapping and improving returns to labor, as cash needs increased.

Government program

From the 1970s onwards, the Indonesian government began to seriously consider supporting the smallholder rubber sector. However, the model was directly derived from the estate model. Rubber monoculture consists of high levels of labor and inputs and there should be no intercropping during the immature rubber period (however, cover crops may be used). Although the rubber estate model was efficient from an agronomic point of view, it has not been adopted by shifting cultivation farmers.

Reasons why farmers did not adopt the rubber monoculture package

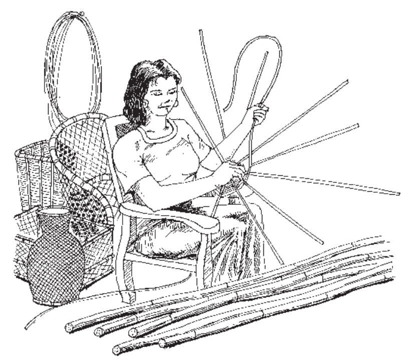
1. Cost of production
2. Farmers were more interested in medium to low intensive systems like jungle rubber.
3. Scarcity of improved planting material and its poor quality
4. Intercropping was crucial for the farmers
5. Inefficiency of extension and lack of information
6. Lack of credit facilities

Rotational Rubber Agroforestry System (RAS)

Nowadays, raising the productivity of rubber agroforest offers a promising development pathway in Sumatra. Rubber agroforestry systems combine low to medium input requirements with agroforestry practices.

During the establishment phase of rubber trees, food crops are intercropped with seedlings, followed by a rubber tree phase. After 20-25 years, the trees are cut and replanted. A new cycle starts. Some forms of RAS also incorporate some natural vegetation which grows with the rubber trees.

Instead of collecting seeds from the estates, rubber clones are obtained by grafting a bud (from a budwood collected in a budwood garden) on a rootstock. It is therefore essential to verify the clonal purity of budwood and the origin of the plants used in a budwood garden.



In Thailand and Malaysia, the wood of the rubber trees are used for construction and furniture making. Tariff barriers and low price of rubber wood in Indonesia do not provide such incentives for the farmers to sell the wood and much is wasted.

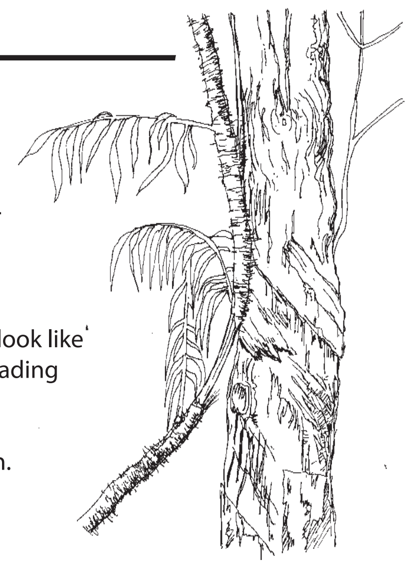
Fig 1: Different Rubber Clone Properties

CLONE	ADVANTAG-	DISADVANTAG-
PB 260	■ Very good growth ■ High-yielding ■ Provides good shade when mature ■ Resistant to Colletotrichum. ■ No stimulation required ■ Permit D3 or D4 exploitation system (save labor)	■ Susceptible to Corynespora and TPD ■ Exploitation system should be D3 or D4 ■ Not very adapted to D2 ■ High risk with over-stimulation or overexploitation
RRIC100	■ Very good growth ■ High- yielding ■ Provides very good shade ■ Resistant to Colletotrichum and Corynespora ■ Adapted to D2 ■ No stimulation required	■ Average susceptibility to leaf Phytophtora and pink diseas ■ Heavy canopy
RRIM1600	■ Average growth and high-yielding ■ The most planted clone in Thailand ■ Resistant to Colletotrichum	■ Susceptible to wind damage ■ Susceptible to Oidium (but there is no incidence in Western Kalimantan)
BPM24	■ Good growth ■ High-yielding with a regular increase of production ■ Resistant to Corynespora ■ Adapted to D2.	■ Not resistant to Colletotrichum
BPM1	■ Very good growth ■ High-yielding with a regular increase of production ■ Provides very good shade ■ Resistant to Colletotrichum and Corynespora Adapted to D2	■ With average susceptibility to Phytophtora ■ With average susceptibility to Oidium (no incidence in Western Kalimantan) ■ Not widely grown so it is not popular

An important feature of the success of RAS is to use clonal rubber with a minimal level of maintenance, but are all high-yielding and fast growing species. RAS is aimed at farmers with limited cash flow and labor. Rubber clones were selected for their production performance and tolerance to leaf disease such as Colletotrichum sp. Other aspects concern growth characteristics and a good ability to support relatively harsh tapping management (e.g. high tapping frequency, bark wounding).

Permanent agroforest system

In contrast to the RAS, we may distinguish a Permanent Agroforest System where rejuvenation takes place at the patch level of one or a few trees without slash and burn land clearing. The system approaches the character of a permanent forest-like vegetation, even if it started in the same way as a rotational system. The rubber agroforests have developed along this line.



Rattan intercropped with rubber: A case from Muara Bungo

Pak Abdul of the small city of Muara Bungo in Western Sumatra knows from experience that rattan grows naturally in jungle rubber. He used to collect rattan from the primary forest, but nowadays collecting sites are vanishing so he thought of growing rattan under the rubber canopy (rattan is an indigenous species).

With this idea, he bought about six hectares of land from another farmer and he established a monoculture of rubber. With his knowledge on rattan and how the collecting places of rattan look like in the forest, he judged that rattan can grow after rubber has become 5-6 years of age. The shading requirements for rattan would then have been reached.

After 25 years, the rubber trees are cut down and planted and he would also harvest the rattan. The rattan could be harvested earlier, but the best quality and price is obtained if the rattan is at least 15 years old. Although this is a long period, he says it is not a problem, as his daily and weekly cash needs are met by the tapping of rubber.

Abdul said that rattan requires no intensive management, except it needs some guidance so that it does not damage the rubber trees with its thorns. Also, he slashes the rattan thorns up to two meters so that the rubber trees can be easily tapped. He has made this into a big business collecting his own seeds, either from his garden or from the natural forest, and raises his own seedlings.

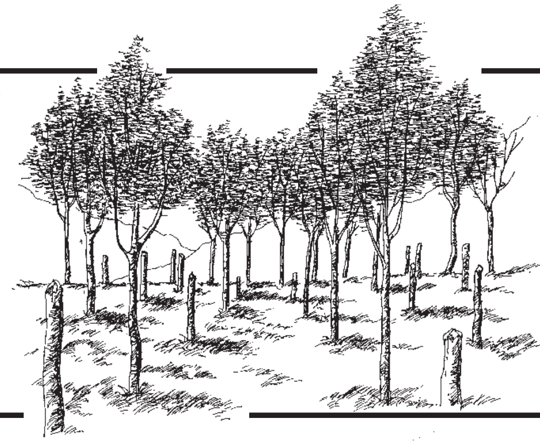
This business has become so successful that he has given out seedlings to neighboring farmers. They grow the rattan and later sell the rattan to him. This is advantageous for both parties, as the plants are certain of a buyer. Abdul, meanwhile, can "extend" his rattan plantation. Seedlings already develop thorns when they are still young, therefore pigs will not eat the seedlings (the biggest problem for rubber seedlings). Abdul experienced an almost 100% survival rate of rattan.

So far, he has sold one truck full of rattan to Jakarta based traders. This money was enough to pay for a course on rattan furniture making for one of his sons. The son now owns a shop where he makes and sells rattan furniture.

He concludes by saying that in contrast to all other farmers in the area, rubber tapping has become a side activity and bridges the gap for the next rattan harvest. He taps only enough latex to satisfy his home consumption needs.

LESSONS:

Although well-intended programs have been developed, the dynamics of diversification strategies among smallholders have often not been well understood. Instead of focusing on monoculture, farmers diversify for good reason, including the need to avoid risks normally associated with monoculture and to respond adequately to uncertainties. Government Programs could focus more on a more diversified pattern, and crops/systems that consist of low-input, low-cost options that are in many cases already developed by farmers.



Farmers themselves have been very innovative in efforts to increase the profitability of rubber in their farming systems. Other agroforestry systems of Indonesia are described in Agroforests in India, pages 142-148.

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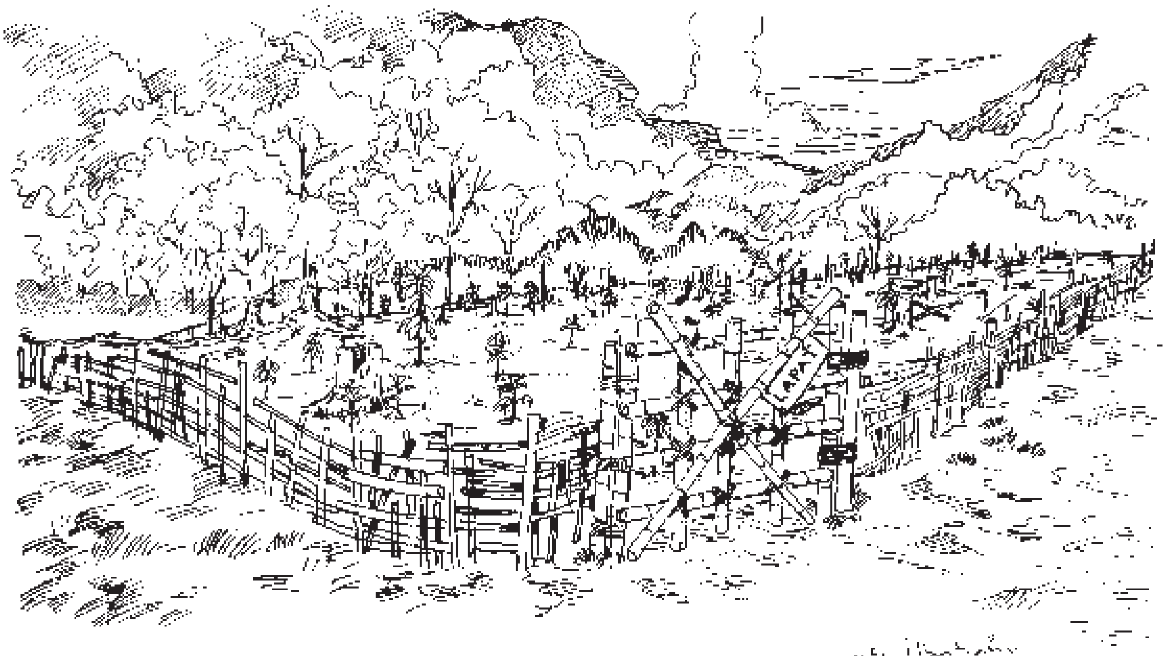
Resource book produced through a participatory writeshop organized by IFAD, IDRC, CIIFAD, ICRAF and IIRR.

Lapat System among the Indigenous Swidden Farmers of Apayao: Its Symbols and Sustainability Functions



Lapat system: definition and history

Lapat is a traditional practice of a bereaved Isnag family where material resources (e.g. a cultivated swidden field or fallowed field, a portion of the mountain, river, or a portion of the forest) are declared off-limits to people to show their respect and value for a dead family member. The Lapat is identified by a symbolic declaration that all persons outside the family member are barred from entering, using, or holding any of the material resource declared as prohibited or off-limit by the bereaved family. The family decides the duration of Lapat, which may be from 1 to 30 years.

This practice can be traced back from the traditional practice of their forefathers who regard death as a "curse" from the spirits for not following ritual procedures on food gathering in the forest. They believe that when somebody dies in the family, they have to return to the spirits the food in the home (like deer and boar's meat) and whatever valuables they have accumulated to amend for having trespassed in the "sacred ground" of the

The data collection was done in Kabugao, Apayao a municipality located in the northernmost part of the Philippines. Kabugao is characterized as mountainous with steep slopes and few plain lands. Swidden farming is the main form of agriculture where rice, the main staple food, and vegetables for household consumption are cultivated. However, the wanton utilization of the forest resources has threatened the people's way of life specifically its .farming activities

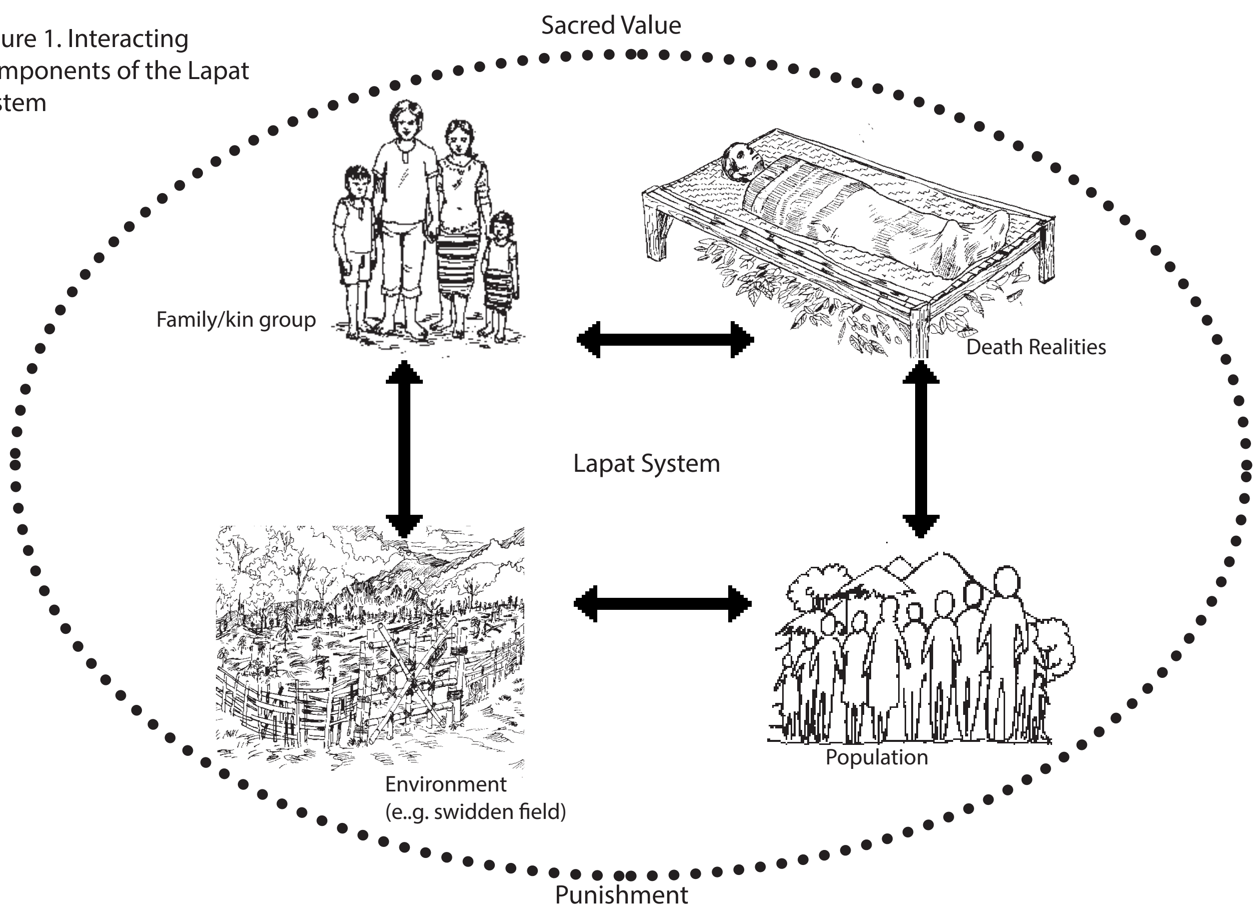
anitos or lanag spirits. This belief has been handed down to the present generation.
Lapat is associated with sacrificial offering to the spirits. In the past, they offer the entire body of the butchered animal and eat the meat only after two to three days. On the other hand, materials made only from forest resources can be declared as Lapat. These materials include hunting tools, rice storage, and farmhouse. Such materials were believed to be more acceptable to the anitos and could easily amend the matter.

Various resources can be declared as Lapat. The common examples of these materials or resources are: an old swidden field, a swidden field with crops, a secondary forest patch, a primary forest area, a portion of the river, planted tree, or even guns. What is important is that the thing or material resources declared, as Lapat, is valuable to the dead person and the bereaved family.

Components of the Lapat system

Lapat is an interaction of the different components namely: family/kingroup, population, environment and death realities. These components are very important and should be present in order for a Lapat to be declared. Without the interaction of these components, the Lapat is not valid. It was reported recently that the components of the Lapat system have already undergone some changes that respond to the needs of the changing Isnag society (Figure 1). Although the difference is not significant, the social, political and economic aspects of the component parts indicate the change in the valuation of the Lapat system.

Figure 1. Interacting Components of the Lapat System



- Family system. Without the bereaved family, a Lapat cannot be declared. It is the family who fulfills the love, value and respect for the dead. Declaration of Lapat is also considered a family obligation. Hence, when Lapat is declared it also means spending quite a sum of money and resources for the say-am (feast), which is held in behalf of the dead person.

- Environment. This component includes the physical and material resources found in the environment, which is the crucial aspect of the economic conditions of the family. These resources include the swidden farms, a home garden, an area planted to food crops (e.g. banana and sweet potato), a tree or a patch of forest, a portion of the river, the farm house, the farming tools, head hunting tools and many others, which are associated with the dead person that can be declared as Lapat. The material and physical component in the environment is important in the Lapat system. These materials are found in the environment where the family population and death realities occur.

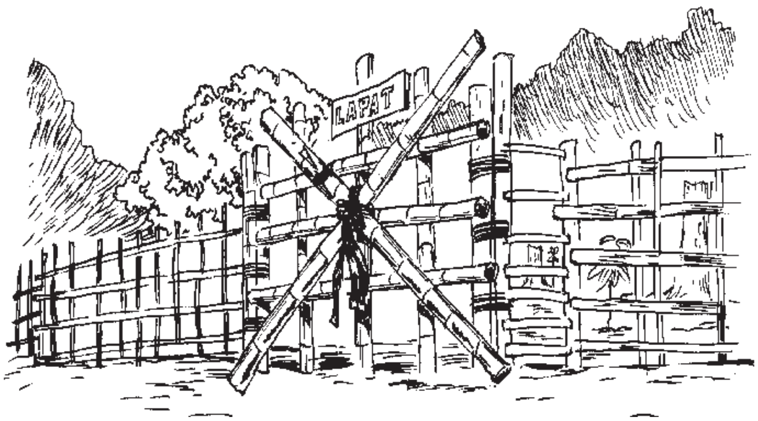
- Death realities. A family cannot declare a Lapat without having death in the family. The death of the physical body represents the value of sacredness. This is considered loss of a human asset who plays a significant role in the family's social and economic relations particularly on their farming/swiddening activities. Often, the household economy (because they spend a lot in practicing a Lapat) is negatively affected when there is death. During Lapat, the family by intention undergoes social isolation, economic loss and political subservience since they are barred (by social sanctions) from productive activities often done in the swidden field, and in gathering and collecting from forest resources. If the family is able to overcome the difficult social and economic effects of the Lapat, the respect and value for the dead and their relationships in the community are strengthened.

A say-am and the rituals are made by Durarakit (Shaman). Shaman is a person who ensures that the family members including all the spirits of the dead family members become the "guards" of the areas or things declared as Lapat.

- Population system (Community). The population system protects and supports the Lapat. Its function is to fulfill the prohibition, a demonstration of the respect for the bereaved family. It is the people outside the family, who also fulfill the value of the areas or things declared as Lapat. The population strongly participates in the Lapat system because they are also consulted about the kind of punishment suited for the violators. Hence, the population has some sort of communal power.

Conservation function of Lapat

The most valuable function and output of the Lapat system in the Isnag communities is its tremendous contribution to resource conservation and socioeconomic upliftment of the family. There are various manifestation of these functions, for instance, they were able to rejuvenate the soil fertility of their 10-year old home garden, harvest large trees for lumber and construction of their new house, harvest 1000 coconuts from only 20 trees and plant more in other cultivated areas. To a certain extent, sustainability of swidden fields in terms of land-use utilization is also experienced by the owners of Lapat. In the case of one of the key informants (KIs), she claimed that the family was able to regain the financial loss and even had more than what they expected after they re-opened the Lapat, 15 years later. This is because they were able to harvest trees, rattans, fruits, and coconuts, and even hunted wild boars and deers.

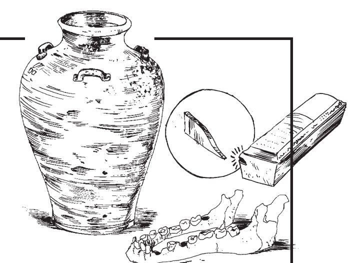


Values of the Lapat

Another valuable effect of the Lapat system is the "sacredness" and "preservation" function, when a swidden area is declared a Lapat. The surroundings and ambiance is regarded as "sacred", thus exploitation of resources in the area is temporarily halted. Therefore, preservation function is very pronounced.

The value given to the Lapat practice is still present until now, but more often, the rich sponsor of the Lapat dictates this. In fact, Lapat has become even more expensive for the bereaved family because of the changes in the economic status of the community, according to one of the KIs. Before, the cost of say-am to establish a Lapat only one to two pigs, but now one should butcher at least one to two cows to be able to invite everyone, or take the criticism for not preparing enough for the visitors.

Signs and symbols



- A placard with "Lapat" written on it
- A bamboo cross, about two meters in length, placed in the strategic area declared as Lapat
- A red or black cloth placed around the Lapat item
- A sturdy fence with a piece of wood from the coffin of a dead
- The skull of a wild animal

Punishment for violations

A violation is an act of trespassing the fenced area of a declared Lapat. Anyone caught violating this practice is "punished" by death and/or has to pay the awat (an indemnity payment). Even the best excuse will never be accepted to the owners of the Lapat. If relatives and friends accidentally violate the Lapat, they are also punished or asked to hold a say-am for the family but at a lesser cost compared to an outsider.

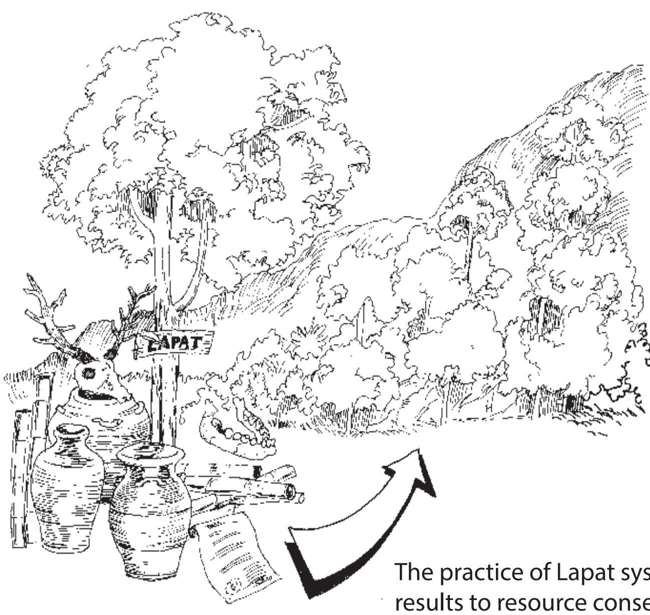
Since the influx of non-Isnags, the holders of the Lapat have become powerful. Among the younger generations, however, death as punishment is no longer practiced. Rather, high monetary payment is usually asked from the violator. If violators have no means to pay for the say-am, then another form of "payment" is requested. In case the usual punishment is not possible, sometimes the violator is asked to work in the farm within the period that the Lapat is still operational. The violators are charged exorbitant penalties.

> Case Report
> Three years ago, a man accidentally killed a relative because he thought he was a thief. He was convicted but in court, was able to pay the most expensive awat (high indemnity) ever in the history of the Isnags. He paid the awat, but he also declared a kilometer-long portion of the river near his house as Lapat (he did this virtue of his being a relative of the deceased). Nobody could fish nor cross the area. The government could not intervene because the government also received a declaration fee for the Lapat.

Insights to consider in sustainable shifting cultivation and resource conservation

The various transformations can be interpreted as insights to consider, as the Lapat system plays a very valuable role in the Isnag society. These insights are as follows:

- Lapat is a strong symbolic expression that indicates the value and respect of the Isnags toward each other and most importantly, toward the environment from which they earn their living.
- The attitude and respect manifested on the Lapat satisfies the bereaved family members and the community. From this, a closer social ties, economic support, cultural and environmental "bond-strengthening" are created.
- Lapat system is a sociocultural and environmental management practice that largely contributes to the behavioral change of the family towards other Isnags and other community.
- Lapat is a unique transformation that eventually contributes to the sustainability of agricultural practices—in this case, swidden cultivation practices and resource conservation.
- Lapat still works to sustain swidden cultivation among the Isnag. Hence, this should be continued as part of the Isnag's cultural practices especially on sustainable and swidden cultivation and resource conservation.
- Lapat transforms the economic conditions of the family to a favorable level.
- Lapat system is similar to the beliefs and practices of some tribes in other parts of Asia.



The practice of Lapat system results to resource conservation

Prepared by
Ben Maata

Resource book produced through a participatory writeshop organized by IFAD, IDRC, CIIFAD, ICRAF and IIRR.

Utilization of Obi in the Shifting Agricultural Methods of the Ikalahan

The Ikalahan tribe (Kalanguya) is one of several Cordillera Tribes of Northern Luzon inhabiting the upper-forested portions of the Cordillera and Caraballo Mountains. Their tribal name explicitly identifies them as "People of the forest."

About 2,500 of them established the Kalahan Reserve near Santa Fe, Nueva Vizcaya. It extends from 600 meters to 1717 meters above sea level. Rainfall is high, usually above 3000 mm per year, mostly falling between June and November.

The topography of the Kalahan Reserve largely determines the technologies for their agriculture which is based primarily in the production of their staple food, obi (sweet potato, Ipomoea batatas). These methods have been tried and tested through generations, enabling them to 'live on the land' while maintaining a harmonious balance between their needs and nature (See The Role of Homo sapiens in the Forests, pages 49-54, and Forest Improvement Technology: An Alternative to Logging,

We were visited about 20 years ago by a delegation of agricultural and forestry specialists. One of them suggested that, because of the steep slopes, we should practice zero cultivation to avoid erosion. We did not object to his suggestion but we raised one small but very important question. "What kind of carbohydrates can we produce that way?" That vanload of Ph.D.s sat for the next two hours on our mountain slopes to debate the question. They finally agreed that the best crop is sweetpotato.

When the decision was translated to Omis, (one of the elders), he just smiled and said, "We have been doing that for many generations already. It is nice to know that the visitors agree with what we already know."

Although obi (sweetpotato) is very nutritious, most lowland societies consider them to be "low class" food, suitable only in times of famine. The obi, however, have been the basic food for the Ikalahan for many generations. The tubers are rich in minerals, the leaves have high protein content and together they provide several of the essential vitamins.

pages 276-280, for more information about the Kalahan Reserve and its people).

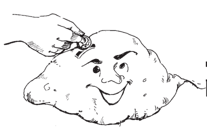
Ikalahan shifting agricultural methods

Intensive research done several years ago indicated that although a small amount of erosion might take place if a heavy rain would occur during the first six or eight weeks after planting, the amount and kind of erosion taking place after that, is the same as within a good second growth forest.

Planting

- Several varieties of obi are planted in every field. The fields are invariably sloped to prevent water logging. The different varieties probably have different nutritional requirements. Mixing and rotating them helps to preserve soil nutrients.
- Planting is usually done in May or June. The first weeding is done about two months later.
- Once the tubers begin to reach maturity (three to five months) they are harvested individually as needed by the family. The harvest continues almost daily for the next two years.
- The Ikalahans never harvest an entire field at one time. There is no need to be concerned about post harvest technologies because both tubers and leaves go straight from the field to the kitchen.

- Defective tubers are never wasted because they are cooked and fed to the pigs, which are invariably a part of the Ikalahan household. Likewise, there is no need for the Ikalahan family to be concerned about keeping the planting materials during a dry season. The weather in the area is not "wet" and "dry" -it is usually just "wet" and "wetter."



The sweetpotato gene bank is a collection of small plots on the slopes above Imugan. Each plot has one of the more than 100 varieties that the Ikalahan have collected. They differ in drought resistance, disease resistance, productivity, time required to produce tubers, flavor, color, texture, etc. The gene bank provides planting materials whenever needed.

Gengen

- After about four months of harvesting, the production of tubers may drop off. Thus, the woman in-charge chooses an area about 10 meters square and removes all of the growth: vines, leaves and tubers. The tubers are then taken home.
- Tubers suitable for human consumption are cooked for the family. The rest are cooked for the pigs.
- A good quantity of the best vines are separated and put in a nearby forest shade to sprout.
- All the other vegetation, including weeds, are buried in contour trenches across the slopes at about eight meter intervals. The area is then replanted.
- The hump over the contour line of in situ composted material is able to catch any soil that is eroded during the next six weeks while the newly

planted vines are maturing.

- When one square is finished, the farmer repeats the process in an adjacent area. This cycle continues until the entire field has been cleared. A field is seldom more than 2/3 of a hectare in size.

This system, is known locally as Gengen. It may be repeated two or more times during the life of the field, depending on the circumstances.

Fallowing

- Although the topsoils are shallow, they have adequate nutrients. However, heavy rains tend to leach out the bases more rapidly than they leach out the acids producing a soil that is highly acidic. When this happens, the phosphorous in the soil is bound to aluminum and other metals, making it unavailable to the plants.
- The production of tubers is greatly affected by the lack of available phosphorous and the farmer knows that she must fallow the field. This usually occurs after two or three years.
- The traditional way of improved fallow was to just leave the field and let the grass, shrubs and trees grow again. A technique for expediting the fallow is given below.
- The field is not used for other crops or pasture because it would interfere with the rejuvenation of the soil. In only a few years, an untrained eye cannot recognize the difference between a fallow and a forest.
- When the trees get as big as a man's leg, the field is cultivated again. In the Cordillera and Caraballo mountains this usually takes about15 years.

Field preparation

- The farmer cuts down all of the grasses, bushes and trees in the fallowed field. Nothing is left more than knee-high.
- The large tree trunks are used for fences or fuel. The rest of the stems, limbs, and leaves are left scattered in the field to dry.
- When the cuttings are very dry, a 2 meter fire-line is made around the field so that the fire won't burn any standing trees or brush.
- Burning must be done on a hot day to ensure a fast fire that will turn the woody biomass into ash. Ash neutralizes the acid in the soil and thus releases the

phosphorous from its bound form. This makes it available to the plants.

- The farmer then plants the obi in the field while her husband makes the necessary fence.
- The obi vines cover the field and protect it from erosion within a month.
- The harvest of tubers begins again after three or four months depending on the varieties planted. The farmer then continues to harvest as before.

Expediting the fallow

- Small alder seedlings, (Alnus nepalensis) are planted in the field with the obi. By the time the field is ready to be fallowed, the tree seedlings are already waist high. In this simple way, the needed fallow time is reduced from 15 years to 7, thus, doubling the available agricultural land. Because the Ikalahan farmers do not need that much agricular land, the "extra" land is allowed to revert to orchards or to production forests. Other farmers within the mountain range are now imitating this simple technique.
- The burning process destroys some of the nitrogen content of the soil. However, there is always an adequate supply. The loss of a small amount of nitrogen is the price the farmer has to pay to make available phosphorous.

Fertility Maintenance

- Clearing is not done until woody fallow reaches its proper size;
- Biomass is composted in situ in the field;
- Ash is used to counter- act soil acidity and to make phosphorous available to the plants;
- Heavy vines protect the field against erosion;
- Mixing and rotating different varieties of Obi helps prevent unbalanced nutritional demands. This mixing and rotating system also helps to protect the farmer's crops during typhoons.

Some observations about innovations

- Attempts to design innovations or establish demonstrations have seldom been successful. Successful innovations have mostly come from local farmers, usually elders, who knew their ancient technologies well. Likewise, they have used some of the basic principles of ecology to improve on them.
- No attempts are made to inform anyone "how to do it." Instead, conscious efforts are made to understand ancient technologies and interpret them into scientific terms.
- Serious efforts are made to interpret sound ecological principles into the local setting. The goal is always to improve understanding, frequently resulting to the production of helpful innovations.

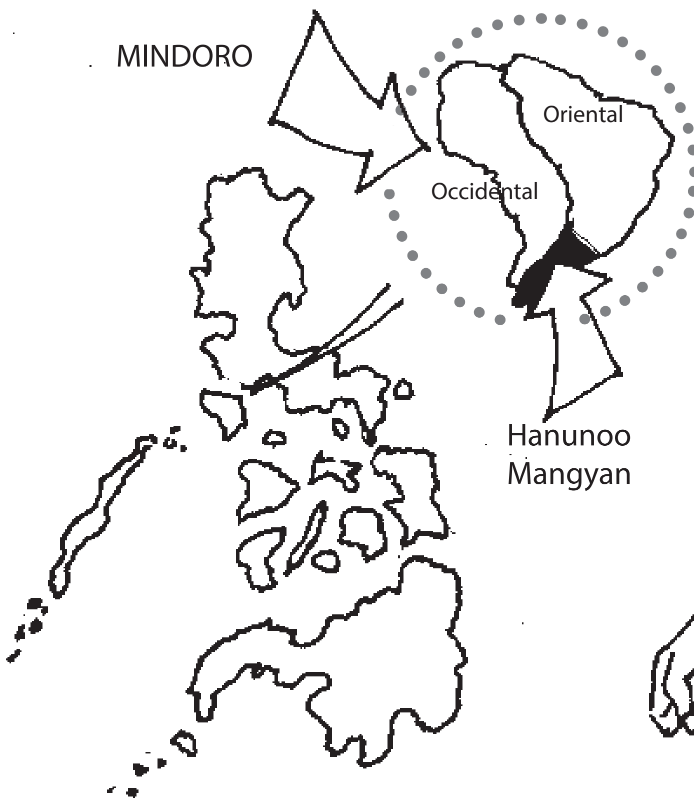
Conclusion

This technology has been used by the Ikalahans for almost two centuries now. The forests are still lush; the small streams still flow clear; and provide a home for the minnows that add a little variety to the farmers' diet.

Prepared by
Delbert Rice

Resource book produced through a participatory writeshop organized by IFAD, IDRC, CIIFAD, ICRAF and IIRR.

Shifting Cultivation Practices of the Hanunoo Mangyans Mindoro Island, Philippines



The indigenous people of Mindoro Island, in central Philippines, are collectively known as the Mangyans. The term Mangyan, however, covers various ethnolinguistic groups scattered throughout the island, namely the Alangan, Bangon, Gobatnon, Batangan, Buhid, Iraya, Ratagnon, Tadyawan, and Hanunoo.

The Hanunoo Mangyans are found in the southernmost tip of Mindoro, most specifically in the municipalities of Mansalay and Bulalacao, in the Province of Mindoro Oriental. They are one of the least acculturated groups among the peoples of Mindoro.

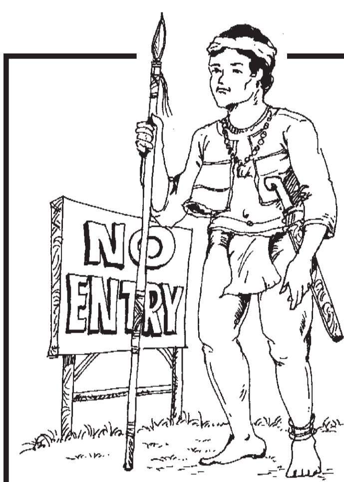
They practice shifting cultivation that is based on time-tested indigenous knowledge. This type of cultivation is characterized by sustainable practices such as a) selectivity in clearing and burning; b) adoption of soil erosion prevention techniques; c) promotion of crop diversity; d) maximization of the limited land; e) use of organic pesticides; and f) observance of a long fallow period.

Selective clearing and burning of forest

Clearing

- Generally, clearing of primary forests is strictly prohibited by the community. Thus, shifting cultivation is practiced only in the secondary forests.
- Only the vegetation along the foothills is cleared for field preparation.
- Areas that are exposed to strong winds and typhoons are considered unsuitable for cultivation.
- There are many taboos prohibiting the clearing of areas believed to be inhabited by spirits. Most of the trees, mountains, rocks, and rivers are left undisturbed to appease the spirits.
- Not all of the trees are cut. The leaves and twigs of woody species are merely pruned. It prevents the crops planted underneath from shading. The cutting of twigs and branches of trees are done carefully, starting from the uppermost branches down to the trunk. This method, called yinangaw, is done to avoid accidents and to protect plants and trees in the vicinity.

> Contrary to public perception, the Hanunoo Mangyan's brand of shifting cultivation does not entail indiscriminate clearing and burning of forests.



Based on customary laws, the Hanunoo Mangyans prohibit the establishment of a tanman (swidden farm) in the following areas:

- Nagkaspuan - a place close to a house or settlement where people have died due to sickness or acts of violence;
- Kalubngan - cemetery or a former burial ground;
- Panagdahan - a religious ground for prayers and offerings;
- Panggangah - a site where illness-causing spirits are trapped or imprisoned.

These taboos practically set a limit on which portions of the forest can be devoted for swidden farming. Many areas are de facto "protected areas" from the local community's perspective. In essence, the practice of animism has contributed much to the protection of the natural environment.

- Many small trees are left untouched to serve as hulungan (climbing posts) for vines.

Burning

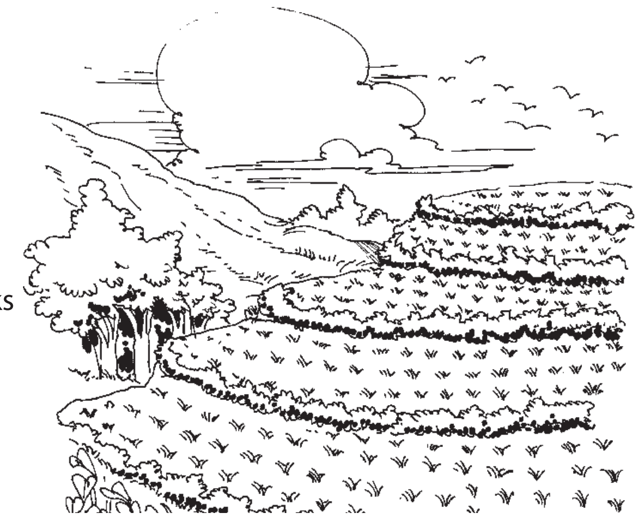
- Prior to actual burning, a wide strip of land around the intended farm is cleared of all vegetation. The kayig (perimeter area) acts as a firebreak. This method prevents fire from spreading to adjacent areas.
- To preserve trees within the intended farm, the Hanunoo Mangyans cover the tree trunks with several layers of banana stalks.

This prevents the tree from smoldering during the burning stage.

Prevention of soil erosion

To prevent soil erosion, the following measures are implemented:

- Trees and plants found in the steep portions of the mountains are left intact.
- Generally, sloping land is not plowed. Digging sticks are used to plant seeds.
- Tambaso (rice bean) is planted as cover crop along the contours of the farm.



Promotion of crop diversity

The Hanunoo Mangyans value crop diversity. They purposely cultivate and propagate various species and varieties of crops:

- At least 104 varieties of upland paray (rice) are recognized and cultivated by the Hanunoo Mangyans.
- Lumabung or mung beans (Vigna sinensis L.) are inter-cropped with rice to replenish the nitrogen content of the soil.
- Cereals, leafy vegetables, legumes, spices, dyes, fruit trees, and other crops are cultivated within the same farm.

Most Preferred Rice Varieties

Rice Variety	Reasons for Preference
Buladlad	Delicious and sweet smelling.
Kahita	Fast maturing: only 3 months to harvest.
Kamoros	Delicious and sweet smelling; most expensive: 1 cavan is exchanged for 3 cavans of lowland rice.
Laganit	Sweet smelling.
Lubang katangraw	Antidote for bleeding gums when made into porridge. Eaten during the ninth day post-burial ritual. Resistant to stemborers. Attracts birds because of its red grains; thus, sparing other varieties.
Paray kasakaw	Delicious; white grains
Paray kinuto	Resistant to white worms. Disliked by chickens because of coarse follicles.
Putâ	Glutinous variety used for rice cakes. Free from bird attacks because its grains are hidden within its stalk.

Maximized utilization of the land

Through mixed cultivation, the limited land is put to maximum use. As coffee trees are non-photosensitive, it is common to find these trees under the shade of banana trees. Mais (maize), however, is not grown together with rice as its ears may fall on the rice stalks during strong winds.

A typical example of mixed cultivation can be found in the farm of Bugtong Bugkat, a Hanunoo Mangyan from the village of Panaytayan in Mansalay. Within his less than a hectare land, he has planted the following:

- Cereals: paray (Oryza sativa), batad (Andropogon sorghum), mais (Zea mays L.), and dawa (Setaria italica L.);
- Legumes: lumabung (Vigna sinensis L.), tambaso (Vigna umbellata), kabatsi (Phaseolus lunatus L.), kadyis (Cajanus cajan L.), kabay (Psophocarpus tetragonolobus L.), buray lubayan (Dolichos sp.), and buray (Dolichos sp.);
- Vegetables: talung pulat-kabayu (Solanum melongena L.), tambalyung (Cucurbitaceae), kamatis (Lycopersicum esculentum Mill.), and upu (Lagenaria siceraria);
- Spices: ladà (Capsicum sp. Sol.), li-a (Globba parviflora Presl.), dilaw (Curcuma longa L.), and lunga (Sesamum orientale L.);
- Fruit trees: lukban (Citrus sp.) and kalamunding (Citrus microcarpa Bunge);
- Dyes: tagum (Indigofera suffriticosa Mill.) and katutis (Bixa orellana L.); and
- Other crops: kapi (Coffea arabica L.) and burak (Gossypium herbaceum L.)

From this meager piece of land, Bugtong is assured of his household's basic necessities. He is not dependent on the outside market, especially for agricultural inputs. His swidden farm provides food security for his family and his extended kin group.

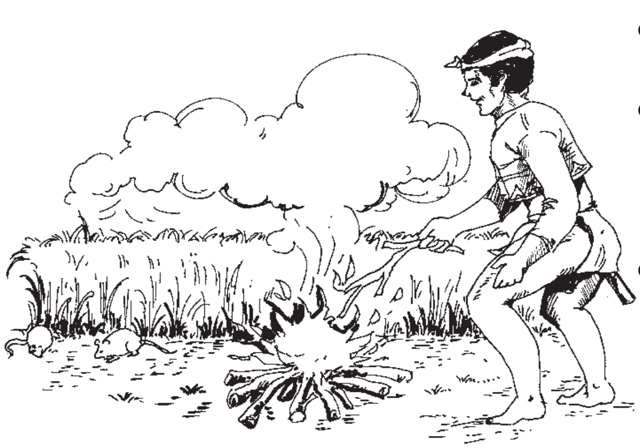
Use of organic pesticides

The Hanunoo Mangyans refuse to use chemical fertilizers and pesticides for their farms. It is believed that these chemicals frighten away the souls of crops. Instead, organic pesticides that are more cost-effective and which protect the soil from poisonous substances are used. The indigenous methods of pest control are:

- Intercropping acts as an organic check to pests.
- Some insects ward off other pests that feed on nearby plants.
- Batad (Andropogon sorghum) is grown beside the rice field so that its grains would attract sparrows, thereby, leaving the rice grains free from birds. The cultivation of lubang katangraw also serves the same purpose.
- Smudging, through the use of dried leaves, is used to protect crops from apsung (green leafhoppers). Mixing ladà (chili pepper) into the dried leaves is believed to be effective against the karikad (stemborer), tikalang (white worm), and atangya (Nephotettix sp.). The dried leaves are burned in a suitable location where the wind blows the smoke towards the direction of the crops.

Long fallow period

- Hanunoo Mangyan farming is characterized by short cultivation and long fallow periods.



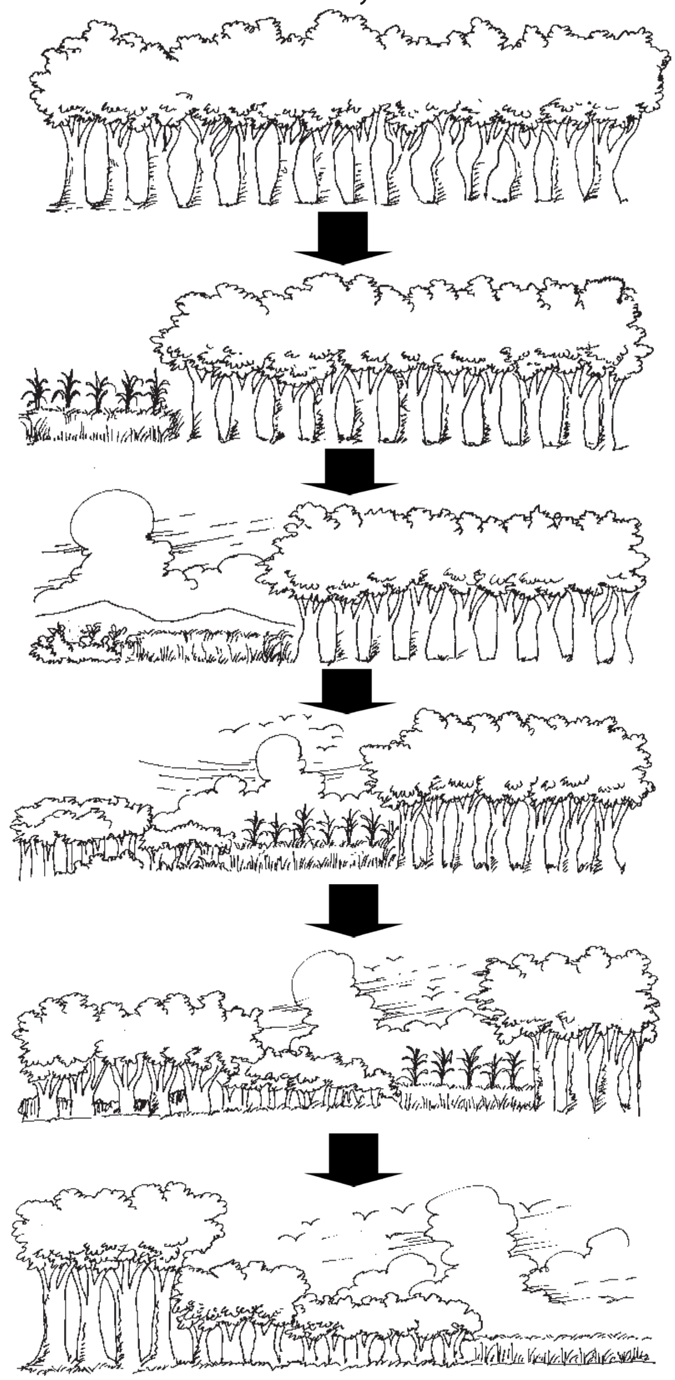
- Coconut oil is poured near anthills to prevent ants from going into the crops.
- In the late afternoon until the next morning, the farmer burns buthuan wood (froma rare tree found in the deep recesses of the forest) near the rice field to drive the rats away. Rats abhor the foul odor it emits.
- The tinawtawo (scarecrow) is erected within the rice field to drive the birds away. This is done especially during the months of May-June and November-December.

- The tanman is utilized for approximately three to five years. After that, the land is abandoned to allow the soil to replenish its nutrients.
- After another three-to-five-year period, the land is again abandoned in favor of a new location. He only returns to the original farm site if the said land has fully regained its productivity.

In the late 1950s, the fallow period observed by the Hanunoo Mangyans can extend up to 25 years. In recent years, however, the fallow period has become shorter because of limited lands to till. This is because lowland migrants have already appropriated most of the fertile lands. Thus, the fallow period has been shortened to 10 to 15 years.

The absence of the concept on private ownership prevents the Hanunoo Mangyans from clinging on to the same piece of land. Ownership is through the principle of usufruct (i.e. a farmer owns the land while he utilizes it). If he abandons the land, the land reverts to communal ownership.

The Fallow Cycle



Issues and challenges

- The sustainability of shifting cultivation will be undermined if the problem of land security is not addressed. The homeland of the Hanunoo Mangyans is slowly being eroded with the intrusion of lowland migrants. The State's recognition of the Hanunoo Mangyans' right to their ancestral domain has not yet been fully materialized. This is because of delays in the implementation of the Indigenous Peoples Rights Act (IPRA) (See Sacrificing Peoples for the Trees: The Cultural Cost of the Forest Conservation on Palawan Island, Philippines, pages 175-181 for more information on IPRA).
- There have been instances where some educated Hanunoo Mangyan youths have abandoned their traditional practices. This is due to their exposure to the ways of the Christian lowlanders. They tend to look at indigenous knowledge systems and practices as things of the past that run counter to modernization. If this trend continues, there is a threat that much of the indigenous knowledge will be lost. Thus, there is an urgent need to document the sustainable practices of our indigenous peoples and integrate these into modern-day realities.

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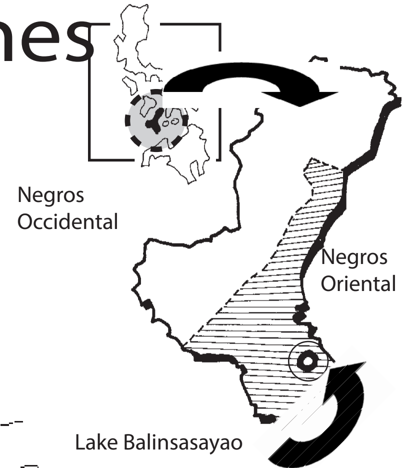
How Household Development Stages Influence Field Expansion among Swidden Cultivators Negros Oriental, Philippines



A household is a developing, progressive and dynamic unit. Under normal conditions, most households undergo a cycle of development stages which influence changes in household labor supply, production and consumption levels, and food supply.

In microeconomics, the household is considered the unit of production and consumption. Unlike their lowland farming counterparts, swiddening households depend largely on family labor and food obtained from crops grown in the swidden farms. What food products to consume, or how labor supply should be allocated are very important domestic concerns. While they may be self-sufficient, these households should be considered "open systems" since they may also work with other households. Consequently, the household development cycle affects the demographic and

Negros Island is located in the Western Visayas region of the Philippines. The island is divided into Negros Occidental and Negros Oriental, the latter, being dominated by a mountain called Cuernos de los Negros. This mountain is one of the last remaining watersheds and forest area in the whole Negros Island.

Negros Oriental is characterized by steep mountains and twin lakes beside the Cuernos. The main lake, Danao Balinsasayao, is surrounded by a forest that is home to four upland communities, namely Balinsasayao, Hanayhanay, Maningkao and Lansob.

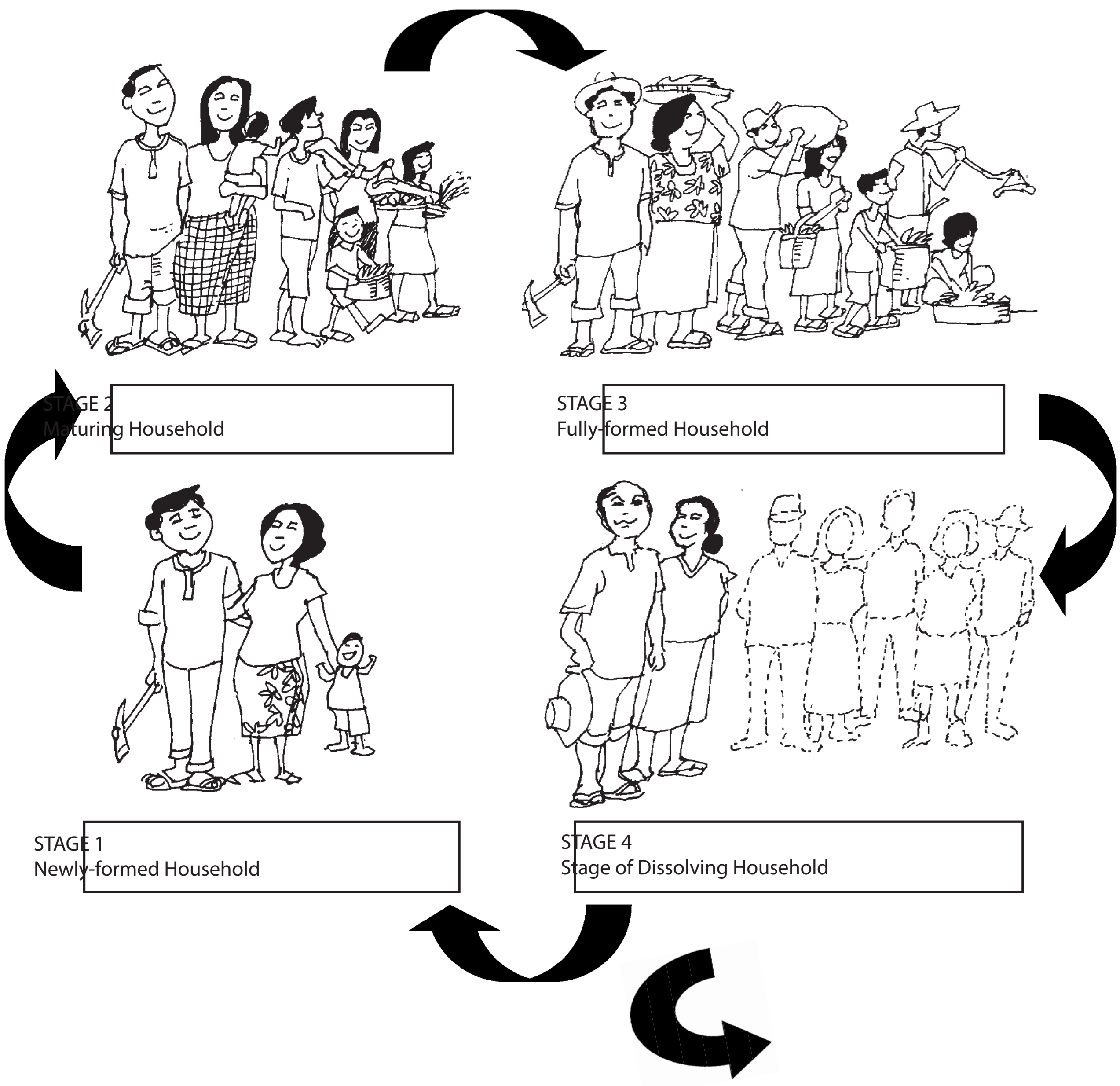
economic condition in the households.

A household undergoes four cyclical development stages. These are:

1. Stage 1. NEWLY-FORMED HOUSEHOLD. The husband and wife have one or two non-working-age children aged 0-6 years old.
2. Stage 2. MATURING HOUSEHOLD. The couple has 2-3 children already of working age (7-15 years) and several children below 7 years.
3. Stage 3. FULLY-FORMED HOUSEHOLD. Majority of the children are already of working age and provide additional labor to the family.
4. Stage 4. STAGE OF DISSOLVING HOUSEHOLD. Most if not all of the children have left home, leaving the couple on their own again.

This cycle is not applicable to households where children migrate early or choose to study outside the community.

Household Developmental Cycle Stages



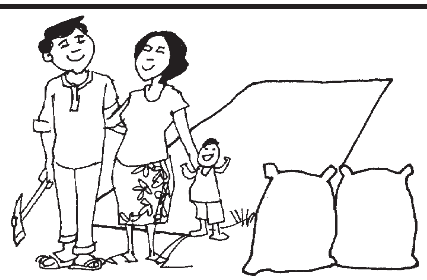
Among the families of Balinsasayao, their only sources of food and livelihood are from swidden farming and from fishing in the lake. Typically, as each family grows with the arrival of children, food supply and labor availability changes. These changes have great bearing on the decision to expand or reduce the area of swidden fields. The following study investigated these relationships.

Interaction of labor supply and food supply

The different household development cycle cases had different levels of labor supply and different food production and consumption levels. All food production and consumption per capita per month were computed. Food production was measured using the standard caloric value table prepared by the Food & Nutrition Research Institute. As each household grew and as more children were able to work in the fields, food needs and labor supply increased.

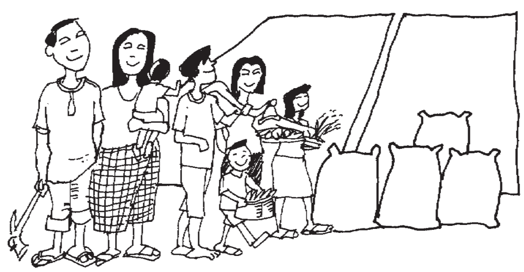
> During the study, food items were carefully weighed and their caloric content taken before they were consumed.

1



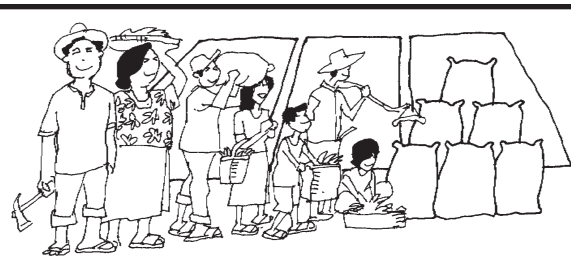
- Food supply from the initial swidden field is enough for the household
- No expansion of swidden field
- Labor supply is low

2



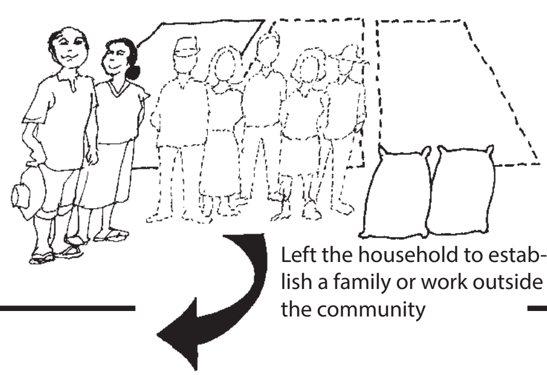
- Deficit in food supply
- Farmer increased size and number of swidden fields to produce enough food for his growing family
- Labor supply is low

3



- Food supply moderate
- Existing swidden field maintained because more family members can work the fields and intensify cultivation
- Labor supply is high

4



- Food supply surplus
- With the children gone, the farmer reduces the size of his field, but produces enough food supply to meet their needs
- Labor supply is low

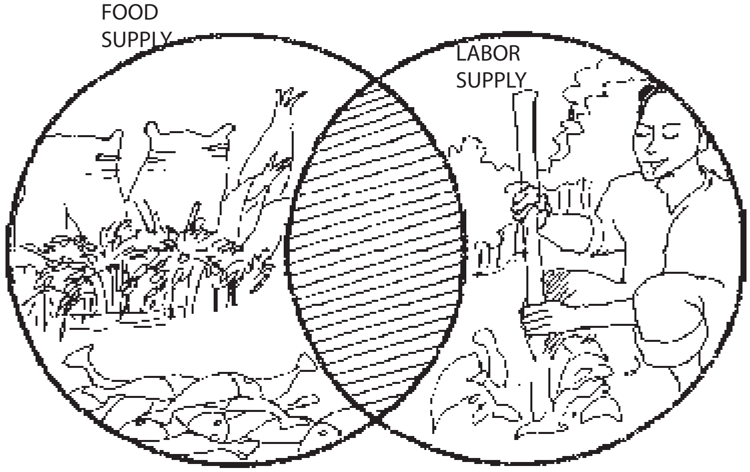
These conditions affected the food supply obtained from the swidden field. It was observed that in a newly formed household (Stage 1), food supply was enough since it was more than what the household consumed. This can be attributed to the fact that with only one child to support in terms of food, the father and mother found it easy to provide for their caloric needs.

However as more children were born, food supply became unfavorable because consumption was now greater than what was produced by the couple in their original farm (Stage 2). Caloric consumption was 38% higher than caloric production per capita per month (Table 1). It is normally at this stage where the farmer experiences a

Table 1. Labor supply and food supply among the household cycle cases in Balinsasayao, Negros Oriental.

Household Cycle Stage	Average Total Caloric Production Per Capita Per Month	Average Total Caloric Consumption Per Capita Per Month	Household Size	Labor Force	Food Supply Conditions
Stage 1	41,181	38,618	3	2	+
Stage 2	47,220	65,158	7	4	-
Stage 3	44,542	45,248	10	10	+ -
Stage 4	66,425	56,740	3	3	+

significant deficit of food supply, hence, economic stress is experienced. But as the children matured and were able to help their parents in the field (Stage 3), the household was able to maintain its caloric production and consumption levels at a tolerable level. The (+ -) sign indicates moderately favorable food supply condition.



As the interaction between food supply and labor supply increases, the tendency to increase the size of the swidden field strengthens.

In the dissolving household (Stage 4), all children except one have left home to start their own families. This household stage had the highest per capita caloric production. With the household requiring less food, food supply condition was again favorable (+). This was also the time when the farmer reduced the size of his cultivated field and concentrated on his home garden.

Among the household cycle cases, the decision to increase or decrease the size of the swidden field cultivated by each family depends greatly on the interaction between labor supply and food supply.

Among the Balinsasayao upland swiddeners, the maturing household case expanded swidden fields because:

- There is an increasing level of food needs and labor supply.
- There is a significant deficit in food supply condition caused by the increased caloric consumption vis-à-vis production in the household.

The Balinsasayao farmers expand their areas using either of these strategies:

- Buying or leasing swidden fields
- Exchanging material goods with swidden fields
- Clearing an additional area in a cultivated field
- Clearing a primary forest area.

The household cycle stage, which does not prefer to expand swidden clearings would:

- continue cropping a cultivated area;
- diversify cropping of existing swidden field; and
- reduce the land area cultivated and improve crops planted in the remaining field.

The responses of the household also depend on the availability of labor and the types of household cycle stages. Therefore, it may also happen that other swidden household cycle stages may possibly respond based on other non-economic and non-demographic reasons.

Other non-swidden activities:

- forest product gathering and collecting;
- hunting of wild boar, birds, monitor lizards, and bats;
- wage on-farm and off-farm labor;
- raising livestock and poultry;
- fishing;
- lumber sewing;
- boat-making;
- wage labor in other farms; and
- abaca-hand stripping.

Ecological concerns

There are two particular ecological concerns in Balinsasayao area

- As long as the household develops and swidden expansion occurs, forest resources will continuously be exploited. This will cause the instability of the forest ecosystem.
- There is a rapid conversion of the remaining forest areas in the same area for agricultural production. Soil, erosion overgrazing, heavy siltation and flooding are the consequences of deforestation that has to be controlled and prevented.

Challenges

Swidden farming is not simply slashing and burning of the forest for economic reasons. It is a livelihood that sustains the needs of the swidden cultivator's family. The impact of swidden farming may be perceived by some governments, environmentalists and academicians as detrimental. But for the ordinary swidden farmer, it is the economics of the household that counts. Unless there are alternatives that could readily respond to the demographic changes of the household and their production-consumption needs, there will always be swidden cultivation in Balinsasayao, Negros Oriental.

It is therefore proposed that the household level, conditions of labor, food supply, structural development and the production-consumption disparities should be considered as the central point of analysis in designing development programs for a sustainable swidden cultivation.

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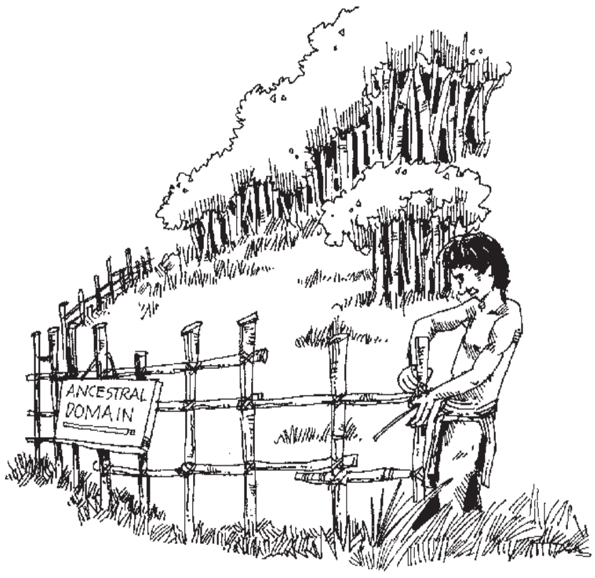
The Cultural Cost of Forest Conservation on Palawan Island, Philippines: "Sacrificing People for the Trees"

Over the past few years, the zoning of protected areas into management categories has become the new paradigm of so-called integrated conservation-development projects(ICDPs). A review of recently enacted environmental laws in the Philippines and of ongoing conservation measures in Palawan, such as the ban on shifting cultivation, indicates that a wide divergence of interests exists between the desires and the needs of the native communities and the government and environmentalists' objectives to conserve natural habitats. In Palawan, the zoning of protected areas based on the biodiversity criteria is curtailing local subsistence practices. On the other hand, even new legislation on ancestral land claims needs to be improved in order to reflect indigenous notions and perceptions of the environment.

Zoning indigenous land: From ejection to marginalization

In recent years, environmentalist discourse in the Philippines has apparently changed its approach. The old, strictly punitive protectionism is now being replaced by an equally dangerous 'people-oriented' conservationism. Indigenous communities, entrapped in large or medium scale biodiversity projects are no longer evicted from their territories as in the case of the 'St. Paul Park'; instead they are allowed to stay in selected areas on the condition that they 'live in harmony' with nature. Thus, they become 'marginalised' in their own land. By the same token, their culture is re-defined by experts in a way that appears ecologically sound and satisfies policy makers, project planners and funding agencies.



Today, many large-scale environmental protective measures in Palawan – and in the Philippines in general – include the demarcation of areas as either off-limits to human population, or reserved for local 'indigenous cultural communities' (ICC), or both. Local communities are expected to limit or refrain from certain subsistence activities when their territory becomes divided into management zones with different levels of protection (from strictly non-touchable to controlled use). This is done with the National Integrated Protected Area System or NIPAS.

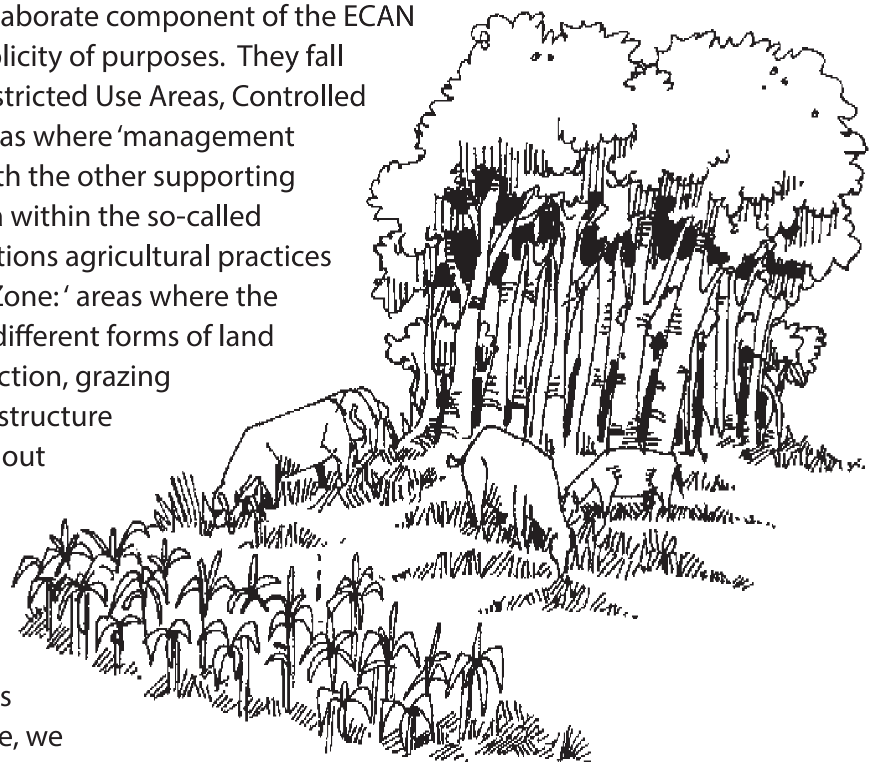
Taking a provocative stand, it could be argued that the NIPAS' objective to reserve areas for the purpose of leaving societies in harmony with the environment and 'free' to adopt the modern technology in their own terms, is not substantially any better than forcing them to move out. Thus, they become 'locatable' and 'being locatable, local peoples are those who can be observed, reached and manipulated as and when required.'

As established by the NIPAS, total protection is likely to be enforced in areas defined as Strict Nature Reserve: 'possessing some outstanding ecosystem, features and/or species of flora and fauna of national importance'; Natural Park: 'relatively large areas not materially altered by human activity where extractive resource uses are not allowed'; National Park: 'forest reservation essentially of natural wilderness character which has been withdrawn from settlement, occupancy, or any form of exploitation'; Wildlife Sanctuary: 'areas which assure the natural conditions to protect nationally significant species, groups of species, biotic communities'.

On the other hand, human occupancy and resource utilization are contemplated in categories such as Protected Landscape/ Seascape: 'areas of national significance which are characterized by the harmonious interaction of man and land'; Natural Biotic Area: 'an area set aside to allow the way of life of societies living in harmony with the environment to adopt modern technology at their pace.'

In Palawan, criticism can be applied to the Strategic Environmental Plan (SEP). The centerpiece of the strategy is the establishment of the Environmentally Critical Areas Network (ECAN), which places most of the province under controlled development. The areas covered by ECAN include three major components: Terestrial, Coastal/ Marine and Tribal Ancestral Lands. Core Zones are defined as areas of maximum protection and consist basically of steep slopes, first growth forests, areas above 1000 meters elevation, mountain peaks, and habitats of endemic and rare species. The law establishes that core zones 'shall be full and strictly protected and maintained free from human disruptions… exceptions, however, may be granted to traditional uses of ceremonial and medicinal purposes.' Interestingly enough, the ECAN core zone coincides with significant portions of the indigeous hunting and gathering grounds. For instance, the resin of Agathis trees is usually extracted in commercial quantities around and above 1000 meters above sea level. In addition, several game animals, and especially flying squirrels (Hylopetes nigripes nigripes) are trapped for food around these altitudes.

Buffer Zones represent the most elaborate component of the ECAN and are designed to serve a multiplicity of purposes. They fall into three categories known as Restricted Use Areas, Controlled Use Areas, and Traditional Use Areas where 'management and control shall be carried out with the other supporting programs of the SEP.' The only area within the so-called Terrestrial Component which mentions agricultural practices is the Multiple/ Manipulative Use Zone: ' areas where the landscape has been modified for different forms of land use such as extensive timber extraction, grazing and pastures, agriculture and infrastructure development.' It is crucial to point out that a large number of indigenous communities are occupying marginal upland areas, which fall under the wider definition of buffer zones. Furthermore, the law never mentions indigenous shifting cultivation practices; hence, we may easily come to the conclusion that only imported methods such as terracing and hillside farming will be allowed in Multiple/ Manipulative zones. There is no specific indication of where such zones are located but it is legitimate to anticipate that these areas are occupied by a vast majority of migrants rather than by 'traditional' indigenous communities.



It is clear that SEP, with a high degree of naivety, proposes the protection of indigenous culture on the one hand, and the implementation of western zoning criteria in tribal lands on the other. So far, the law and its promoters have been unable to provide a convincing argument of how this can be achieved.

One may gain the impression that local communities are allowed to live within a protected area on the condition that they obtain from the forest what is strictly essential to satisfy basic subsistence needs. Undoubtedly, this expectation matches conservationists' perception of the ideal interaction between man and nature.

It should be stressed that environmental laws such as the NIPAS and the SEP are not concerned with the protection of the land but rather of landscapes. In Section 2 of Republic Act 7586

(NIPAS Law), we learn that the 'policy of the state (is) to secure for the Filipino people of present and future generations the perpetual existence of all native plants and animals through the establishment of a comprehensive system of integrated protected areas, and that the 'use and enjoyment of these protected areas must be consistent with the principles of biological diversity and sustainable development'. As has been noted by Ingold, land and landscapes are not the same thing at all. The latter may be constituted by rocks, trees, streams, lakes, caves, and so on, or a combination of these. On the other hand, land is rather 'the common denominator of the natural world' (Ingold 1996:154), which also includes people.

The indigenous groups living in Palawan do not only hunt and gather but also practice shifting cultivation, which is their major productive activity. Access to forest resources and foraging grounds is open to every member of society. Individuals may claim rights to specific resources, but not to the land where such resources are found. To give an example, an area covered by baktik (Almaciga philippinensis) trees is 'managed' by several individuals, each in charge of specific trees. However, not all forest products (rattan canes, game animals, fish, etc.) are subject to individual rights. Patches of forest with valuable fruit trees (such as daraq (Nephelium mutabile), bulnuq (Mangifera caesia) wani (Mangifera odorata), luwad (Durio zibethinus), dugjan (Durio graveolens), bamboo groves, caves where swallows are abundant and other land features derive their significance from the relationship that people have established with such features, either in the historical past or through mythological events. Hence, trees may serve to trace back a relation with those members of the previous generation who first planted or utilized them over the years. All these features have a time dimension which creates a stable link between past and present, and they serve to constitute the indigenous country.

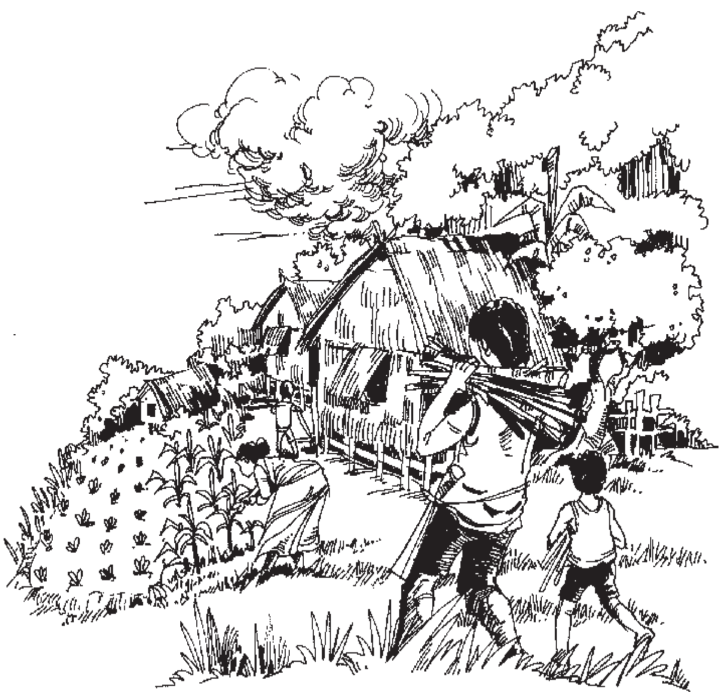
Towards a 'Pro-Native' legislation: Innovation or illusion?

What is perhaps surprising is that only the NIPAS and the SEP but also laws which have been specifically conceived to enhance indigenous land rights might not bring great advantages to the local communities, but rather increase the efficacy of government power and control over them. The identification and demarcation of ancestral lands in Palawan is in line with the constitutional mandate for the recognition and protection of the rights of indigenous communities. On January 15th, 1993, the Department of Environment and Natural Resources (DENR) in the Philippines enacted Special Order no. 25 for the creation of a task force responsible for identifying, delineating and recognizing ancestral lands and domain claims. A more recent act is the 'Indigenous Peoples' Rights Act of 1997' (also known as Republic Act No. 8371) which recognizes, protects and promotes the rights of indigenous cultural communities. The legislation on ancestral lands represents a very fundamental step in favor of the indigenous peoples. On the other hand, most of its definitions dealing with land and the environment imply utilitarian criteria of human action and thus do not represent epistemologically valid concepts for indigenous societies to whom these notions are applied. This does not mean that the recent government effort to protect indigenous peoples' land has to be jettisoned. On the contrary, I rather question the very lengthy and complex procedures related to the final recognition of the ancestral domain.

To give an example, Article One of the Department Administrative Order No. 02, S, 1993, sets the basic policy and objectives for the identification, delineation and recognition of ancestral land and domain claims. In this respect, I do believe that Ingold touches a very relevant point when he claims that the notion of tenure 'implies man's subjective transcendence of the natural world: one cannot appropriate that within which one's being is wholly contained.' (See Resource Tenure Systems and Stabilization of Shifting Cultivation, pages 55-60, for more discussion on Tenure Policy).

The 'ancestral land legislation', the DAO #2, S1993, is characterized particularly by the rather complicated procedure that indigenous claimants have to follow in order to apply for the Certificate of Ancestral Land Claim. As is specified in Section 5 of the DAO #2, people are expected to submit proofs of their land claims. These include 'the testimony of the elders of the community under oath and other documents directly or indirectly attesting to the possession or occupation of the area since time immemorial', 'written accounts of indigenous customs and traditions, political structure, survey plans, anthropological data, genealogical survey, photographic documentation of burial grounds, agricultural improvements, hunting grounds, traditional landmarks, etc.' Paradoxically, the indigenous peoples are asked to utilize western analytical tools to interpret, document, and explain their own culture. Therefore, if local communities want to enforce their land claims, they need to request the assistance of foreign experts, NGO representatives and government officials. Again, it is the authority of western scientific methods to provide the criteria for what constitute legitimate ancestral rights over land. On the other hand, local criteria of validation of land claims are not fully taken into account.

Aside from the problems caused by outsiders' interpretations of indigenous desires and aspirations, there are more practical factors delaying the whole process of government recognition of indigenous land claims in Palawan. So far, efforts to survey and delineate indigenous ancestral lands have been slow, due partly to a shortage of government funds and staff allocated to the tasks, and also to the inability of the DENR to carry out its own legislation. Not surprisingly, three years after its submission, the documentation for Batak ancestral land claims is still pending approval in the DENR regional office. While bureaucratic procedures proceed, very slowly, for the identification, delineation and recognition of claims to ancestral lands and domain, Batak territories are being occupied by Filipino migrants. Forest areas with valuable timber forest products (NTFPs) such as Agathis resin and rattan canes are being given in concession to outsiders, before ancestral rights are granted. As a result, the potential for future income from commercial gathering by indigenous peoples is highly reduced or virtually lost.



Even in Southern Palawan government recognition of indigenous land rights is far from satisfactory. For instance, in the municipality of Rizal, the endorsement of ancestral domain claims has already encountered the strong opposition of the local authorities. In October 1996, the former mayor stated that the endorsement of ancestral land claims "for a handful of men is contrary to the ideals envisioned in our Constitutions for equitable access to the natural resources, and violates our Land Reform Law which allow only five hectares of land for an individual Filipino".

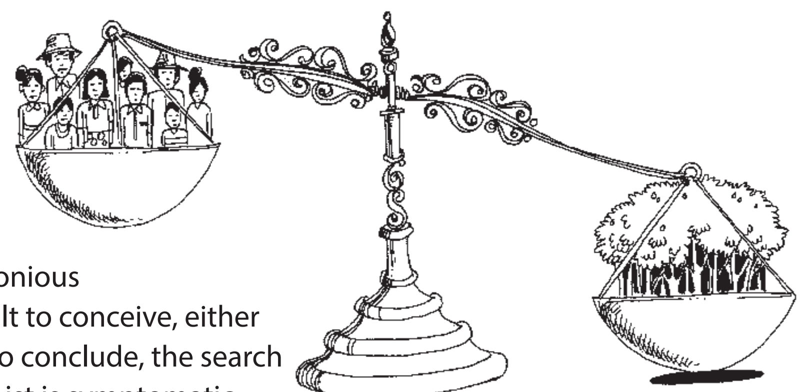
The impact of the ban on shifting cultivation

A number of infamous government policies aside from zoning are being implemented in Palawan. One of the most unpopular is the ban on kaingin (slash-and-burn farming). In the Municipality of Puerto Princesa, the city government is quite determined to stop forest destruction, which it blames on shifting cultivation. In a letter to Survival International dated 28 March 1996, the city mayor, Edward Hagedorn, admits that "the farmers (including the tribal groups)… were adversely affected by the policy." On the other hand, he claims that necessary support and assistance are being provided to soften the impact of the ban. We learn that such remedies consist of "cash-for-work programs, rice subsidies, and permanent mechanisms such as the carabao (water buffalo) and tractor pools, the provision of seedlings and the introduction of various livelihood opportunities including training and initial capitalization grants" and the introduction of alternative farming methods. However, according to the affected communities, the promised rice supplies had not come through, and hundreds of people faced starvation.

Many of the 'remedies' proposed by the mayor face long-term and deep-seated constraints to effective implementation. In the first place, the transition to permanent cultivation in the uplands is frustrated by the unresponsive soil, commonly deficient in micro-nutrients. In addition, 'traditional' indigenous cultivation practices in Palawan are better suited to tropical conditions than many imported agricultural methods. If many communities are currently forced to shorten the fallow period on swidden fields or to plant on very steep slopes, this need not to be considered a cultural feature of the local indigenous groups but rather their ultimate response to the drastic reduction of land and inadequate government policies. Furthermore, it is interesting to note that indigenous swiddeners in Palawan usually use secondary and tertiary forest which is grown during the fallow period rather than primary forest. In fact, the latter would need a higher energy expenditure to be chopped down. Traditional planting techniques are also ecologically sound, since the dibble stick does not disturb the fragile forest soil below a depth of a few centimeters.

Despite these facts, the ban on slash-and-burn agriculture has been implemented, with disastrous consequences both for the environment and for the survival of the local indigenous communities. The ban was recently partially lifted in favor of 'regulated burning,' but until now, indigenous peoples have found it very difficult to maintain their traditional swidden practices.

On the other hand, the idea of granting land occupation privileges to an 'imagined community' living in balance with nature virtually excludes all the others. It is well recognized that many indigenous groups have been forced to adopt less sustainable practices of land utilization as a response to the dramatic ecological and social changes taking place in their territory. Hence, in Palawan, 'a harmonious interaction of man and land' is now difficult to conceive, either as a theoretical or a practical possibility. To conclude, the search for the authentic indigenous conservationist is symptomatic of a hysterical awareness especially among western ecologists that the 'noble savage' living in harmony with nature does not exist in the real world and therefore it must be created. So, using an expression of Lohman, indigenous peoples continue to be 'recruited as subcontractors to build our own utopias.' This construed and romanticized image of 'pristine forest dwellers' invented in the west and constantly reproduced by the media has now become 'agentive' and influential just as the real one, thus determining the ways in which indigenous communities should be 'managed', 'assisted' and, possibly, 'improved'.



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Dario Novellino

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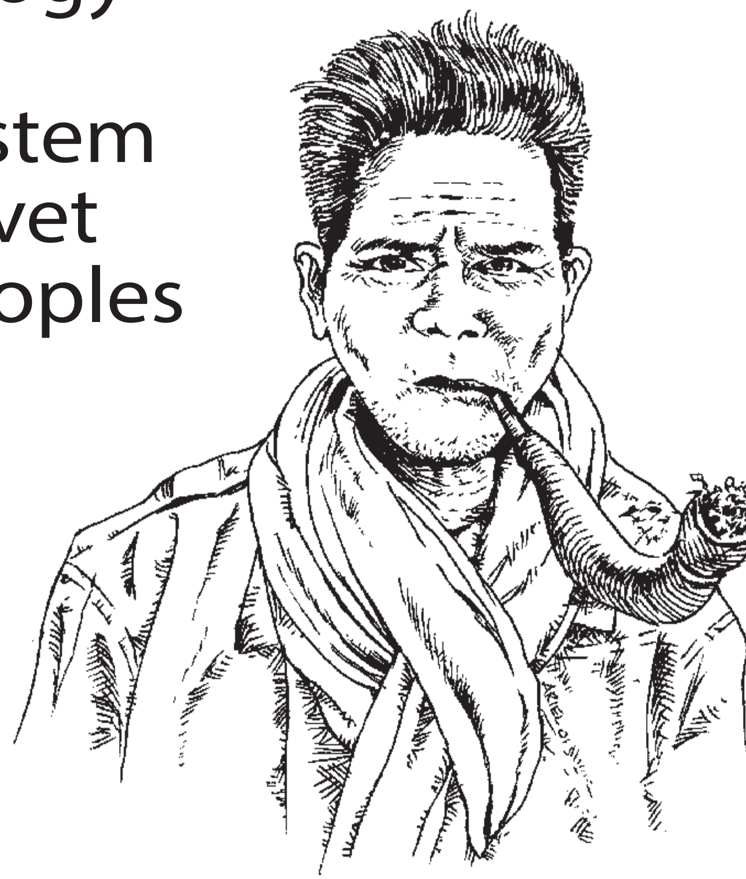
The Ethnoecology and Swidden Agriculture System of the Brao-Kavet Indigenous Peoples of Ratanakari Province, Northeast Cambodia



The Brao-Kavet are an animist Mon-Khmer Western Bahnaric language speaking group of indigenous peoples with a long history of inhabiting the remote, hilly and densely forested region that straddles southeastern Laos and northeastern Cambodia. In northeastern Cambodia, their traditional territory comprises almost all of Cambodia's largest National Park, Virachey.

The Brao-Kavet practice a traditional form of rotational subsistence-oriented swidden agriculture in hilly areas 150-600 m above sea level. Their agricultural system has been developed over generations, and is founded on a high level of Local Ecological Knowledge (LEK). Swidden plots are generally between one and three hectares in size (1.5 hectares on average), and 181 different crop types are regularly cultivated, including 36 varieties of upland rice and 145 other types of annual and perennial crops. The average family cultivates between three and seven varieties of rice, and 60 to 100 types of other crops in each swidden plot. Although a number of forest types are utilized for swidden agriculture, bamboo forests are the main and preferred habitat type to be cut and burned for agricultural purposes, with areas generally being cultivated for two years. All crops are cultivated for the first year, with only a limited number being planted during the second year. However, some perennial crops may be harvested from fallow areas for years after. The land is then left to return to forest, before being re-cultivated after a number of years, depending on various factors, including forest re-growth rates, soil fertility and spirits.

The study

In July 1999, a participatory field-based study was initiated regarding the livelihood systems and ethnoecology of the Brao-Kavet peoples living in Voen Say District, Ratanakiri Province, Northeast Cambodia. Initially, a "Participatory Landscape Ecology, Wildlife Habitat Assessment and Mapping Training Workshop" was organized, in which 20 Brao-Kavet forest and wildlife "experts" from four villages in Kok Lak Commune, officials from the Ministry of Environment and Virachey National Park, and project staff from the non-governmental organization (NGO) supported Non-Timber Forest Products (NTFP) Project participated. During the training, a number of methods adapted from participatory rural appraisal (PRA) techniques were presented, including:

1) "Free listing" activities to generate an indigenous list of Brao-Kavet language "forest" types;
2) "Ranking" exercises designed to investigate forest habitat and agriculture suitability associations;
3) "Habitat/season wildlife usage matrices" designed to provide information about seasonal wildlife behaviour; and
4) "PRA mapping" to investigate spatial relations and resource use patterns.

> Ethnoecology is defined as the way in which people evaluate, classify, label and reject or use all the resources, biotic and abiotic, of their ecosystem.

Following the initial workshop, follow-up work was conducted in a number of stages, culminating in a detailed field survey conducted with Brao-Kavet peoples in parts of their traditional territories within and adjacent to Virachey National Park in February 2000. Conducting forest treks with Brao-Kavet "experts" was the foundation of this work.

The main objectives of the field survey were to:

1) Investigate and expand on the ecological classification system outlined by the Brao-Kavet people from Kok Lak Commune in 1999.
2) Investigate the general ecology and status of wildlife, fisheries and non-timber forest product resources in Kok Lak Commune.
3) Investigate the swidden and lowland wet rice agriculture systems of the Brao-Kavet in Kok Lak Commune, including their ecological, socio-economic and cultural implications.

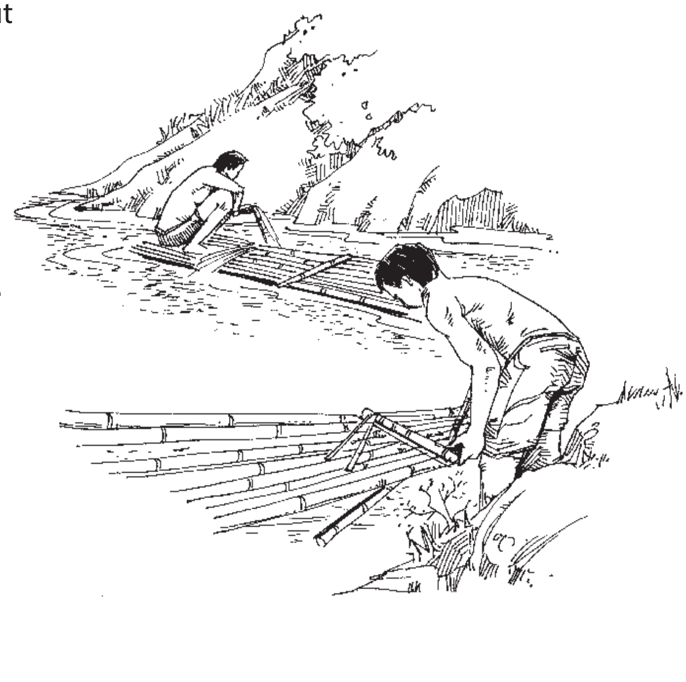
Results

"Bree" and "Dak"

The Brao-Kavet have a remarkable system of ecological classification which recognizes at least 108 land-based categories. Being heirarchal, descriptions can range from the very broad to the very specific. Further, it is oral-based and incorporates Brao-Kavet experiences, culture and beliefs. It is essentially based on two general Brao-Kavet language ecological terms: "bree" and "dak". "Bree" is often translated as "forest" in

English, but in fact means "the condition of the land". A "bree" can be a forest, since forests often dominate the "the condition of the land", but "bree" can also be used to describe areas that are not normally categorized as "forests". For example, the Brao-Kavet call grasslands "bree treng" (short vowel), and salt licks are known as "bree graik". Areas covered entirely in flat slabs of granite, with virtually no vegetation present, are known as "bree ta tar", or "bree ta maw ta tar". "Bree" types are sometimes named after dominant species of plants, but "bree" is not used to describe individual plant species. Instead, "bree" types represent ecological areas, or biotopes.

While "bree" habitats are only found in terrestrial areas, "dak" localities are only within river and streambeds up to the top of their banks. "Bree" terms exist for all terrestrial lands, and "dak" areas make up all the aquatic habitats. "Dak" means "water" or the "condition of the water". Therefore, the Brao-Kavet do not classify seasonally inundated forests found in a riverbed as a type of "bree", because even though they are "forests", they are found in essentially "dak" areas. However, areas adjacent to, but outside of river and streambeds that are flooded annually are considered "bree" areas, regardless of the extent to which they are flooded each year. These areas include "bree trang" (pandus grass forests flooded annually) and "bree a-ra cheu" (a type of bamboo forest found in lowland floodplains). "Bree ja-naw", or stream forest, is found only outside the streambed, but adjacent to it, on top of the stream banks. The term "bree-dak" is commonly used by the Brao-Kavet, which essentially means "natural resources". It is significant that two of the Brao-Kavet's most commonly referred to spirits are "Arak Bree" (spirit of the land) and "Arak



Dak" (spirit of the water). The cosmology of the Brao-Kavet is clearly closely linked to the way they classify the natural world.
Although the Brao-Kavet are not in entire agreement regarding exactly what areas are ecologically significant enough to be called "bree", our investigations have determined that they generally recognize at least 108 basic land-based ecological classification categories, or "biotopes". 21 "bree" types are considered to represent "broad ecological classes", 12 are based on "topographical" or landform features, six represent "successional stages", seven are based on "pedologic" or soil characteristics, 57 are based on "dominant plant species" and five fall into the "miscellaneous" category.

The 108 ecological "bree" classes used by the Brao-Kavet are commonly combined to allow users to describe ecological areas in detail. For example, the term "bree baw-jeung-jun-dou" combines two base "bree" terms, "bree baw" (a type of forest dominated by a particular bamboo species) and "bree jeung-jun-dou" (an area in the foothills of a mountain). Therefore, the composite term means a type of bamboo forest found in the foothills of a mountain.

The Brao-Kavet's creative combination of ecological classification terms is not standardized, and is based on an oral tradition. Therefore, Brao-Kavet people do not always classify the same areas in exactly the same ways, and the knowledge of Brao-Kavet people varies from person to person. However, the Brao-Kavet rarely use contradictory terms to describe the same area. Instead, differences in classifications are often based on the level of importance put on particular habitat characteristics by individuals. For example, if a person is concerned with the state of the soil in a particular area, the soil classification terms will be used to describe it, and if dominant plant species are of concern, the area will be described according to dominant species terms. This essentially means that the same area can be described in many different ways, according to need. The creative combination of terms also indicates that there are actually many more than 108 classes of "bree", and that there are an infinite number of ways to describe the same ecological areas in Brao-Kavet language.

Place Names

Apart from classifying landscapes into ecological areas, the Brao-Kavet use "place naming", a "universal tool of the historical imagination" as an important means for communicating where certain areas are found. In fact, place names are more commonly used than ecological classification terms. Mountains, streams, places where "events occurred", and former and present swidden fallows are the most significant places named by the Brao-Kavet.

Eco-Regions

Apart from recognizing a broad range of ecological terms for individual habitats or biotopes, the Brao-Kavet also perceive broader ecological zones, or eco-regions, in which a large number of individual biotopes are found. In Kok Lak, four eco-regions or "levels" are recognized. The first is in the lowlands from the Se San River up to the foothills to the north, and the next three "levels" extend one by one to increasingly higher elevations until reaching the border with Laos. Each eco-region contains a unique assemblage of "bree" and "dak" habitats, although many biotopes are found in more than one "level".
It appears that these broad ecological classes provide the Brao-Kavet with a means for

communicating broad ecological concepts. Interestingly, the Brao-Kavet hierarchical ecological classification system is not unlike systems used by ecologists for classifying ecological regions.

Apart from classifying according to horizontal classification, the Brao-Kavet also classify both "bree" and "dak" habitats according to vertical classification, although this aspect of their ethnoecology has not yet been studied in detail.

Spirits and Beliefs in Nature

As strong animists, spirits influence all aspects of the lives of most Brao-Kavet people, and a number of kinds of spirits are recognized. Spirits are believed to be more common and dangerous in deep forest areas far from human settlements. Therefore, when in the forest, Brao-Kavet consultants required that we not yell or call to each other when other members of our group were out of sight, as calling someone deep in the forest can attract dangerous "tiger spirits". In addition, the two largest mountains in Kok Lak Commune, "Haling" and "Halang" are especially significant to the Brao-Kavet, who have strong taboos against hunting and conducting swidden agriculture on the mountains. Only a few plants can be carefully harvested after conducting special ceremonies. Bad things about other people cannot be uttered on the mountains, and only the Brao-Kavet language can be spoken, since other languages might anger the spirits.

A number of important ecological areas for the Brao-Kavet are associated with the occurrence of spirits. For example, "bree wang-houng", "bree ga-wang", and "bree gout-ja-naw" are all highly associated with spirits, and there are often restrictions associated with the use of these habitats. "Bree dom" was explained to us as being ecologically the same as "bree greung" (the oldest growth forests). However, "bree dom" are inhabited by some of the most powerful spirits, which prevent people from entering their forests or acting in certain ways when inside them.

The Present Condition of the Brao-Kavet in Kok Lak Commune

Many of the Brao-Kavet from Kok Lak Commune want to practice swidden agriculture in old fallow "bree baw" bamboo areas, both inside and adjacent to Virachey National Park. Before starting our fieldwork, some Brao-Kavet presented an informal but well thought out proposal that they hoped would be seriously considered by the Government. They want to be allowed to do swidden agriculture in an approximately four km2 area situated in the southern-most part of the park, and another larger tract of land outside of the protected area. However, in recent years almost all the people in the four villages in Kok

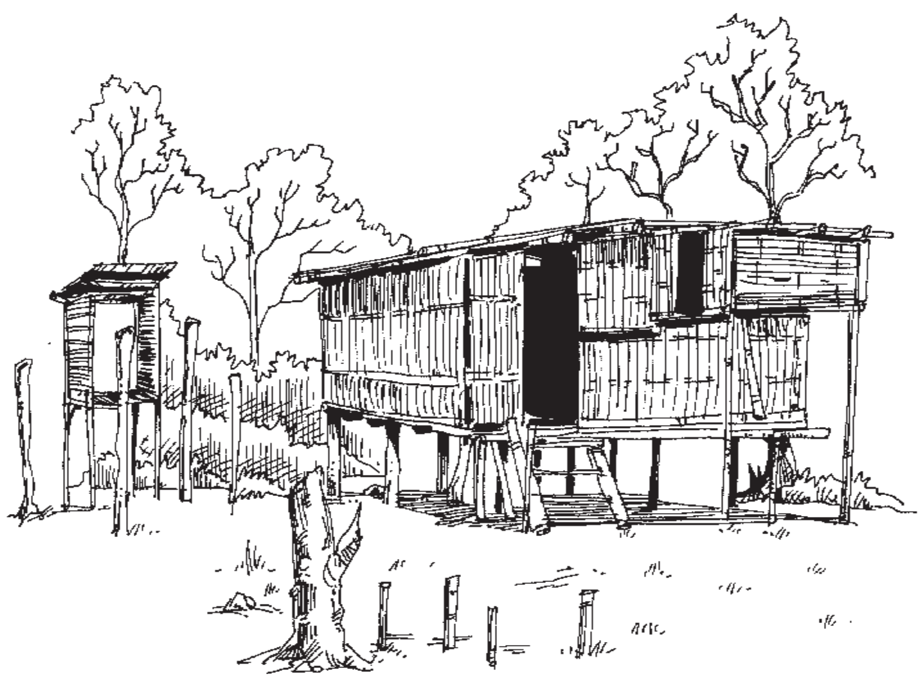
Lak (all populated by Brao-Kavet) have been pressured into living in lowland areas near the Se San area, outside of their traditional territory and in the traditional area of the ethnic Lao, who have long lived in villages situated adjacent to the Se San River.

The Brao-Kavet have been encouraged to live a "settled" existence and adopt lowland wet rice agriculture and reduce or stop conducting swidden agriculture.

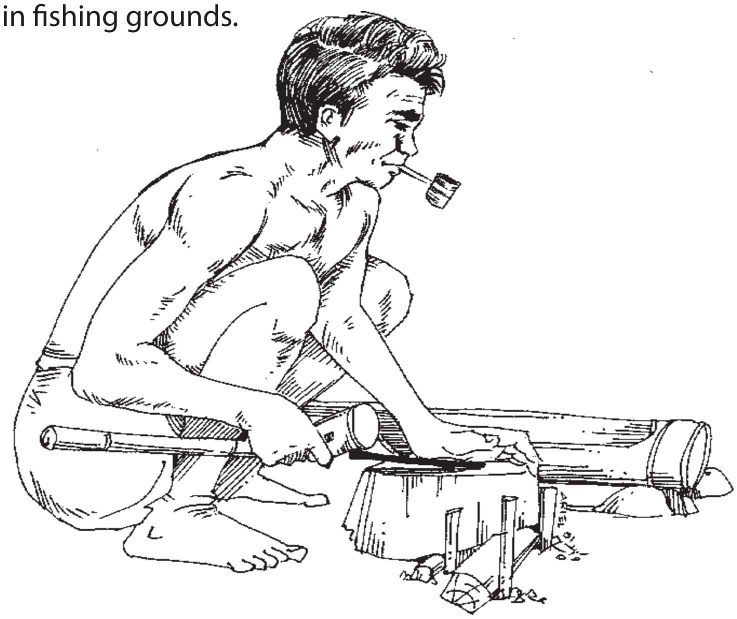
The Brao-Kavet have adapted poorly to not living in their traditional territories, as their swidden agriculture is not a very successful strategy in the lowlands, due to the presence of imperata grasses, which make forest re-growth in fallow swiddens difficult. Moreover, regular burning of the forests and grasslands by the ethnic Lao to encourage new grass growth for livestock rearing and open areas for hunting has contributed to serious ecological problems that have caused old growth forest areas to become converted to imperata grasslands in just one swidden cycle. Moreover, there are insufficient areas suitable for converting to lowland paddy, and high human density in the villages has made NTFP gathering and foraging difficult. Food security problems are serious, and virtually all the families in Kok Lak were seriously short of rice, their staple grain, in 1999/2000, forcing them to eat wild tubers and other forest products as a strategy for eeking out a meager and precarious living.

Brao-Kavet Swiddens

A few Brao-Kavet are resisting government efforts to "settle" them, and are continuing to conduct traditional swidden agriculture in hilly areas in and adjacent to Virachey National Park. Most of them are not suffering food serious shortages. We observed that most of the presently functioning swidden areas, as well as fallows, in the hilly areas (eco-region 2) are situated in relative lowland areas, and we did not observe any swidden



plots in very steep areas or on the tops of mountains. The Brao-Kavet never cultivate the tops of mountains, as they believe that the soils there are not suitable for swidden agriculture. High mountain areas also become excessively dry in the hot season, causing banana trees and other crops that normally survive the dry season to perish. In addition, high mountain areas are far from perennial streams and rivers, which are the main water sources for the Brao-Kavet, and are also the main fishing grounds.



Situating swidden plots in the relative lowland valleys of hilly and mountainous areas has significant implications in terms of reducing soil erosion associated with swidden agriculture, and for encouraging good re-growth during fallow periods. When the tops of mountains are maintained intact, they act as important sources of seeds for reforesting fallow swiddens below. Bird and wildlife also play an important role in reseeding fallows.

The Brao-Kavet choose the places where they conduct swidden agriculture carefully, and generally avoid cutting the largest trees in the forest, unless there are no other suitable areas available, as is presently the case in lowland areas near where the villages in Kok Lak are located. Old forests are generally not cut because the labour required to do so is much greater than for cutting secondary growth. It is also much more dangerous to cut down large trees. The Brao-Kavet are aware of the ecological damage they are causing in the extreme lowlands, but government policy has forced them conduct swiddens in these areas.

The Brao-Kavet prefer to do swiddens in "bree baw" forests, because these bamboo forests are relatively easy to cut down, tend to burn well and produce fertile ash, and are often associated with high quality soils, and re-grow quickly, often being ready to re-cultivate again within three to seven years. Rice grows much better in these areas, and those who make swiddens there can generally grow enough rice to feed themselves all year. A number of other bamboo habitats, including "bree lao", "bree pok", "bree eung-le", "bree ha-gou" and "bree ha-tiang" (all named after species of bamboo) are popular habitats for doing shifting cultivation. Semi-evergreen forests ("bree lawng") and secondary semi-evergreen forests ("bree chal-chawng") are also popular for doing swidden in.

Soil quality is undoubtedly one of the most important factors affecting the choice of swidden areas, and even some "bree baw" forests with poor quality soils are not desirable for swidden agriculture. Areas with large amounts of small pebbles ("bree bree-o-bree-o") or excessively sandy soils ("bree phaik-phaik") are deemed unsuitable for cultivation. Areas with a limited amount of boulders are desirable, because plants cultivated next to them are cooler when temperatures are high, and warmer when temperatures are low. The presence of dark worm casts is also an indicator of good soils. The presence of certain herbaceous plants and trees indicates good soils.

Successional patterns are extremely important when considering swidden agriculture, both in terms of agricultural and environmental sustainability, and with regard to the maintenance of biodiversity values. Forests at different stages have particular names in Brao-Kavet. "Meurl" is a swidden, "chal-chal" is a new swidden, "chal gra" is an old swidden, "chal chawng" is a young forest, "bree lawng" is a semi-evergreen forest, "bree gra" is an old growth forest, and "bree greung" is a very old forest.

In the extreme lowlands, successional patterns vary from those that occur in the hilly areas the Brao have traditionally inhabited, and plant species found in fallows differ. The Brao-Kavet IEK is vast, and they are very aware of the ages and characteristics of particular fallow areas. They know that while imperata grasses dominate fallows in the extreme lowlands (eco-region 1), hilly area fallows (eco-region 2) are dominated by fast growing trees and banana trees. These species quickly become established in just a year or two, and provide substantial protection from erosion. They also provide shade for other trees to grow up, which eventually crowd them out. The pioneers reach only 10 m high and live only five or six years, or until they are shaded out by other longer living trees or bamboos.

The areas where the Brao-Kavet would like to do swidden agriculture in Virachey National Park are dominated by 20 to 100 year old stands of "bree baw", with other habitats dominated by large trees being found on the mountains. These stands have been cultivated by the Brao-Kavet in the past, who have influenced their dominance, and encouraged this habitat type, over history through swidden agriculture. These are the only areas where the Brao-Kavet are proposing to do swidden within the park.

Implications and Conclusions

The Brao-Kavet are suffering in the extreme lowlands, and many wish to return to their traditional lands, where they believe they can sustainably survive doing swidden agriculture largely in fast regenerating bamboo forests. They are willing to do some lowland paddy, but few want to entirely abandon swidden agriculture. The Brao-Kavet are also generally willing to help protect wildlife with the National Park from poachers if provided the opportunity to do this, and they are not proposing to do shifting agriculture throughout the park, only the southernmost part, which is not very rich in wildlife as compared to other parts of the park.

The Brao-Kavet have strong arguments for wanting to return to the hills, and their extensive IEK regarding the forests indicates that they are not just randomly doing shifting cultivation anywhere, but are carefully choosing the places they farm. Their extensive IEK indicates why it will be difficult to do swidden sustainably in the extreme lowlands, and why they have a better chance of practicing a successful livelihood strategy in the hills. Moreover, there are insufficient areas suitable for wet rice in the lowlands, and few Brao-Kavet are skilled at lowland cultivation anyway.

Nobody asked the Brao-Kavet whether they agreed to give up all their traditional lands to create a National Park, but despite their suffering, they are not altogether opposed to the park, as they also wish to see natural resources protected for future generations. At the same time, present day concerns indicate to them that something must change, and so they are asking for some of their land back. There are both strong ethical and practical reasons why their request should be seriously considered, and why we must learn from them and try to understand them. Studying the way indigenous peoples classify ecological areas has, surprisingly, rarely been done in the past, but it represents an important opportunity to understand why shifting cultivators make particular decisions, and conduct agriculture the way they do. Indigenous shifting cultivators know much more about ecology and the forests than they are often given credit for, and we can learn a lot from them that will be useful for blending protected area management with sustainable livelihoods.

Prepared by
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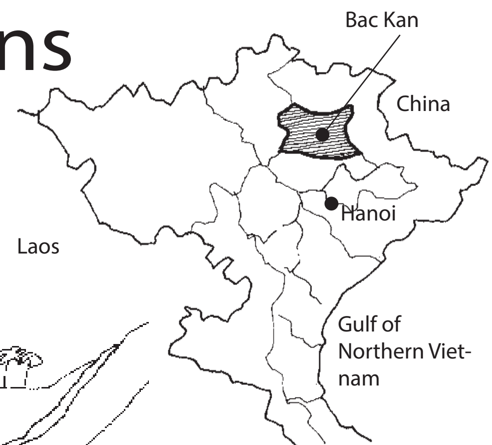
Resource book produced through a participatory writeshop organized by IFAD, IDRC, CIIFAD, ICRAF and IIRR.

Agriculture Systems in the North Mountain Regions of Vietnam



In the highlands of Vietnam, the high population growth rate puts much pressure on forest and other natural resources. More than 50 ethnic minority groups live here. Many of them practice shifting cultivation characterized by progressively shorter fallow periods and increasing degraded and denuded land.

Some of these ethnic groups did not receive paddy fields after decollectivization and land allocation. One of these is the Dao people of Ban Cuon village in Bac Kan Province whose only means of livelihood is slash-and-burn cultivation. After cultivating the land for about 3-4 years, the people shift to other fields, sometimes even into the watershed areas, where they begin to clear the forest. Since they do not practice soil protection measures, the fertile soils are soon degraded, and after 5-20 years, these fields become fallow lands.

The VietNamese economy is predominantly based on agricultural production which is 30% of the national gross domestic product (GDP) and 40% of the nation's total export. Agriculture provides jobs and food for more than 70% of the labor force. Eighty percent of the population live in the rural areas.

Some fallow lands, especially those with 5°-15° slope are very good for cultivation but are not used as pasture lands because of the lack of good grasses for grazing.

Progressive farmers tried to cultivate some of these degraded fallow lands that became pasture areas. However, this proved to be so time- and labor-consuming and could not be done in large areas. They also encountered soil-related problems like low acidity and nutrient availability, high toxicity and soil compaction. Uneven rainfall distribution has also made conversion into agricultural lands quite difficult.

In 1998, the Vietnam Agricultural Science Institute and the Centre de Cooperation Internationale en Recherche Agronomique pour la Developpement conducted the System Agricultural in the Mountain (SAM) Project at Ban Cuon Village. They tried different technologies for sloping areas that would increase productivity and promote sustainability of soil resources. The different technologies are described below.

Soil compaction

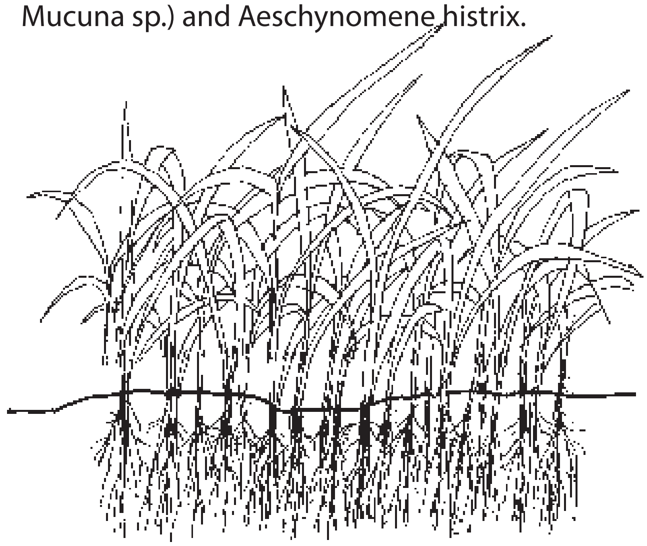
- Soil erosion and animal trampling lead to severe soil compaction.
- Compacted soils impede water infiltration, causing greater surface run-off.
- Root penetration is difficult and is one cause for the slow regeneration of forests in the fallow lands and impossible growth of crops.

Breaking soil compaction

Certain grasses and legumes have very strong root systems that can break up the soil and develop even in the compacted soil. When the roots decompose, they make the soil softer/lighter. These plants may also provide fodder, mulching materials and weed control.

GRASSES: Koronivia grass (Brachiara humidicola), Ruzi grass or Congo grass (B. ruziziensis), palisade grass (B. brizantha), finger millet (Eleusine coracana), and Paspalum atratum.

LEGUMES: Roundleaf cassia (Chamaecrista rotundifolia), stylo or Brazilian lucerne (Stylosanthes guianensis CIAT 184), tropical kudzu (Pueraria phaseoloides), siratro (Macroptilium atropurpureum), jack bean or horse bean (Canavalia ensiformis), rice bean (Vigna umbellata), velvet bean (Mucuna sp.) and Aeschynomene histrix.



Grasses can be used to break up soil compaction

Preventing soil erosion in cultivated lands

1. Plant grasses and legumes for green cover – Grasses and legumes can be intercropped with rice or corn depending upon the crops and time of the year.

For example:

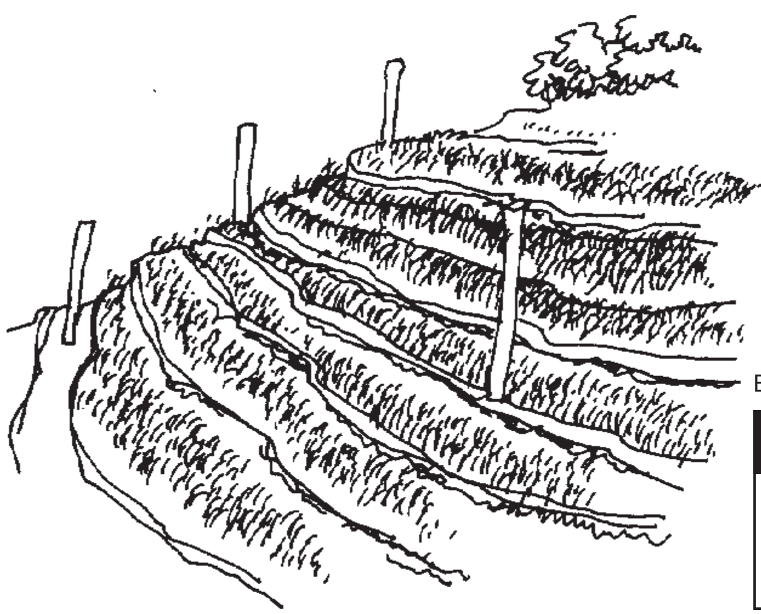
- During summer, rice bean and velvet bean are planted 25-30 days after sowing corn.
- Ruzi grass, Aeschynomene or round leaf casia is planted 30-40 days after sowing summer upland rice.

Advantages of cover crops

- Prevent soil erosion
- Improve physical properties of the soil
- Retain soil moisture
- Activate soil microorganisms

2. Use mini-terraces – This is recommended for areas with slopes of at least 30°. When combined with mulching and zero-tillage, the soil structure was greatly improved and upland rice yields doubled.

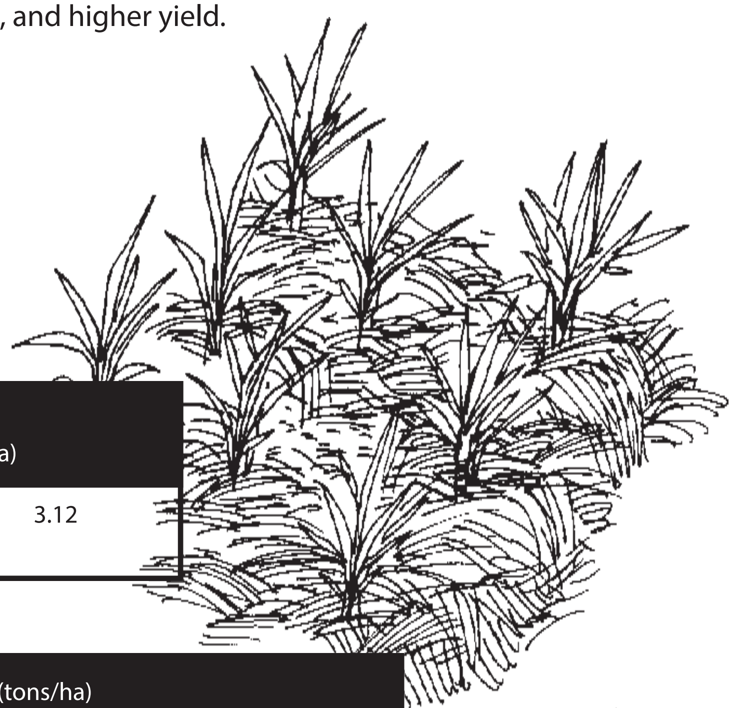
Steep fields often come from clearing old forests (>30 years) where the soil is very fertile and light. Crop yield is often high. However, these fields are easily eroded.



Effect of mini-terrace on upland rice yield

Treatments	Yield (tons/ha)
Control (farmer's practice)	0.96
Miniterrace	1.31
Miniterrace + Mulch	1.92

3. Apply organic mulch – Plant parts and residues (rice straw, corn stalks and leaves, beans, peanuts and grass) are suitable mulching materials and are always available in the mountain regions. While farmers spend time to gather mulch materials and cover the fields, they are rewarded by less land preparation and weeding activities, improved soil fertility, better soil structure, and higher yield.



Effect of mulch on corn yield

Treatments	Total Investment (1000)	Yield (tons/ha)
No Mulch	1140	3.12
Mulch	280	4.01

Effect of mulch on upland rice yield

Treatment	Investment Value (VND)	Yields (tons/ha)			
		Local varieties		LC 90-2	
		F_0	F_2	F_0	F_2
No mulch	1800	0.31	0.36	-	-
Mulch	840	0.42	0.80	0.41	1.08

F_0 = No fertilizer
F_2 = With fertilizer (urea, fermophosphate, KCl)
VND = VietNam Dong

Some on-farm mulching materials used during the winter season are wheat, barley and oats. During spring, ruzi grass, sorghum and millet may be used. Wild species like Cassia tora, Chromolaena odorata, Tephrosia candida, Indigofera teysmanii and Tithonia diversifolia are also suitable mulch materials.

In 1998, the SAM Project tested 108 upland rice varieties. A year later, two varieties showed the most promise: LC 90-2, an early maturing variety, and IR 57920 AC 252, of medium maturity.

Planting suitable crops and varieties

Planting varieties with such desirable characteristics as high yield, early maturity, and high adaptability to the area is one way of preventing villagers from clearing another part of the forest. Using an early maturing variety, farmers are now growing spring upland rice, a practice that they did not do before. This gives them the opportunity to have two croppings of rice a year and double their income from the same field. Other crops like sunflower, sorghum, millet, winter wheat, barley and oat have been introduced for spring planting. If rats can be controlled, winter wheat, barley, oat and sunflower may also be planted. Trees and other plants like hybrid acacia, Leucaena leucocephala, Gliricidia sepium and Calliandra callothyrsus may also be planted as an improved fallow method while providing villagers with fodder, fencing materials and additional income.

Sustainable agricultural systems emphasizing conservation farming is proving to be a solution to the problems associated with shifting agriculture in the mountain regions of Vietnam. Conservation farming projects for bare hills and barren lands that started from general soil improvement to soil protection will hopefully lead the way to sustainable shifting cultivation practices.

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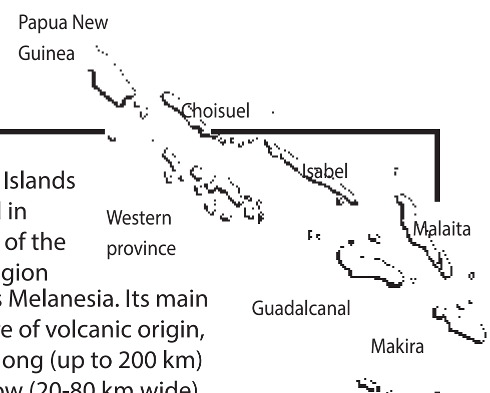
Resource book produced through a participatory writeshop organized by IFAD, IDRC, CIIFAD, ICRAF and IIRR.

Traditional Slash and Mulch Systems in the Solomon Islands

Traditional agriculture in the Solomon Islands is based on the shifting cultivation system. Long forest fallows were the traditional norm (15-25 years fallow) and are still practiced in some areas. Population growth (3.6% per annum), land degradation, and occupation of land for cash crops have led to declining of the fallow periods. In many areas, shifting cultivation is now under a system of bush fallow with fallow periods from five to seven years. In the high population pressure areas, fallow periods have been reduced to critical levels from six months to three years with no other practices to maintain soil fertility. In these areas, yields are declining along with soil degradation and loss of biodiversity.

The main staples are all root crops— yam (Dioscorea esculenta), taro (Colocasia), sweetpotato (Ipomea batatas), and cassava. Other important crops include slippery cabbage (Abelmoschus manihot), beans and other vegetables, sugarcane, bananas, corn and various wild semi-cultivated crops.



Solomon Islands is located in the heart of the Pacific Region known as Melanesia. Its main islands are of volcanic origin, typically long (up to 200 km) and narrow (20-80 km wide) with mountains up to 2400 m. The country has a wet tropical climate with a rainfall of 2500-6000 mm per annum. It has no distinct wet and dry seasons although it is wetter from January to April in most areas. Most of the country is covered with rain forest. The coastline is fringed in coral reefs. From the two environments— forest and sea— depend the livelihood of most of the country's population.

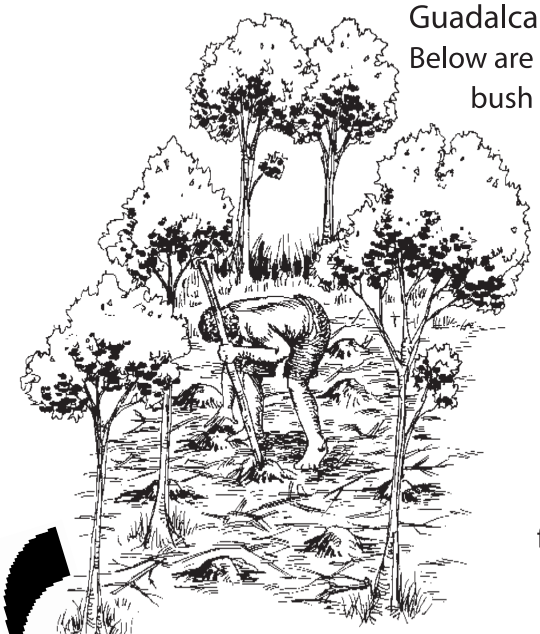
Eighty percent of the Solomon Islands' 450,000 people live in small isolated communities on their 'customary' or tribal lands. Customary land ownership is protected by the constitution and is a central component of the Melanesian culture. Land ownership passes through patrilineal and matrilineal descent in the different islands.

The formal cash economy is based on exporting copra, cocoa, timber, tuna fishing licenses, and more recently mining. It is supplemented by a non-formal economy that provides the food and livelihood for most of the population.

Most of the farmers are currently practicing slash and burn system of shifting cultivation. This involves the slashing of bush or secondary forest, leaving it dry and then setting fire to it. Many farmers perceive that this has always been the practice and that it is their kastom (traditional way of preparing the garden site for planting).

It appears that as fallows have shortened in recent years, farmers have resorted to using fire more intensively than in the past. Our experiences have indicated that the reverse practice would be better – less fire with shorter fallows and more incorporation of organic matter in the soil to preserve soil fertility.

Further investigation by field staff talking with old people and visiting different parts of the country looking at traditional methods has shown a much more diverse approach to the use of fire. A number of methods on the use of organic matter were documented. Some of these methods are still commonly practiced while others are close to disappearing from use. These traditional methods have been used as an entry point to discussing with farmers the role of organic matter in soil fertility. This aims to build on farmers' traditional understanding of the role of organic matter in their farming systems.



Guadalcanal slash and mulch

Below are two systems practiced in the Guadalcanal island's bush or inland areas.

1. Yam (Dioscorea esculenta) and pana (Dioscorea alata) slash and mulch

Guadalcanal is known for planting yams without the use of fire or staking. In most of the other parts of the Solomon Islands, yam gardens are cleared with fire before staking the yams with a material cut from the fallow vegetation. Traditionally, yams need a long fallow to produce a good yield. Thus, yam gardens are usually in the forests rather than in the bushes or shrub fallows.

How it is done

- The undergrowth, usually of mature forest but sometimes of younger secondary forest, is cleared but most of the larger trees are left standing.
- The yams are planted using a traditional digging stick.
- The vegetation is then in a random pattern over the

site. The leaves eventually rot forming a rich matt of organic material. The trunks and branches form a mass of crossed stakes for the yams to climb. Sometimes, bananas and taro can also be planted in this type of system.

2. Tasimate slash and mulch gardens

This is a method similar to the yam planting described in the yam and pana slash and mulch. However, this method of slash and mulch can be applied to all the food crops, especially on sweet potato and taro.

How it is done

- The undergrowth is cleared in a fallow of typically 4-6 years. The secondary forests are often dominated by stands of maturing pioneer species (such as Macaranga spp.) of trees with an understorey of soft ginger and banana-like plants. This vegetation is cleared and made into a garden under the canopy of the larger trees.
- The crops are laid in rows in a pattern planned with an awareness of how the fallow trees will be cut onto the garden. Planting is done with the traditional digging stick.
- Once the cuttings have started to grow, the trees are cut. Unlike the random pattern for yams, the vegetation is laid carefully on the garden. The branches and trunks are laid in wide rows across the garden. In between where the crops have been planted, the soft leaves and stems are cut into thick mulch (often 5-10 cm thick).
- For sweet potato, the cuttings are planted further apart than is typical in slash and burn systems. The vines eventually grow over the thick mulch and the rotting trunks. The first harvest is dug along the vines that grew out from the mulch. A second harvest is made in the sticks and trunks.

The system gives more yield than slash and burn system practiced in the same area on the same soil type. It also appears to yield very well in relatively short fallows. Short fallow areas are preferred by farmers who practice the Tasimate slash and mulch gardens.

Lau partial burn systems

In the Lau area of Malaita island, farmers report that they do not have enough organic matter for a good burn. This is due to the shortening of fallow periods caused by very high population pressure. Fallows are now often from six months to three years only. Soil fertility is declining and so even these fallows grow poorly and are being dominated by fire resistant ferns, grasses and shrubs.

This practice has often led farmers to import more organic matter (usually coconut leaves) for burning on the gardens. It is laborious for farmers but they consider it worthwhile to achieve a good burn across the whole garden site.

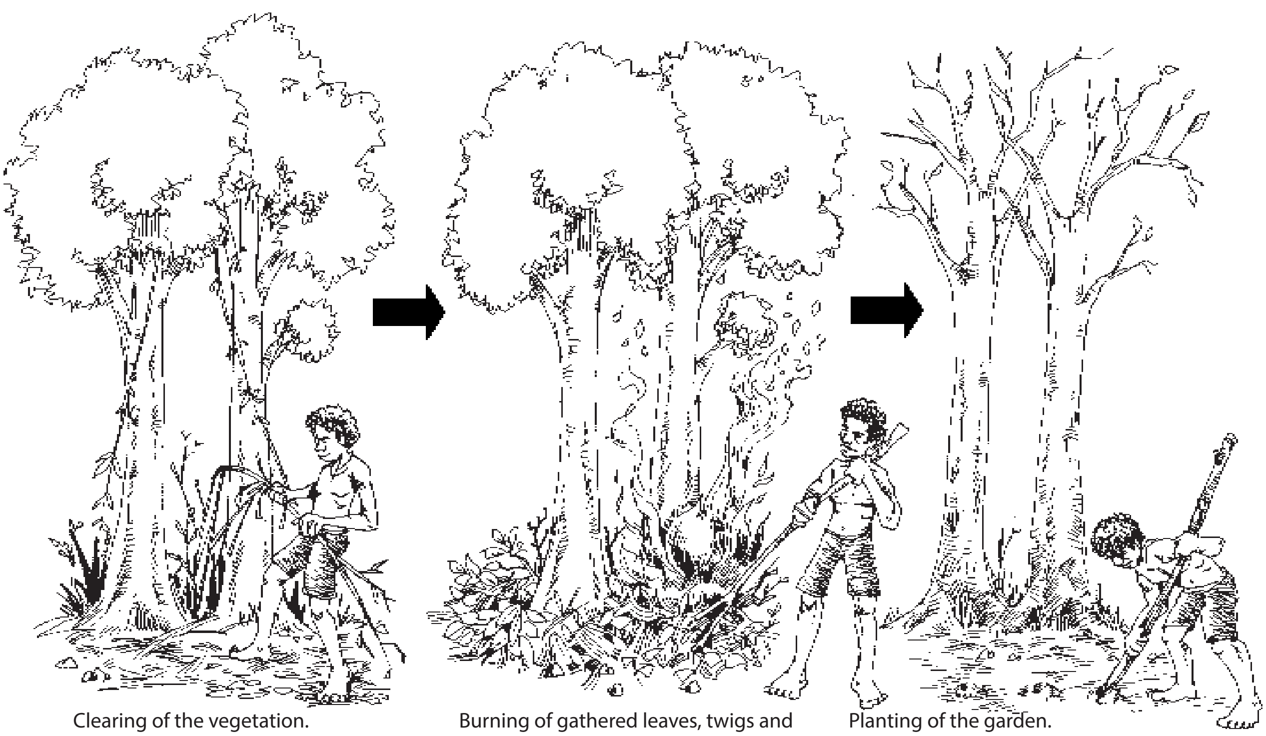
With short fallows often fewer than two years, the Lau partial burn systems lead to rapid soil degradation. In the near future, much of this land may become a grassland as what has happened in some other parts of the Solomon Islands. But in this same area, there are some traditional practices which show that uniform burning of all the slashed fallow vegetation is not always the traditional way.

1. Edu gardens

Edu (Colocasia sp.) is an important crop in this area. It is usually planted on stony soils that would not be productive for other root crops but where edu can grow well because the tuber develops on top of the ground level. These sites are reserved for edu cultivation. Edu has a high cultural value and is traditionally used as part of bride payment and for the purchase of traditional 'shell money' that is used in cultural payments of various types.

How it is done

- Vegetation is cleared from a four- to seven-year fallow site. The organic matter is then heaped around the bases of the remaining trees and burned. This effectively kills the trees.
- The garden is planted to edu mixed with slippery cabbage, beans and occasionally other crops.



Clearing of the vegetation.

Burning of gathered leaves, twigs and branches around the base of remaining trees.

Planting of the garden.

- The trees then slowly die, dropping a good mulch cover over the garden. The trees also provide initial shade in the early growth of the plants.

2. Tuku and biru

Tuku and biru are compost heaps in the bush gardens. This is a traditional practice that is disappearing in some areas in favor of burning all the organic materials. Tuku and biru are used in gardens on slopes and flat lands.

Advantages	Disadvantages
Yam and pana slash and mulch ■ No need for staking. ■ Ground is covered with organic matter. ■ Yam and pana are well protected during dry weather. ■ Slow supply of nutrients to the crop as organic matter decays.	■ It can be difficult to harvest the yams under the tree trunks. ■ The method is applicable only to yams, which have strict cultural practices associated with their cultivation in each area. Hence, the method has not yet been applied to other crops. ■ The method appears 'messy' or in disarray, which is culturally unacceptable in some areas where there are strict perceptions of what a garden should look like. ■ In very short fallows, there will not be enough tree branches and trunks to provide adequate 'stakes' for the yams to climb. This may result in poor yield.
Tasimate slash and mulch gardens ■ Plants yield higher than in the slash and burn method. ■ Abundant organic matter is returned to the soil. ■ Fallow recovers very quickly with many trees coppicing. ■ Smaller gardens provide the same yields as larger slash and burn gardens. ■ The main crop yields well with other crops grown in the area. ■ The garden appears to be "in order" with rows of mulch and sticks that fit local perceptions of a good garden. ■ Farmers can work under the shade of the trees while planting.	■ Difficult work in clearing, spreading organic matter, and felling the trees correctly without damaging the crops. ■ If there is no large amount of vegetation, weeds may recolonize the garden faster than in a burned area.

Advantages	Disadvantages
Edu gardens ■ Garden is mulched with a layer of organic matter that falls from the trees. ■ Less labor is involved in burning tree trunks than in cutting them down. ■ Some potash is still made available in the form of ash. ■ Soil microorganisms are not disturbed too much by the spot burning. ■ Trees can be used for staking of yams or beans, which are often planted in this type of garden along with slippery cabbage as an understorey.	■ It is considered to be a culture-specific practice and so most farmers have not applied the method to other crops. ■ Some burning of organic matter still occurs, which may become a critical issue to conservation as fallows get shorter in the future due to population growth.

How it is done

- The bush is cleared then the branches and leaves are piled across the slope to stop soil from washing down during heavy rain.
- In between the tuku/biru, sweet potato, beans and other crops are planted. Taro is planted along the tuku/biru piles.

Conclusion

Traditional knowledge plays an important role in reinforcing sustainable management systems. It also provides important links to move from the known to the unknown in the trial and development of new methods to cope with changing land use pressures.

We cannot assume that the traditional way is a fixed group of methods. Traditions are in a constant state of change, sometimes very slow and sometimes very rapid. In many instances, local people may not immediately recognize the changes in their farming system and stick to methods as their 'custom'. Participatory approaches can be used to discuss change and tradition and help farmers understand the positive and negative consequences of current and past practices for sustainable food production.

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CHAPTER
THREE

adaptive strategies & best practices

Relay Cropping as an Improved Fallow Practice in Northern Thailand

Fallow is generally defined as a farmland that has been left unplanted and its practice is a substantial component of traditional upland farming. Natural fallow has various functions, such as, maintenance and regeneration of soil fertility, control of unwanted vegetation and pests, and provision of forest products and by-products, among others.

Because of increasing population, forest dwellers no longer practice natural fallow in its traditional form (10 years or more). Thus, the benefits of the practice that are important to sustainable livelihood systems are reduced. As an alternative to natural fallow, farmers, extension workers and scientists are applying crop production systems where concepts of improved fallow practices are incorporated.

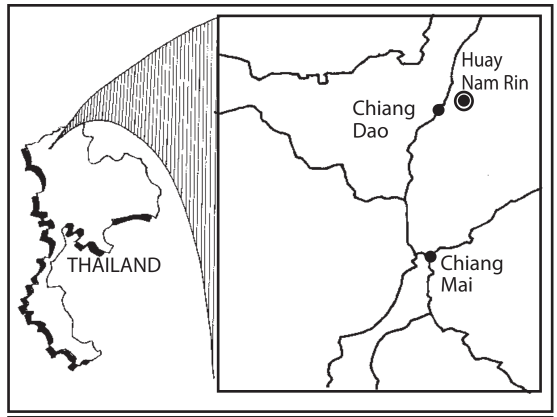
One recognized improved fallow practice is relay cropping of soil improvement crops. Among the Lisu people of Huay Nam Rin, a village in Northern Thailand, planting legumes after corn is not a new system. They used to grow upland rice and opium before they

Improved fallow is defined as the "targeted use of planted species in order to achieve one or more of the aims of natural fallow within a shorter time or on a smaller area" (Prinz, 1987). As a substitute for natural fallow, improved fallow can increase soil fertility and raise the productivity of smallholder farming systems in the tropics.

Two common types of improved fallow methods are successive and simultaneous fallows. In successive fallow, the fallow plants are planted after the main crop. In the simultaneous fallow, both cultivated and fallow plants grow at the same time in the same field.

adopted a permanent cultivation system of planting corn with fruit trees and wax gourd. Without the possibility of practicing natural fallow anymore, the Lisu were confronted with prospects of ever declining yields and weed growth problems. With the practice of planting legumes after corn, the farmers recognized the potential of this method to gain additional income and control weeds to a certain extent.

The farmers in Huay Nam Rin plant three types of legumes: lablab bean (Lablab purpureus), rice bean (Vigna umbellata) and cowpea (Vigna unguiculata). They experienced that with multiple crops grown, the risk factors of one crop failing would be reduced.

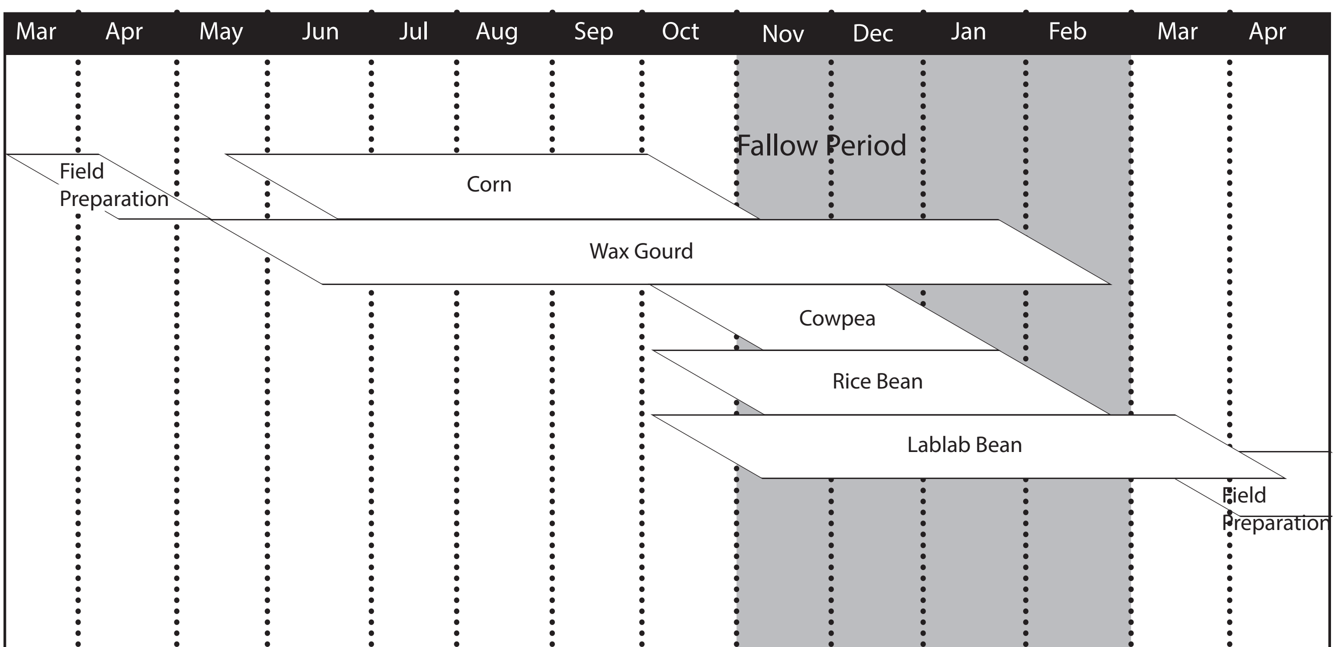


Huay Nam Rin lies about 20 km. north of Chiang-Dao, Chiang Mai, at the boundary of a national forest reserve. Its elevation is 450-500 meters above sea level. The Lisu people settled there in 1978.

The villagers follow a planting calendar and certain steps that they have developed for many seasons in practicing relay cropping.

Benefits of the relay-cropping system as improved fallow method

Cropping Calendar



Rice bean and lablab bean provide organic matter and soil cover for up to four months after the corn has been harvested. This is an important feature in managing organic matter.

Schedule of Activities

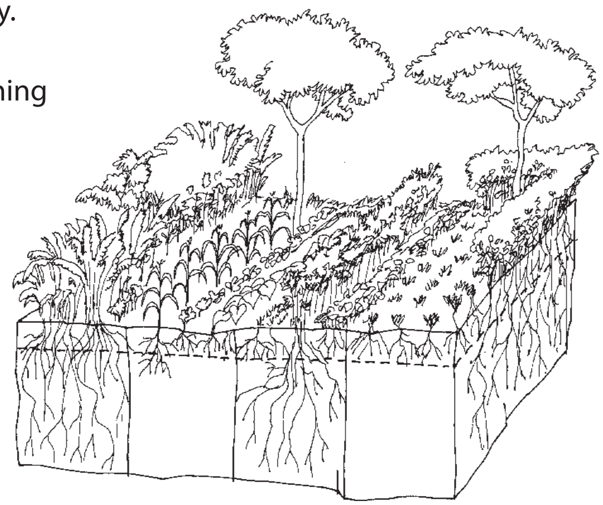
March/ April (Dry season) 	■ Slashing/cutting of weeds and legume residues, and piling and burning are done. Immediate shallow hoeing helps to incorporate ash into the soil but this practice is not done by everybody. <u>Note:</u> On fields where viny legumes like lablab are grown, post-harvest weed growth is reduced considerably.
May (start of rainy season) 	■ Corn and wax gourd are planted. Seeds are mixed at a ratio of 20-40:1. Plant spacing is 70x50 cm. ■ Wax gourd is thinned to 2x2 m.
September 	■ 30 days before harvesting of corn, manual or chemical weeding is done. Farmers may strip some of the lower leaves of corn. ■ Vines of gourd are pulled out and placed around the plant hills. This practice would not harm the wax gourd but instead, stimulate the growth of more shoots. ■ Planting of legumes starts with cowpea (70x30 cm), followed by rice bean and lablab (70x50 cm). At 2-6 legume seeds per hill, this rate does not affect the yield of corn.
October 	■ Corn harvest begins. Farmers push the stalks toward the ground and step on the stalks. ■ They also step on the growing bean plants. This results in more branches and inflorescence.
December- April 	■ Legumes and wax gourd are harvested. Harvest time — Crop December / January — cowpea January / February — rice bean February — wax gourd March/April — lablab bean

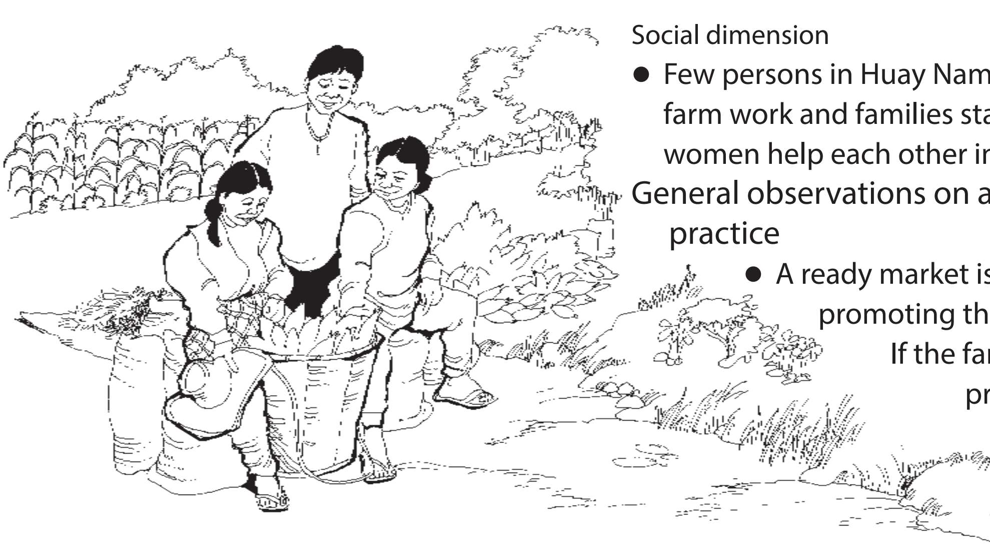
Economic dimension

- Continuous satisfactory yields of corn without external input of nitrogen fertilizer is experienced.
- Income gained from the sale of products is distributed over a long period of time.
- If one crop fails, the farmer can rely on the other crops for income.
- The different cropping periods of the three legumes helped in the distribution of labor requirement during harvest time.
- The input for land preparation of the relay crop is reduced.
- Minimum tillage is possible.

Ecological dimension

- Legumes add substantial biomass to the soil. This improves or maintains soil productivity.
- Effective nitrogen fixation by legumes contributes to soil fertility, thus sustaining productivity in the absence of N-fertilizers.
- The legumes' root systems improve soil porosity and aeration. Rice bean has an extensive root system with taproots reaching down to 1 to 1.5 meters.
- Extended soil cover and shading help control weeds and slow down erosion.
- Sufficient soil moisture is available for the establishment of legumes.
- Diversity of cultivated plants is increased.





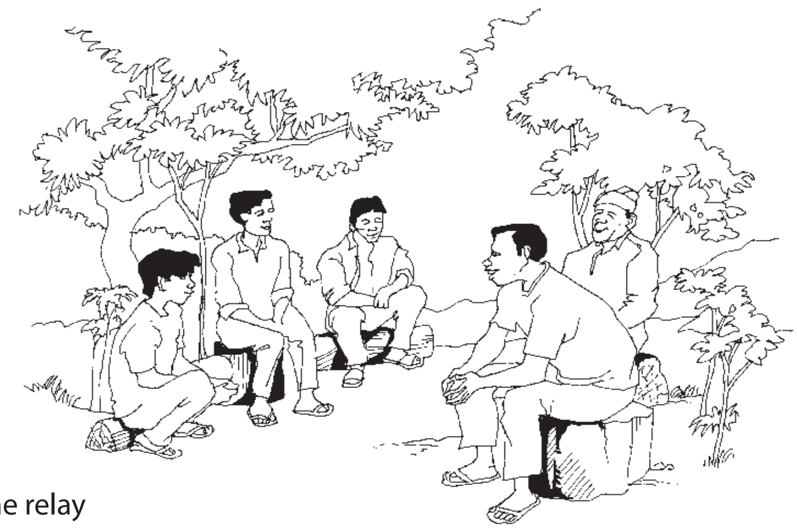
Social dimension

- Few persons in Huay Nam Rin are engaged in off farm work and families stay together. Men and women help each other in fieldwork.

General observations on acceptance of the practice

- A ready market is an important factor in promoting the cultivation of legumes If the farmer cannot sell his produce, he will only plant enough beans for one consumption.

- This legume relay-cropping system in corn is promoted by government extension workers in a less formal way among other ethnic groups like the Palaung, Karen and Lahu. However, different types of legumes may be used depending upon the available market.
- Time of planting, harvesting and length of overlap periods have to be observed. The choice of the specific varieties of legumes to be used depends upon the purpose of the relay cropping system and the existing local conditions.



As a whole, the acceptance of this relay-cropping as an improved fallow method hinges on this: that the method should not only raise the income of farmers indirectly by improving soil fertility, but that it should also do so directly by producing marketable products or by-products of economic importance.

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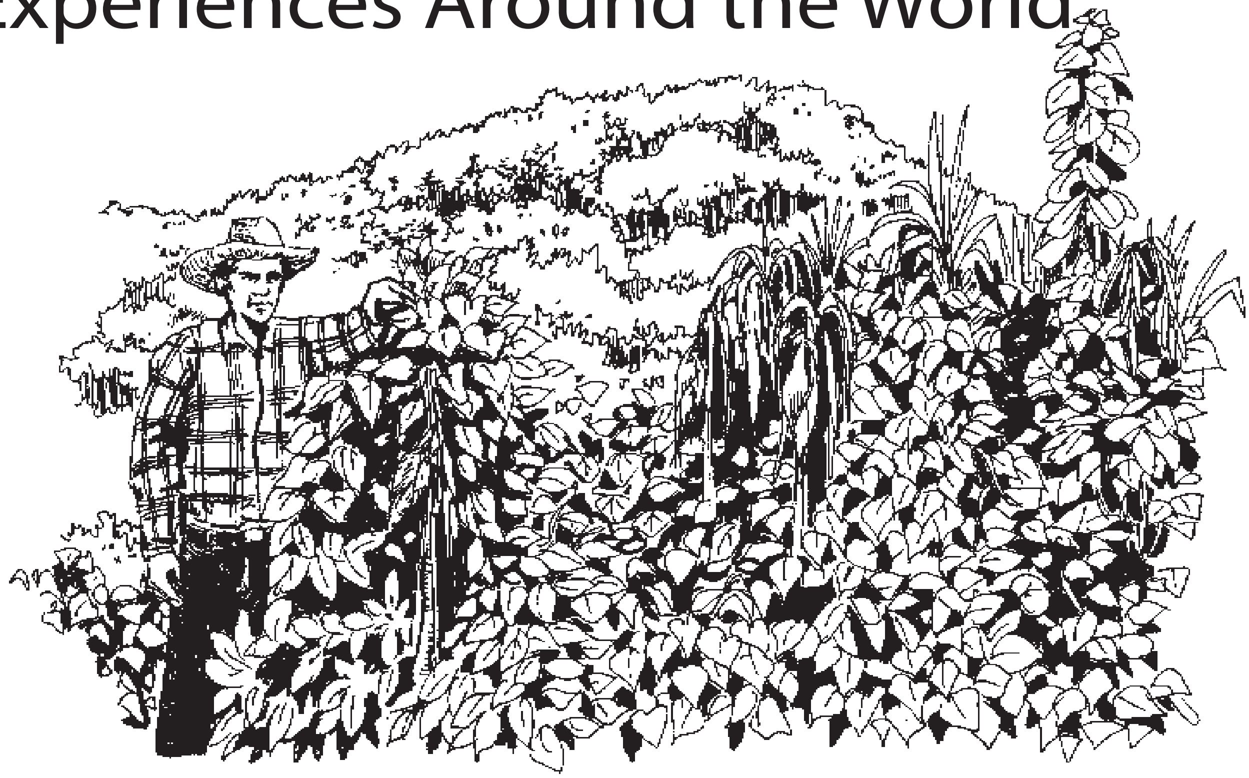
A Proven Technology for Intensifying Shifting Agriculture Green Manure/Cover Crop Experiences Around the World



In general, the most efficient technologies for intensifying or sedentarizing shifting agriculture are agroforestry systems (most notably improved fallows) and green manure/cover crop (gm/cc) systems. Each of these systems generally follows the five principles of managing tropical soils (listed in Changing Our Understanding of the Fertility of Tropical Soils: Nutrient Banks or Nutrient Access?, pages 65-71), thereby sustainably maintaining soil fertility at a very low cost. And each system also fights weeds by shading them out. Thus, both systems can overcome the two major problems that force farmers to fallow their land.

What do we mean by green manure/cover crops?

The name "green manure/cover crops" (gm/cc) does not refer to what has traditionally been called "green manures". We are not dealing here, in most cases, with legumes that are grown alone and then incorporated into the soil when they begin to flower. First of all, of the 140 gm/cc systems on a list of documented gm/cc systems from around the world, about 9% do not involve legumes. Second, in over 60% of the systems, the gm/cc is intercropped among traditional crops or planted under tree crops. Third, the gm/ccs are almost always applied to the soil surface, right where they grow, rather than incorporated into the soil. And fourth, they are almost always applied to the soil after they have fully grown because the farmer wishes to eat the seed, sell it, or feed the seed to the animals, and almost always wants to save at least some seed for future plantings. Thus, while gm/ccs still use the basic idea of fertilizing the soil with plant material, most of the rest of the ideas about how to use green manures were long ago rejected by the farmers as being inappropriate to the farming systems of resource-poor farmers.

Another change has come from the fact that most shifting agriculture farmers are much more interested in controlling weeds than in improving their soil's fertility. Therefore, many organizations have joined the concepts of green manures (which are to fertilize the soil) and cover crops (which are to control weeds). Thus, we speak of green manure/cover crops. This paper defines a green manure/cover crop as a species of plant, often but not always a legume, whether a tree, bush, vine or crawling plant, which is used by a farmer for one or several purposes, at least one of which is that of improving soil fertility or controlling weeds.

Green manure/cover crop systems are surprisingly common and varied

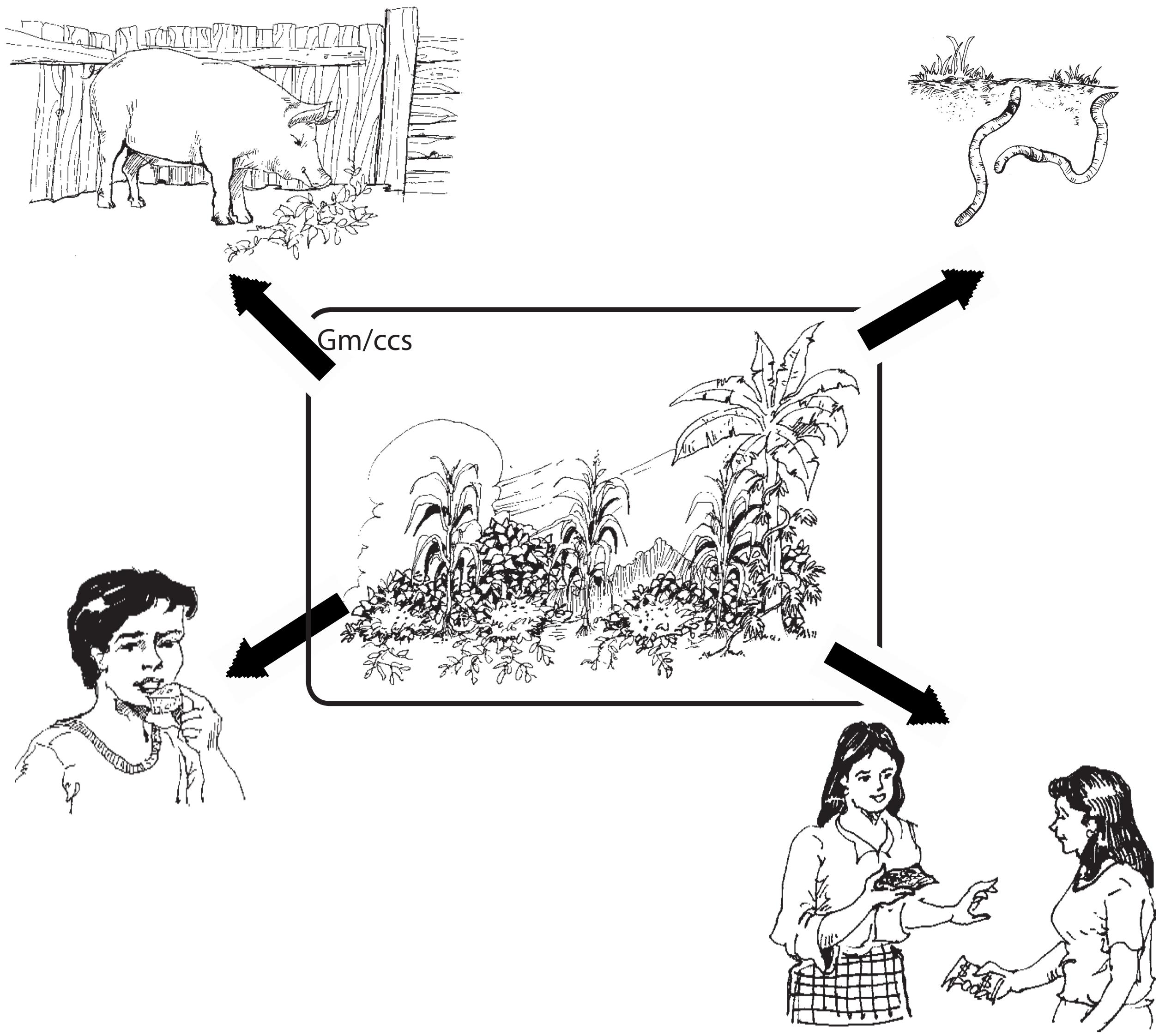
Gm/ccs are now widely used around the world. The information in this paper is based on a list of 140 different gm/cc systems involving 41 different gm/cc species being used by farmers in 23 nations in the tropics. But shifting agriculture farmers around the world are using many more systems than that. For instance, just in the very small State of Santa Catarina in Brazil, over 125,000 farmers are using some 60 different species of gm/cc with dozens of different cash crops. Yet there are only 11 systems from Brazil that are mentioned in the list. Based on the information we presently have, we estimate that farmers are now using more than 500 different gm/cc systems, just in those nations that are in the tropics.

Of the systems on the list, a good majority of them (60% or more) are systems that were basically developed by farmers themselves. This, perhaps more than any other fact, shows how appropriate these systems are for village farmers, and how interested farmers themselves are in finding and adopting gm/cc's to improve their shifting agriculture systems.

Purposes of green manure/cover crops: Gm/ccs can:

- Improve the soil and control weeds
- Provide human food
- Provide animal feed, both the seeds and the foliage
- Increase income
- Restore wastelands, both those with very low fertility and those invaded by very bad weeds, such as imperata grass (Imperata cylindrica)
- Increase the organic matter and earthworms in the soil in order to change to zero tillage systems
- Provide shade for other crops, such as coffee or cacao
- Prevent erosion
- Save soil moisture, either as green or dead mulches
- Use with animals in various ways
- Prevent plant diseases, such as sun scorch on citrus fruits
- Control pests, including nematodes, and pests of stored grain
- Contour bund or vegetative barrier species
- Firewood (dried jackbean (Canavalia ensiformis) pods are even being used as firewood in El Salvador).

The most common uses given to gm/cc species—apart from soil fertility and weed control—are those of providing human food, animal feed, and products that can be sold.



Some people think that the viny gm/ccs so widely used in Latin America are not useful in Southeast Asia. Nevertheless, the list includes 17 gm/cc systems from Southeast Asia that use 11 different viny gm/ccs.

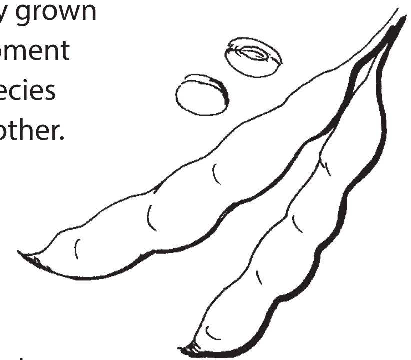
Species most used

The gm/cc species that are probably most commonly used around the world are:

1. Scarlet runner beans (Phaseolus coccineus). This legume is grown by hundreds of thousands of farmers in the highland areas of Latin America and Southeast Asia. Farmers mostly grow scarlet runner beans intercropped with maize, and then eat the beans. Usually, they also know it is very good at maintaining soil fertility. Many farmers report growing maize and scarlet runner beans for 20 straight years in the same soil with no chemical fertilizer and without any decrease in the yields of their maize.

2. Pigeon peas (Cajanus cajan), common beans (Phaseolus vulgaris), soybeans (Glycine max) and oats (Avena spp.) are certainly more widely grown than any other gm/cc species. In fact, pigeon pea is the fourth most commonly consumed grain in the world.

3. Velvetbeans (Mucuna spp.) are undoubtedly the most widely grown gm/cc species that have largely been introduced by development programs. In Central America, Brazil, and West Africa, this species has been successfully introduced to more farmers than any other. It is also grown traditionally in some countries, including most of Southeast Asia. The velvetbeans is only one of the most widely grown gm/ccs that is not usually consumed by humans. Thus, the velvetbean's widespread use by development programs is probably due to the professionals'unfortunate lack of attention to edible gm/ccs, the velvetbean's very efficient control of weeds (especially important in West Africa, where it is grown to control imperata grass), and possibly the fact that it also effectively controls nematodes and several plant diseases (including Phytophthora and Rhizoctonia root rots).



4. In Southeast Asia, probably the most widely used kind of gm/ccs would be the family of beans called Vignas, which includes mungbeans or green beans (Vigna radiata), cowpeas (V. unguiculata) and the rice beans (V. umbellata). These species are all tasty, easily grown, and drought-resistant. They can, for instance, be planted in rice paddies just before or after the rice is harvested in order to grow during a dry season. The mungbean is eaten as beans, sprouts, and in sweetcakes.

5. Very likely, the second most widely used introduced gm/cc are jackbeans. This species is very useful because most varieties are not as aggressive climbers as the velvetbeans. It is also extremely capable of surviving and growing well in the worst of conditions. The jackbean is highly resistant to drought, poor acidic soils, shade, and insects and diseases. Thus, it can often be used during the dry season, in very difficult situations, where crops will not grow, and for recuperating wastelands. Often, shifting agriculture farmers can plant this bean (or Tephrosia candida) in fields that are soon to be fallowed, and within two years the soil will be fertile enough to grow rice again.

   Furthermore, since the jackbean is capable of fixing up to 240 kg/ha of N, withstands heavy pruning and, in most cases, does not climb very much, it can be intercropped quite easily with many different crops, such as maize, cassava, sorghum, tomatoes, and chili.

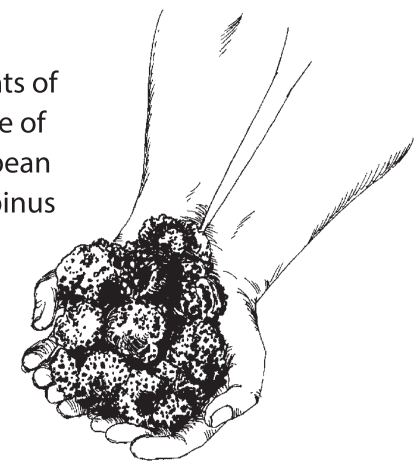
Advantages of green manure/cover crops

1. Increase in organic matter

   Gm/ccs are capable of adding up to 50 t/ha (green weight) of organic matter to the soil at each application. These nutrients have mostly been recycled, pumped up to the soil surface by the legume plant. The organic matter produced by the gm/cc has, in turn, a whole series of positive effects on the soil, such as improving the soil's water-holding capacity, nutrient content, nutrient balance, number of macro- and microorganisms, softness, and pH. Another very important role of this organic matter is that of making soil nutrients, including those supplied by chemical fertilizers, more accessible to crops. In the case of phosphorus, which in acidic soils may be 4 to 5 times more accessible to plants when surrounded by organic matter, this factor is particularly important.

2. Nitrogen fixation

The organic matter produced by gm/ccs also often adds large amounts of nitrogen to the soil. Many of the most widely used gm/ccs are capable of fixing more than 75 kg/ha of N, while a few fix even more: the velvetbean can fix 140 kg/ha/crop, the jackbeans up to 240 kg/ha, and tarwi (Lupinus mutabilis), fava beans (Vicia faba) and Sesbania rostrata can fix 400 kg of N/ha or more. Even at just 140 kg/ha, this means that by planting a gm/cc, farmers can add to each hectare of their soils the same amount of nitrogen as that contained by some six 44-kg sacks of urea.



Velvetbean nodules

3. No transportation costs

These additions of organic matter and N, unlike most other things we use to improve our soils, require no transportation; they are produced right in the field, and are already well-distributed.

4. Very low cost

Gm/ccs require no cash whatsoever once the farmer has purchased his or her first handful of gm/cc seed.

5. Weed control

As already mentioned, gm/ccs can also be very important in reducing weed control costs. By controlling weeds, they often decrease dramatically the amount of work that shifting agriculture farmers have to do, especially the women.

6. Reduction of agrochemical use

Gm/ccs can significantly reduce the use and cost of agricultural chemicals. They can reduce the use of chemical fertilizers, often down to just 25-40% of their previous levels. They can also reduce or even eliminate the need to use herbicides. Some species of gm/cc can also substitute for other chemicals: the velvetbean is a very good nematicide, and sunnhemp (Crotalaria ochroleuca) leaves can be used to control grain storage pests.

7. Soil cover

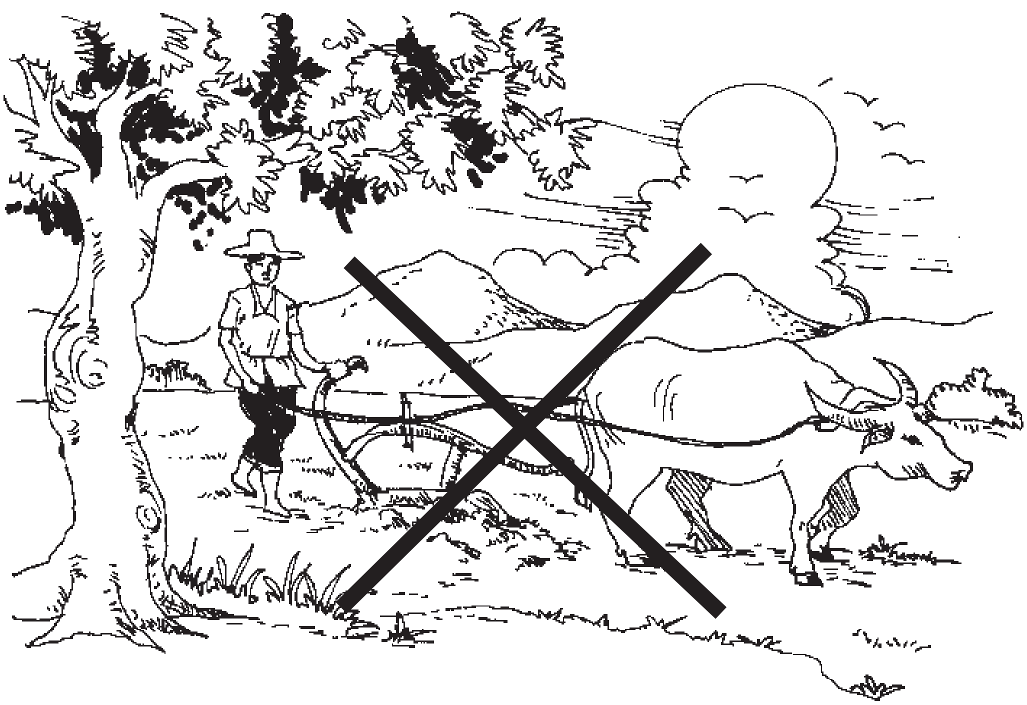
The soil cover provided by many gm/ccs can be very important for soil conservation. In general, the value of soil cover in preventing erosion has been greatly underestimated. Erosion starts when raindrops falling out of the sky hit the soil. When they do, pieces of soil are broken away, so it can be washed away easily. If the soil is covered, the soil particles will not be broken away, and very little erosion will occur. Field-level experience confirms this fact. For instance, a careful study has shown that farmers cultivating maize on 35% slopes with more than 2,000 mm of rainfall in Honduras are actually increasing the productivity of their soil each year, even though they have no soil conservation structures at all. How? Their soils are covered with velvetbean plants ten months out of the year.

8. Improved soil moisture

The organic matter makes rainwater filter into the soil, keeps it from evaporating out of the soil (because it covers the soil), and makes the soil better able to hold a lot more water until our crops need it. Thus, they protect our crops from droughts (although if they are intercropped with an annual, they may in some cases compete with the crop for moisture). In one experiment carried out during a drought, maize fertilized with chemical fertilizer died one month into the drought; maize fertilized with animal manure died about two weeks later; and maize fertilized with jackbean still managed to produce a small harvest.

9. Zero tillage

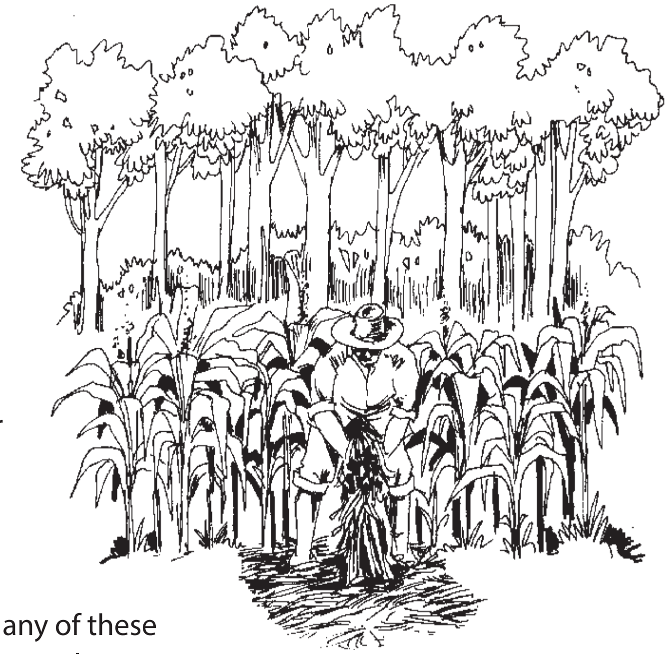
The experience of tens of thousands of farmers who previously used shifting agriculture shows that after two to four years of heavy applications of organic matter from gm/ccs, farmers can begin using zero tillage systems that provide high levels of productivity. Farmers who previously used shifting agriculture in Honduras, using velvetbeans with no chemical fertilizers and zero tillage, have maintained yields of maize of 2.5 t/ha for 40 years. With very small applications of urea, these farmers can attain yields of 4 t/ha on the same land. In Brazil, farmers using chemical fertilizer along with gm/ccs regularly harvest 7 to 8 t/ha of maize without tilling the soil.



Tilling the soil becomes unnecessary if farmers use chemical fertilizer with green manure/cover crops.

10. Competitiveness with mechanized farmers

Weeding and plowing are the two heavy jobs that have always given a major advantage to farmers with tractors, yet, as we have seen, gm/ccs are capable of eliminating both these jobs. It is therefore quite possible that once shifting agriculture farmers start using gm/ccs, they will be able to compete with wealthier, mechanized farmers. This factor will be especially important when globalization allows farmers from the United States and Europe to sell their cheap grains all over Southeast Asia.



11. The production of additional benefits

Many gm/ccs produce additional benefits, such as food, feed, or products that can be sold. Of course, any of these products that are used in these ways will reduce the total amount of organic matter and nutrients being recycled onto the soil.

When we compare the above advantages to those of composting, we find that in most cases, gm/ccs will be far more attractive to farmers than composting. The exceptions to this rule would be those cases of farmers who are growing very high-value crops, and those who only have about half a hectare, and therefore would probably have virtually no niches where the gm/cc's could be grown.

Disadvantages of green manure/ cover crops

In spite of all these advantages, it is sometimes difficult to find out where and how gm/ccs can be grown and used profitably. There are some important disadvantages to using gm/ccs, and we must overcome them if we are to use them successfully.

1. Can the farmers use the land some other way?

Farmers will not plant a gm/cc that only fertilizes their soil where they could plant either a subsistence or a cash crop. Unless the gm/cc also produces food, the land used to grow gm/cc's must not be land the farmer could use for any other crop at that time. This is why the traditional green manure systems used before the 1980s were never accepted by shifting agriculture farmers: the farmers, quite rightly, were not willing to plant the green manures on land on which they could grow another crop.

2. The slow results

The improvement of the soil is a long-term process which is not noticeable right away to the farmer. Usually, significant improvement in productivity does not occur until after the first crop of gm/cc has been applied to the soil, which means that visible results are not apparent until well into the second cropping cycle. This slow appearance of results that are also rather difficult to believe, complicates the adoption of gm/cc's. For this reason also, it is usually preferable to promote gm/ccs on the basis

of some benefit they provide other than soil fertility.

3. Dry season problems

Often gm/ccs must produce organic matter at the end of the wet season or continue to grow during the dry season. Grazing animals, wild animals, termites, agricultural burning, bush fires, or several other problems may result in the destruction of the gm/cc or the organic matter it provides before the farmer can use them the following rainy season. Furthermore, in very hot climates and on soils with no shade, the nitrogen and much of the organic matter will be burned off by the tropical sun during the four to six months of the dry season, so that almost no benefit from the gm/cc will be enjoyed by the soil at all.

4. Difficult growing conditions

Very low or irregular rainfall, very acid or very alkaline soils, waterlogging, or a combination of these–problems that are all too common on the farms of resource-poor farmers–will reduce the growth of gm/ccs, thereby reducing or destroying the benefits they provide. We have gradually learned how to overcome most such problems, often by using gm/cc species that are resistant to the particular problem. Nevertheless, being forced to choose a specific gm/cc because of such a problem often means we cannot choose other species that will produce more vegetation, fix more N, provide other important benefits, or fit other niches in which gm/cc's might fit within the local farming system.

5. The timing of nutrient access

The nutrients provided by the gm/ccs, especially N, must be available to the crops at the times the crops need them. Thus, gm/ccs will boost farmers' productivity only when these nutrients are accessible at the time the crops need them and in the amounts the crops need. In many gm/cc systems, the crops need a large quantity of nutrients at specific times that the gm/cc does not provide very many. That is, at certain times, the nutrient supply runs out faster than the gm/cc can resupply it. The productivity of the system can thereby be greatly reduced. Nevertheless, natural foliar sprays (e.g. solutions of crushed Glyricidia sepium leaves or of cattle urine) or small amounts of chemical fertilizer can usually be very useful in providing nutrients at critical times when the crops' needs are likely to exhaust the supply of nutrients from the gm/cc.

The paper on Achieving the Adoption of Green Manure/ Cover Crops, pages 335-342 in this book, deals with how to overcome these problems.

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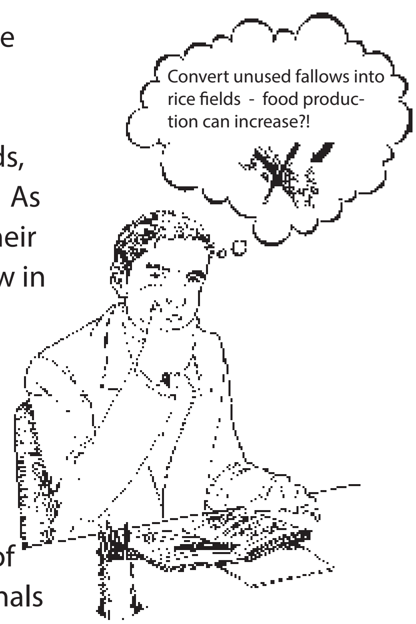
The Role of Fallow in Household Livelihood Strategies

Different concepts of the word "fallow"

In the absence of more profitable options to make a living, agriculture and forest related activities remain important for households practicing shifting cultivation. Case studies from shifting cultivation households throughout Southeast Asia have shown that fallows are not unused lands, but a highly dynamic component within the shifting cultivation system. As such, the forest-fallow is often managed by the households to sustain their livleihoods and outsiders have often misinterpreted the role of the fallow in the total farming system.



Conventional perception of fallow by outsiders

- A fallow is "resting the land".

The perception of a fallow as unused land, combined with the concern of food security for a growing population, led policy makers and professionals

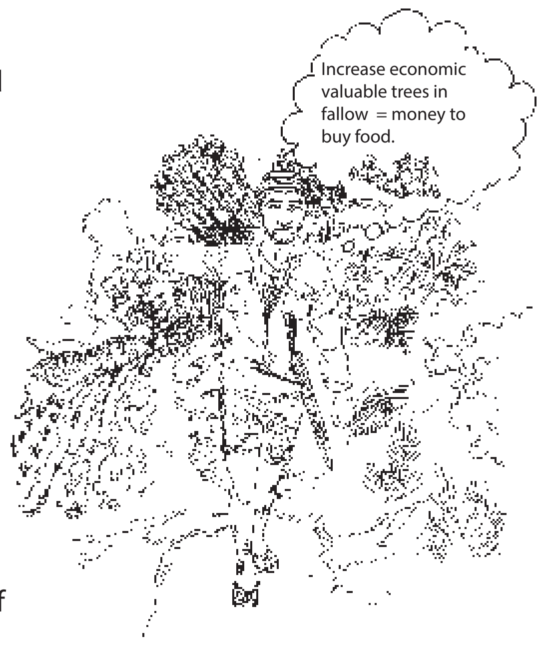
> The conventional thought on what constitutes a fallow is that "during a fallow period after a cropping season, land is abandoned (land is just covered by planted or regrowth vegetation) in order to rejuvenate the soil fertility and/ or disrupt pests and diseases." (Ruthenberg, 1976)

dealing with shifting cultivation, to focus on the cropping phase. As improvements were sought to increase food production, the fallow period could be reduced, since it was regarded as unused land. Although the fallow functions to restore soil fertility and reduce pests were recognized, it was thought that intensification of food cropping could be achieved by applying inorganic fertilizer and pesticides.

Role of fallow for the households

A shifting cultivation household views a fallow in a number of ways. For them, a fallow is part of an integrated farming system, in which multiple objectives for the farmer's livelihood can be met (also see How Household Development Cycle Stages Influence Field Expansion Among Swidden Cultivators, Negros Oriental, Philippines, pages 169-174). For the household, fallows exist for a number of biological and socio-economic reasons, including:

- Restoration of soil fertility after cropping.
- The decrease of erosion with the establishment of a secondary forest.
- The opportunity to gather a number of products from the fallow vegetation for immediate food cropping, construction materials, medicines and firewood.
- The provision of fodder for livestock.
- The opportunity to obtain cash income through the sale of specific products.



This difference in what constitutes a fallow often creates low adoption rates of well-intended programs between outsiders and the households themselves to improve the food-situation among shifting cultivators. They focused mainly on the food cropping mode, while households have always been using the fallow vegetation not only to satisfy food needs, but also cash and other needs.

Management of the fallow vegetation: Let nature work

Normally, a household has several options to sustain the livelihood. In the absence of more profitable options to make living, the fallow vegetation fulfills the role of meeting multiple objectives to sustain the livelihood (which is more than a lack of income). The shifting cultivation communities mainly use family labor, and limited capital resources for their farming. Therefore, the phrase "let nature do the work for you" is a very realistic option. It has been able to sustain their livelihood for generations. Although many shifting cultivation households live in quite remote upland areas, they are all somehow linked to "the outside" world and respond to social, economic, political and environmental context. The management strategies originated from changes in the internal initiatives and are known under the term indigenous management strategies. Indigenous management strategies are directed at the

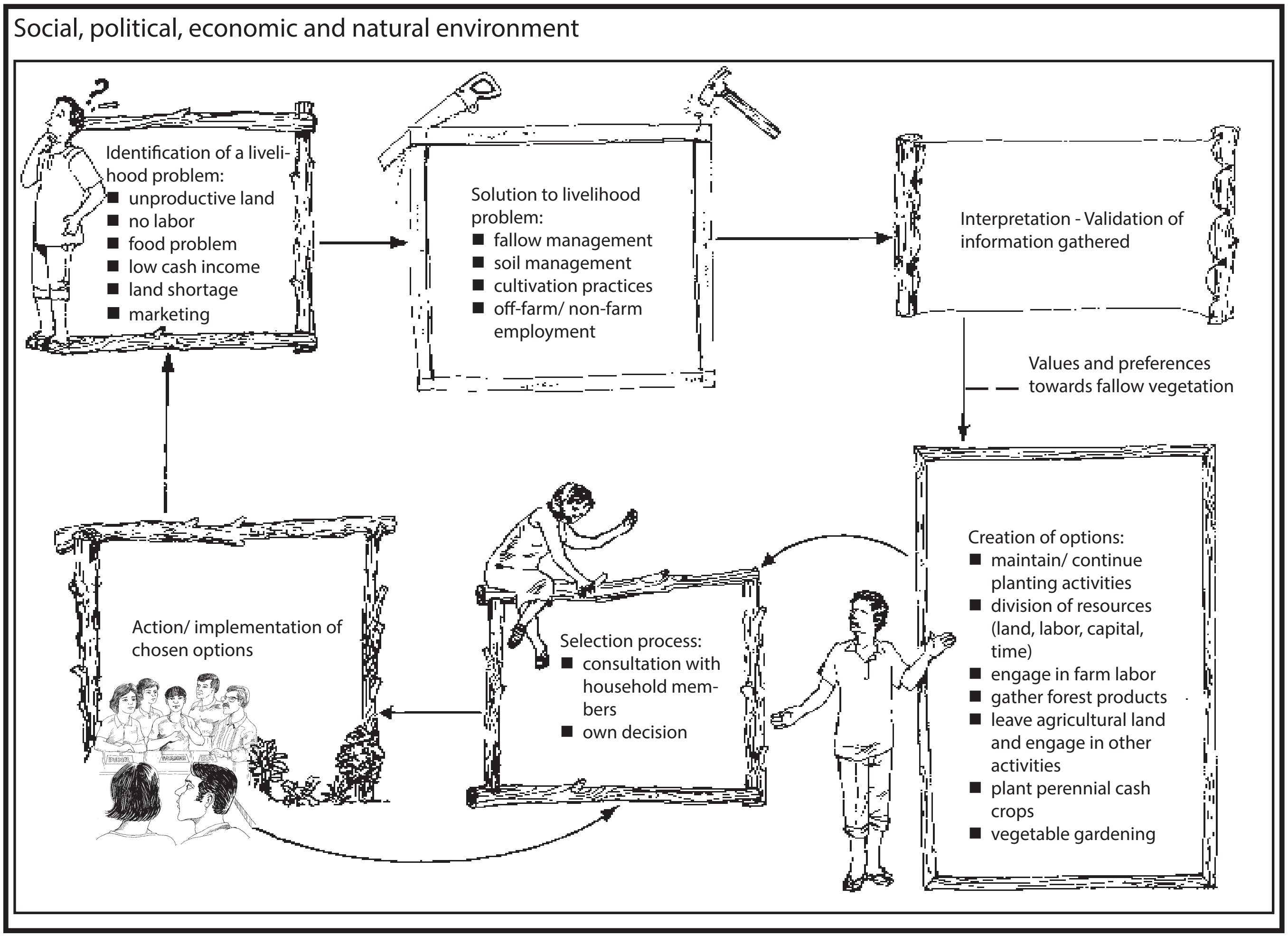
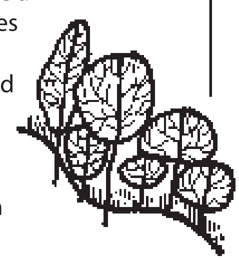


Figure 1. Flow of decision-making process within a household.

integration of the fallow and its functions into the total farming system to sustain or improve the livelihoods. These strategies were developed and tested by farmers, and are flexible and able to respond and adapt to changing needs and aspirations of the households over time, without the involvement of formal research and extension services.

> The management of the fallow vegetation and division of "resources" are a reflection of the opportunities and constraints in a wider social, political, economic and natural environment. This is embedded in and resulting from a process of learning and experience of farming in that locality.



Management of fallows

We can say, that management strategies to manipulate fallow vegetation vary between two extreme options: on one side to sustain annual food cropping (a), and on the other side a system where economically valuable woody vegetation dominates (b). In figure 1, the directions to manage fallows are summarized.

Manipulation of fallow through on-farm growing of food crops

Most fallow management strategies consist of different components. However, in remote isolated areas, subsistence farming (the growing of food crops) may continue to be the most important target for the household. When land pressures increase, households may find that the length of a natural regenerated fallow-vegetation is no longer enough to sustain food cropping. With their knowledge of the local environment, households start to select and promote those perennial species that can speed up the soil restoration.

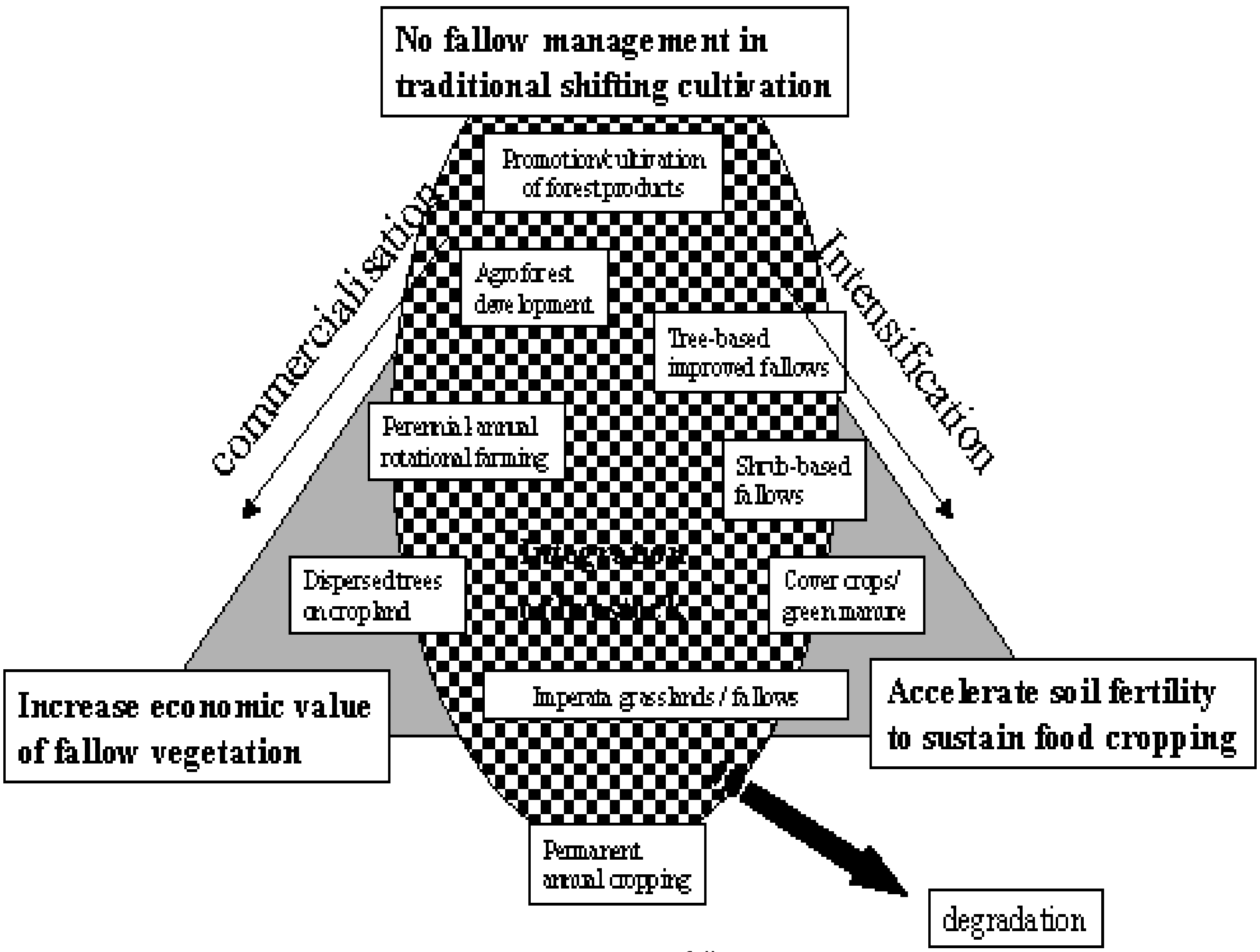


Figure 2. Directions to manage fallows.

Symptoms of over-intensification are:

- increased weed pressure
- reduced soil structure
- increased pest frequency

In the figure, we have called them tree-based improved fallows, shrub-based and cover crops/green manure.

When households continue to grow food crops on farm, there will be a time when shrubs cannot restore soil fertility to sustain crop production. In such cases, households develop fallow systems, which must be based on herbaceous legumes.

If developments continue whereby fallow periods shorten, ultimately biological functions of any fallow may seize to exist. If households lack the resources for permanent food cropping (with external inputs like fertilizer, pesticides and so on), swidden cultivation systems may enter a phase of degradation, resulting from "over-intensification".

In Southeast Asia, this "over-intensification" has led to the establishment of an aggressive weed, called Imperata cylindrica. Once established, the land will be hard to cultivate, and is generally not productive as Imperata does little to restore soil fertility (although Imperata fallows may prevent complete soil degradation). This is true from an ecological point of view, but households do not always view Imperata as a "weed". Farmers in Bali, Indonesia, have found good use for Imperata fallows, and even promote the growth of it on their land. The grass is widely used for roof thatching. Many hotels on Bali and other parts of Indonesia are using this grass to construct roofs. The sale of this "weed" provides the farmer with considerable cash income.

In herbaceous legume fallows in Northeast India, farmers use Flemingia vestita as it fixes nitrogen, while the tubers are eaten. This legume is rotated with annual crops.

Increasing the economic value of the fallow vegetation

The close links that most farming communities in Southeast Asia have with the monetary economy, means that shifting cultivation households have more options to make a living, in or outside agriculture. It allows a diversification of the farming system and a shift away from food cropping. A growing number of economically valuable trees are planted in the fallow vegetation to satisfy the increasing cash needs and aspirations of the households. To further diversify their livelihood, and to avoid risks associated with monoculture types of systems, part of their land may still be used for shifting cultivation of food crops. This could give the household food-security for at least a certain time of the year.

Perennial-annual crop rotations. Many systems, which consist of timber trees are rotated with annual crops, like the use of Melia spp in farming communities of Northern Vietnam, and the indigenous paper mulberry tree (Broussonetia papyrifera) rotated with rice in Northern Laos. The inner bark of paper mulberry is used to make coarse-textured parchment for handicrafts and other uses.

- In Nagaland, Northeast India, Alnus nepalensis provides soil fertility properties as well as firewood and timber for housing, while these trees also become part of a shifting cultivation cycle.
- In Papua New Guinea, fallow composition is manipulated by promoting species such as Parasponia rigida, Schlenitzia novo-guineensis, Albizia spp to provide the family with timber for house construction, fencing and firewood.
- In Laos, teak trees can be intercropped in the fallow, and can provide timber for sale and other households' needs.

If commercialization processes continue, it may result in a more intensive propagation of economic valuable trees. Perennial-annual crop rotations, also referred to as commercial shifting cultivation, may develop. Commercial food crops (e.g. vegetables) are rotated with economic valuable trees. The succession phases of the different crops imitate natural succession processes of natural vegetation to re-establish a (secondary) forest in traditional shifting cultivation.

Agroforests. The cinnamon-coffee agroforests in Kerinci, West-Sumatra and India provide a good example. Together with vegetables, farmers plant coffee trees, while after two years seedlings of cinnamon trees are incorporated. In this way, farmers are secure of short-term cash income from vegetables, medium term income from coffee, and long-term income from the cinnamon trees. The different layers and sequences of crops and tree mitate natural regeneration processes, normally observed in the establishment of a fallow. A similar example is found in Adaptive Changes in Upland Mindoro, Philippines: Intensified Land Use among Buhid Shifting Cultivators, pages 293-298.

When tree crops become the main agricultural products, tree based systems may develop. They are known under the term "agroforests".

Indigenous Fallow Management systems (or Fallow rotation systems) are , therefore, all systems between agroforests or tree crop plantations on one hand, and continuous cropping on the other hand. This diversity of the land-uses and the resilient indigenous management strategies has made these systems apparently sustainable.
In Southeast Asia, we find many examples of systems that sustain the livelihood of the households, based on strategies to manage fallow, which follow natural processes of a secondary forest. A number of reasons may be mentioned for this development:

- A change towards increasing the economic value of the fallow vegetation is made easier, as households are able to find alternative employment. Large markets could be accessed for selling farm products. This can bridge the income-gap between the establishment of the trees and the harvest of the tree crops.

- Shifting cultivation households have been using trees in order to satisfy their multipurpose objectives: cash, food, fuel, fodder, and a claim for land, where economic valuable trees can be planted on areas with an "open access". The use of trees has been a common practice among these communities to claim land.

- Southeast Asia's long history of indigenous tree crops that produce spices for world markets could have helped further in market channel development, commercialization and fostering attitude towards growing trees.

- Heavily subsidized consumer prices of rice (the main staple crop in Southeast Asia) in a number of countries make it more profitable for the households to buy rice and produce other "more economically valuable crops" (e.g. commercial valuable tree crops). It is easier to buy rice from the harvest of "economically valuable fallow crops".
- Fallows to improve food production are not "popular". Fallows, which increase soil-fertility processes often consist of species that produce beans as well. Although the consumption of beans is quite known in countries like India and some areas of Vietnam, in many other countries in Southeast Asia, the staple crop is rice.

- Land use pressure may hamper a sustainable tree cropping system. Tree cropping often owes its success to the combination of growing annual crops in a sequence with longer term tree crops.

- Incentives to stimulate tree cropping are important issues to be addressed. In other words, the political context may be another aspect that can stimulate fallow management towards agroforestry development, be it informal or formal "regulations".

Some reflections for policymakers

- Political systems must be willing to recognize the fallow as a crucial component in the livelihood of the people.
- Recognizing indigenous strategies may contribute to a more appropriate "farmer-developed" intensification and diversification of the agricultural systems in the uplands of Southeast Asia while saving in investment costs for several reasons:

    - Improvements in shifting cultivation can develop within the constraints and opportunities of their context.
    - Indigenous strategies have evolved with low cost and in most cases with little or no outside (expensive) technologies and high amount of capital.
    - The systems are flexible and can be gradually refined and intensified by the farmers themselves in response to changing circumstances.

- Access to large enough markets for (tree) products is another factor for dividing resources between the continuation of foodcropping and/or increase the economic value of the fallow vegetation itself.

Reference:

Wiersum, K. F. (1997). "From natural forest to tree crops, co-domestication of forests and tree species, an overview." Netherlands Journal of Agricultural Science 45: 425 - 451

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Medicinal Plants for Sustainable Management of Uplands in South & South-East Asia

How do medicinal plants fit in the sustainable development framework?

Medicinal plants are uniquely geared to address both people and environment issues. They operate within the parameters of both subsistence and cash-based economic systems that characterize rural economies and livelihood patterns in the uplands. They can be a bridge that unites the sustainable and healthy existence of the past with the unsustainable use and commercialization of the present, thus moving forward into a sustainable future.

Advantages of Medicinal Plants (MPs)

- Affordable medicines
- Commonly found in many areas
- Easily cultivated and managed
- 80% of the people in Asia depend on them for their primary medicines
- Traditional medicine systems (TMS) largely depend on wild collections
- MPs are critical sources of livelihoods for forest dependent communities.
- Many MPs occupy low-volume, high-value 'niche' markets

Sources of healthy societies

Medicinal plants (MPs) offer simple, safe and affordable health care thereby providing alternate and complementary livelihood and health care systems. Most of the valuable medicinal plants are found in fragile ecosystems, conservation of which will also directly or indirectly conserve the area's biodiversity. Thus, by sustainably using and managing medicinal plants in shifting cultivation areas, we can help restore the balance toward livelihood and environmental sustainability in the Asian uplands.

Social perspectives

Social acceptability/cultural familiarity. Around Asia, the use of medicinal plants is traditional in most cultures — spanning at least a few thousand years. The practice poses no major problems of acceptability related to lack of familiarity with the plants and their use. Cultivation methods for many commonly grown plants developed so far are not suited to shifting cultivation, and processing of the raw products into safe and effective medicinal products is not usually standardized. However, by and large, society feels comfortable in incorporating these plants into their farming systems and household uses.

Employment avenues for women. Traditionally, men have been the mainstays of MP-based micro-enterprises because of the nature of collection – plants grow in wild and difficult terrains – and because, processing takes place outside their homes. However, as medicinal plants are being managed through community participation and the products also being used as home remedies, more women can join in MP-based activities. The greater options provided by the MP-based activities may better fit the average daily schedule of women. These typically include collecting raw materials, drying of the plant parts and products, and transporting to the market. Trained women can be employed by the herbal drug industry in simple processing, packaging, labeling, bulking, and quality control.

Family orientation. Herbal medicine can also be a family-run, health-based livelihood enterprise. Many traditional healers have been running MP-based health care systems as a family business in Asia since they believe in passing on the indigenous knowledge only to a close member of their family. The family-based enterprises not only strengthens the social fabric but preserves the traditional knowledge and also offers a safer framework for children to learn a trade from their parents.

Using and preserving traditional knowledge. If the economic value of the medicinal plants is added to the wide range of health and subsistence-level applications, livelihood opportunities can be created in the shifting cultivation areas, thus providing an alternate source of livelihood. Through this approach, medicinal plants can help bridge the gap between sustainable subsistence, which generally prevails in the shifting cultivation areas, and cash economies. Even at current levels of conversion of knowledge in traditional medicine into economic opportunities, the cultivation and utilization of these resources can employ thousands of people, even those with limited educational background.

The conversion of socio-cultural traditions and indigenous knowledge into livelihood and economic opportunities also preserves the rapidly eroding cultural knowledge and practices which are increasingly threatened due to globalization and the homogenization of culture. Like biological diversity — the product of millions of years of evolution - we need to protect indigenous knowledge and cultural diversity existing in the shifting cultivation areas. In the uplands of Asia, especially in the areas dominated by marginal agriculture, there is a need to give economic value to traditional and indigenous knowledge that can be done through MP-based activities.

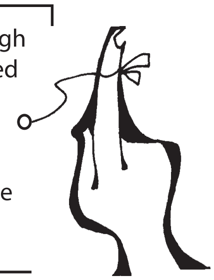
Why Medicinal Plants Provide Safer and More Efficacious Health Care Options

- Since whole parts of the plant are consumed rather than individual constituents of the chemicals they contain, medicinal plants have synergistic effect on the user.
- They are consumed in large bulks as primary compound and therefore, have less, if any, side effect associated with high dose chemicals.
- The treatment of ailments takes a more holistic approach.
- Traditional (documented) medicine systems were developed over a span of 4000 years and their efficacy and safety are tried, tested and accepted.
- Medicinal plants-based treatments can combine with modern health practices. They, therefore, have both alternate and complementary roles to play.

Environmental perspectives

Medicinal plants provide a viable economic and ecological alternative to unsustainable forest exploitation and conversion to shifting cultivation. Forest vegetation can be protected for their rich biodiversity, and their many service functions. The growing apathy toward products made from biotechnological and chemical means (e.g., allopathic products) as well as the continued cutting down of forests results in a product vacuum that needs to be filled. Medicinal plants have the potential to fill that need as they provide green health alternatives and a number of other eco-friendly products of domestic and industrial usage.

Remember that even though most of the commonly-used herbal medicines are safe and have no known side-effects, they should not be taken without the guidance of a trained practitioner.



Found as trees, shrubs, grasses and vines, these medicinal plants run into thousands of species. Their entry into the world food and drug market as environment-friendly botanical products is looked upon as a new development that can save tropical and subtropical forests by promoting community-based enterprise development and conservation.

Medicinal plants are ubiquitous resources and can be cultivated in a variety of land use systems and ecosystems. There is an estimated

8000 species of medicinal plants known to be in use in South Asia. The Task Force set up by the Government of India has reported that agro-technologies for approximately 30 species have already been developed. The environmental value lies in the fact that by growing these plants as under-storey crops, associated species and intercrops, they complement the growth and sustenance of trees thus conserving the forests.

The root systems of many medicinal plant species contribute to soil stabilization and prevent erosion. Some medicinal plants can grow in poor soils and under low rainfall and moisture conditions. Thus, there are vast areas including shifting fallow land where medicinal plant plantations can be developed. Many of the species are shade tolerant while others are climbers, trees, shrubs and herbs that can be grown in different configurations of crop geometry.

Economic perspectives

Major economic roles. Medicinal plants can provide cash income to shifting cultivators. A sustainably- and ethically-run commercialization process of medicinal plants can benefit local collectors by providing higher price for traditionally-traded products and by opening national and global markets for new products. Also, enterprising members of the community can establish locally-based health care facilities.

If they can build partnerships with shifting cultivators and collectors of wild medicinal plant materials, the private sector can be assured of sustainable supply of quality raw materials. However, a major concern here is the protection of intellectual property rights (IPR). A more equitable relationship is possible if the often maligned arrangement of bio-prospecting can be replaced by bio-partnership between collectors and traders.

Medicinal plants also score high in economic terms. The annual turnover of Ayurveda, one of the major Indian systems of medicine, is estimated to be more than half a billion dollars. Traditional Chinese medicine is also estimated to make an annual turnover of more than five billion dollars. For information on commercializing medicinal plants, refer to Guidelines for the Commercialization of Medicinal and Aromatic Plants (MAPs) in Shifting Cultivation Areas, pages 232-237.

The collection of raw materials and the production of traditional medicines require high labor input. Collection from wild and selective harvesting in addition to primary processing is mostly done manually. At the secondary and tertiary processing levels, medicinal plants have substantial labor requirements. Thus, MP-based industries expand employment, increase cash earnings, and enhance traditional uses through value added processing.

Practical applications. Some of the practical applications integrating medicinal plants into rural lifestyles have assisted in backstopping upland agriculture. Other important advantages of cultivating medicinal plants include:

a) ease of their incorporation into the existing farming systems due to availability of a large number of plant species belonging to all types of vegetation, and,
b) their suitability to grow in different eco-physical conditions.

Developing solutions: Agenda, tools and methods

If we agree that we have chosen medicinal plants cultivation as our means to develop sustainable land use systems in the shifting cultivation areas, the next question will be, how do we achieve our objective? The answer is by developing strategies, technologies and tools that infuse conservation concerns with economic opportunities, and then adapting and transferring that knowledge widely to achieve sustainable development while enhancing human capacity and livelihoods.

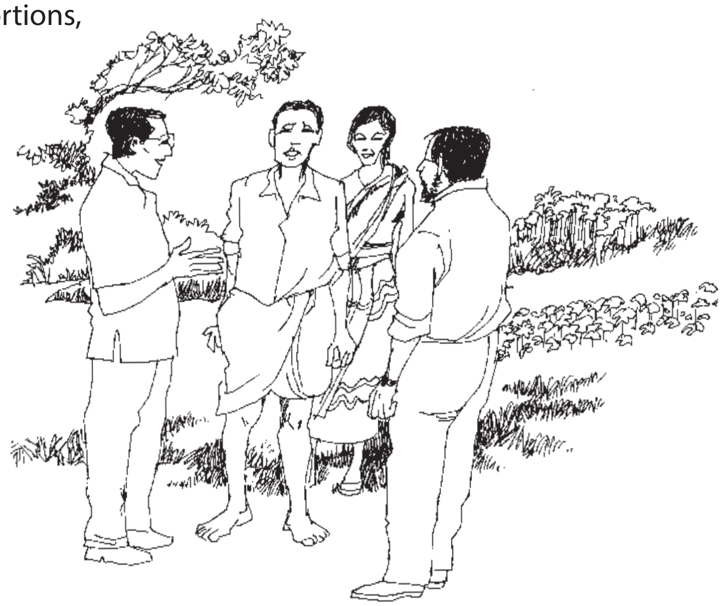
Best solutions for action

The action agenda for the use of medicinal plants cultivation and the in-situ management for containing the problems of shifting cultivation in the uplands can be summed up in the following ways:

Policy and Institutional Solutions

- Institute national, provincial and local level policy reforms by putting medicinal plants and their users on the development agenda of governments, agriculture/ rural development banks, and other agencies.

- Enabling policies that prevent market distortions, provide incentives to specialized groups and enterprising individuals, promote wider use of traditional medicines and encourage simple value additions in the rural areas can lead to:
  a) intensifying shifting cultivations both in private and degraded lands by incorporating high-value, low-volume cash crops;
  b) encouraging community-based resource management enlisting sustainable participation of the community from production to marketing activities; and



c) integrating traditional medicine into modern health care systems.

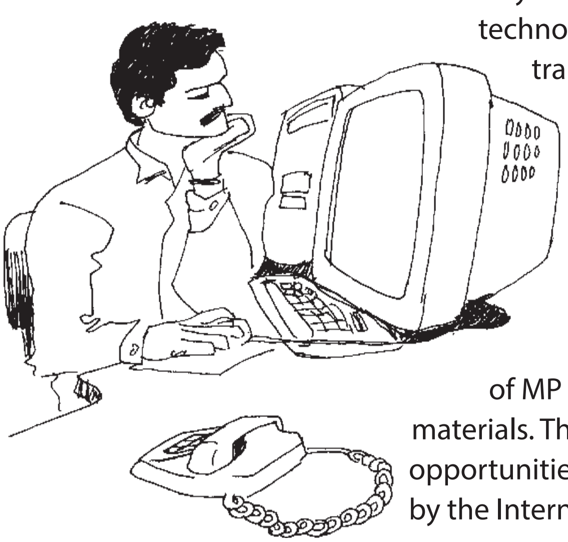
Outreach and networking solutions

- Learn from other sub-sectors in developing collection-production-marketing-consumption systems in the uplands. These systems would take into account the activities and interest of the key players in the value chain.

- Local, national, regional and international level networking can bring individuals, groups and organizations together to discuss problems and solutions in a more cost-effective manner. Researchers, development workers and local communities can be tapped in the identification of priority species for conservation, collection and development.

- Non-government and government organizations who are willing to be change agents and facilitators of a community-based development process, and want to get the MP-based solutions in shifting cultivation areas should first reorient the ways shifting cultivation is viewed and understood by outsiders. For example, in Jhum (shifting cultivation) areas of North-East India, policy makers and development administrators could use the cultural strength fof the forest dwellers in planning conservation-oriented development programs.

Information technology solutions



- Maximize the use of today's information technologies for transfer of technical know-how and for the innovative designing of the supply system of MP raw materials. The emerging opportunities afforded by the Internet-based

Effective Application of Information and Communication Technologies (ICT) in Medicinal Plants

Arya Vaidya Sala (AVS) Kerala, a traditional drug manufacturer and health service provider, publishes monthly market prices of major medicinal plants in their bulletin and passes on this information to the cultivators who use this information in their market decisions.

Traders in Delhi, India have agreed to put price information on the web page of the Jadibuti Association of Nepal, an NGO, so that intermediary traders can decide where to sell their produce. The intermediary traders are also required to pass on the information to the collectors and the farmers in the high Himalayas.

ICTs can also be used for product advertising and doing business with e-commerce.

technologies provide big opportunities for quick and cost-effective accessing of market and price information. The use of tele-electronic communications can be encouraged to acquire up-to-date information on markets, price and products.

Applied research solutions

- Design and implement on-farm, participatory and action-oriented research to popularize MP-based sedentary cultivation technologies to benefit shifting cultivators and conserve biodiversity.

- Develop agroforestry system models based on indigenous knowledge, changing socio-economic parameters and national/global economic scenarios

- Apply simple research tools to solve sustainable shifting cultivation and management-related problems.

Finance and marketing

- The MPs markets as they function today are extractive and may serve as means to exploit poor collectors and small-scale producers. Securing proper and sufficient financing is always the key to carrying on efforts toward a sustainable, equitable and socio-economically-sound use of medicinal plants. Best practice in medicinal plant farming in shifting cultivation needs best financial support to the growers. Marketing of NTFPs generally is discussed in Practices in Marketing Forest and Agricultural Products: Lessons for Resource Managers, pages 232-237.

- Strategic financing and marketing efforts should be done to gain medicinal plants' acceptability all over the world as a complementary medicine. Consequently, phytomedicines become socially acceptable, financially affordable and environmentally sound means for uplifting the poor.

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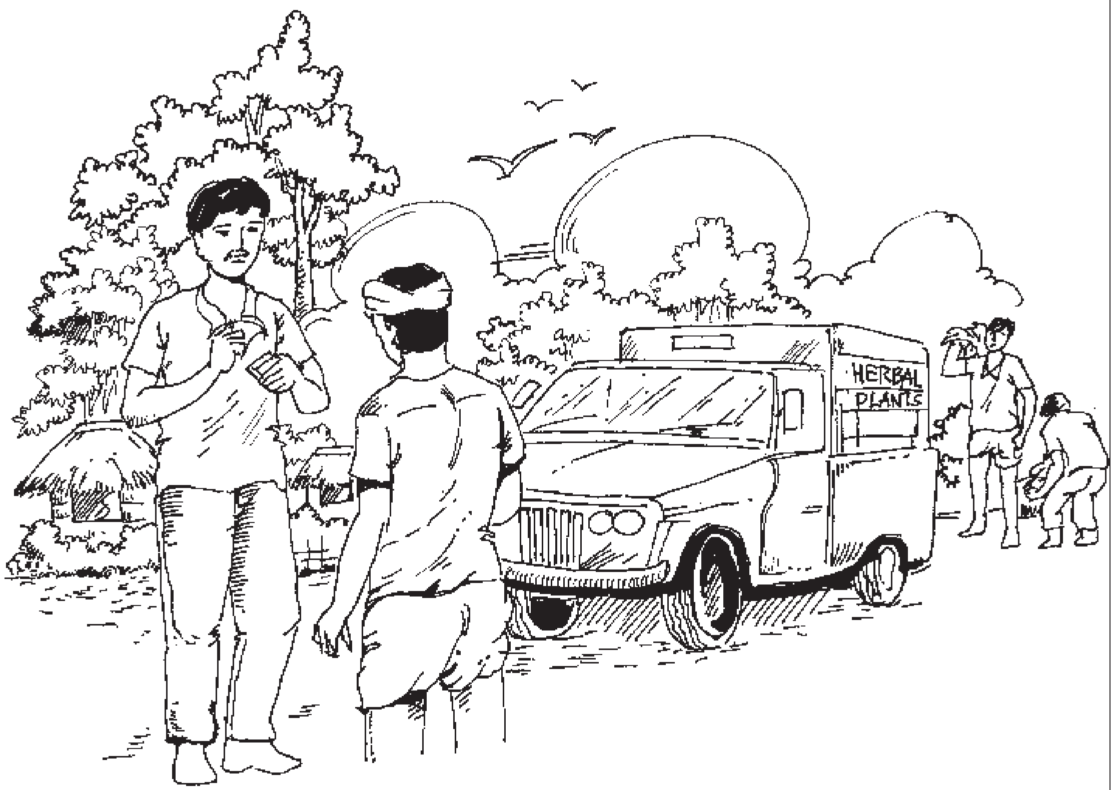
Guidelines for the Commercialization of Medicinal and Aromatic Plants (MAPs) in Shifting Cultivation Areas



Medicinal and aromatic plants (MAPs) are critical sources of livelihood to the local people, especially the marginalized and poor farmers. They also have the potential to be a substantial source of revenue to the government. However, these valuable non-timber forest resources are greatly underutilized and undervalued at present.

MAPs have comparative advantages over other plants as they are more knowledge-based due to their association with traditional systems of medicine. They require low or no capital and are low technology-based. Likewise, they have high local use.

Their locations in fragile, remote ecosystems amid rich indigenous systems of management favor disadvantaged and marginalized communities. Consideration of communities in managing these plants cannot be limited to local subsistence use alone. Cash earning is an important and necessary element of the people's livelihood. Refer to Practices in Marketing Forest and Agricultural Products: Lessons for Resource Managers, pages 281-288, for a broader discussion on marketing forest and agricultural products.

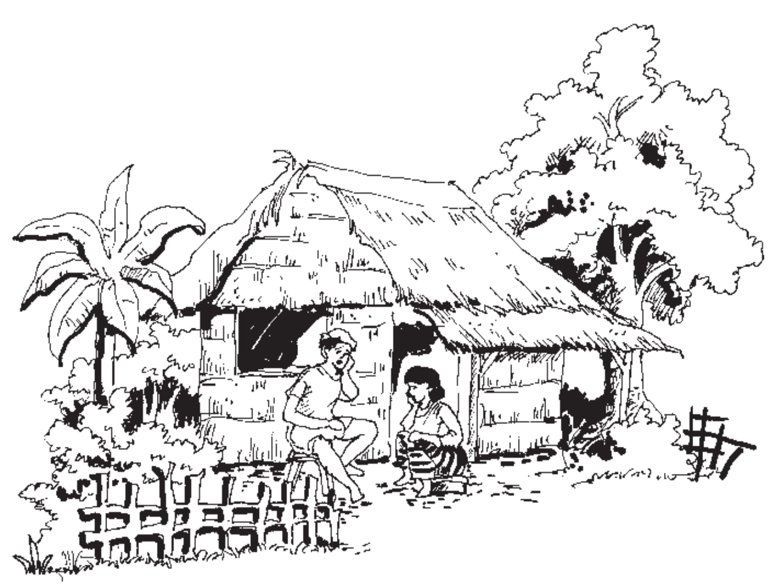
Potentials and pitfalls of commercialization

In some cases, MAPs may have high subsistence value and low commercial value. However, it may be otherwise. In both cases, they are either unsustainably utilized or underutilized. One of the problems faced by commercial producers, especially small-scale growers, is the fact that markets for MAPs are complex and trade practices are difficult to understand and access.

Potential to enhance livelihoods security

- The products can be produced in different volumes and are often household based.
- They are generally seasonal in nature and provide food and supplementary income during periods of food shortage;
- They are a) labor intensive; b) use simple technologies; c) provide direct benefits to the local people; and d) are accessible to the low income and socially disadvantaged groups.
- In the context of increasing costs of modern medicine, more and more people will be dependent on traditional medicine.
- On the other hand, in the context of liberalization and globalization, products based on MAPs can have comparative advantages.

Although commercialization of MAPs has a marked potential, it also has an equal magnitude of pitfalls and dangers.



Pitfalls

Socio-economic problems

- As most of the MAPs are common property (open access) goods, they have potentials to be exploited as public goods. If the process is unregulated, commercialization can wipe out valuable biodiversity resources from uplands, further marginalizing the poor people.
- As gains from commercialization increase, powerful local traders develop monopolistic relationships with the collectors.

- The commercialization of MAPs may aggravate the inequity that exist in the impoverished uplands, where poverty is rampant and awareness is lacking.

Environmental problems

There are a number of biodiversity conservation issues in the commercialization of MAPs which are intrinsically associated with livelihood factors:

Species loss

- An unplanned, poorly implemented and unmonitored commercialization may lead to mining of biodiversity for scarce raw materials as it encourages maximization of profit.
- As the information regarding the sustained yield potential is unknown and untrained villagers often carry-out extraction in an unsustainable manner from the forest, permanent loss of threatened species is feared.
- The MAPs are often found in fragile ecosystems. Thus, their destruction leads to the endangerment of other plant species. Likewise, it opens up the ecosystem to invasive species. Therefore, unsustainable extraction of MAPs may lead to the loss of valuable biodiversity both at the ecosystem and the species level.

Loss of traditional knowledge systems

- The threat to indigenous knowledge systems due to increasing bio- prospecting and bio-piracing by commercial interests threatens the indigenous people's intellectual property rights (IPR).

- Local people generally receive little or no compensation for their indigenous knowledge in the current process of commercialization.

Therefore, there is a need to protect the IPR of local people through improved arrangements under existing IPR protection schemes.

How should the commercialization process be managed?

Four major strategies are discussed to develop and manage a sustainable commercialization.

1. Equitably distributing benefits

The demand for MAP-based raw materials is growing at an approximate rate of 10-15% per year, both nationally and internationally. One main reason for this is largely due to the unprecedented growth in number of industries in the different sectors (i.e. pharmaceuticals, cosmetics and natural diets) that use medicinal plant resources. Although trade volumes have increased many folds, its benefits have not always percolated down to the collectors and local traders commensurately, thereby leading to greater social inequity.

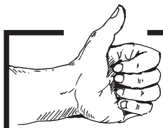
2. Transparency and fairness

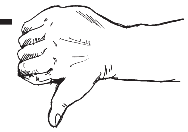
It is increasingly being realized that commercialization processes need to have meaningful participation of all the stakeholders from collectors to consumers. There is a need to make the process transparent and benefit-sharing fair.

Ideal Functions of Different Actors in the Supply Chain

Producer/ Collector →	Local Trader →	Regional Trader/ Processor →	Exporter
■ Decides what and how much to collect based on the knowledge of price/ market situation. ■ Carries the produce to the road head or agents to get the maximum price for the produce.	■ Looks for reliable collectors and producers who always honor their verbal commitments. ■ Gives regular information about the prices and markets of MAPs. ■ Keeps track of the national and regional price trends. ■ Tries to give the best maximum prices to the producers.	■ Purchases raw materials from traders based on the demand of the MAP industries. ■ Tries to do primary processing to meet the quality standards set by the industry. ■ Keeps himself informed of the market trends in both the national and international markets and regularly passes on the information onto the local traders. ■ Makes fair profit by processing the raw materials to meet the quality requirements of the manufacturers and exporters.	■ Purchases finished products (well packaged and labeled) raw materials. ■ Takes care of all the legal procedures including the certification requirements for export trade. ■ Organizes meeting of processors to make them aware of the rules and regulations of the importing countries. ■ Invests in advertisements. ■ Makes efforts in creating greater markets.

DOs and DONTs in the commercialization of MAP-based raw materials





Dos	Don'ts
Provide access to information on market and price	Do not provide wrong and incomplete information
Formulate rational policies and create enabling institutions	Do not implement wrong policies such as banning of species for trade
Create markets for new products	Do not replace or disturb the traditional marketing institutions
Provide incentives to both individuals and group	Do not create disincentives such as setting of production quota or unrealistic price ceilings
Diversify products and target niche market	Do not depend on single source and/ or suppliers
Pay a fair price according to quality	Do not cheat the suppliers on price so that they will not cheat on the quality of the produce
Build bio-partners in ensuring a sustainable supply	Do not promote bio-prospecting and bio-piracy

HIMALAYAN MOREL MUSHROOM
(Morchella conica)
Morel mushroom is marketed as natural medicine and food from the Himalayas in high-end markets in Europe and Japan.

3. Marketing strategically

Marketing includes all operations of value adding and product transformation as the products move from the primary producer to the final consumers. It is a process through which goods are exchanged between producers and consumers through a number of intermediaries.

The traditional MAP markets are extractive. The market largely serves as a means to exploit forest workers or collectors. Also, it keeps wages or prices low, while increasing the value of the products.

Suggested Marketing Strategy

- Construct common storage facilities to prevent 'distress selling' by the collectors and to maintain good quality of the produce;
- Construct /rehabilitate marketing infrastructures such as permanent sheds in the local Bazar for storing and selling MAPs, as well as build approach roads/trails to hasten the transportation of these produce;
- Augment MAP resources through agroforestry activities in farm and community lands;
- Construct low-tech storage and primary processing facilities; and
- Traditional trading groups and individuals in the villages should be organized into marketing federations or cooperatives to increase their bargaining strength.

4. Developing sustainable supply sources

The sourcing of raw materials adopted by industries continues to be based on the premise of abundant and ever-available raw materials from the natural habitats. However, it is clear that the supply crunch is already strongly affecting the industry as well as the local users. It is evidenced by a high rate of turnover in small-scale industries, as well as increased contracting by large firms to regional suppliers and dealers. The result is an increasingly unreliable market for medicinal plants raw materials that is secretive, inefficient, and frequently exploitative.

Hence, there is a need to reassess the herbal industry's supply process. Likewise, there is a need to make this process more transparent, participatory, equitable and sustainable. It is with this opportunity that the idea of 'bio-partnerships' is being proposed to be the new mechanism of partnerships between the industry and private sectors in Asia.

Bio-partnership is the development of equitable relationship among collectors, producers, suppliers and consumers for marketing biodiversity products for mutual benefits.

Conclusion

Commercialization of medicinal plants holds a great promise in promoting economic growth in poverty-stricken areas. However, the current process is highly inequitable and unsustainable. Therefore, it calls for an urgent recognition by the concerned governments, industry and development agencies.

A holistic approach based on the production to consumption and marketing system (PCMS) is recommended. Lessons learned from a number of case studies can provide important guidelines. It can be safely argued that commercialization, if managed properly has the potential to increase one's income, enhance social equity and strengthen the livelihood security of a large number of poor people in the Asian upland regions.

KEY POINTS TO REMEMBER

Key Program Focus
- Pilot pocket area
- Enterprise promotion
- Empowerment of local community
- Package to support commercialization

Main Activity Focus
- Networking with partners
- Institution building and strengthening
- Cash through conservation
- Equal opportunities for women and disadvantaged groups

Main Result Focus
- Coordination through participation
- Integrated forest resource management
- Nested biodiversity support
- Equitable benefits and inputs
- Monitoring adaptive socio-ecological impact
- Action facilitation

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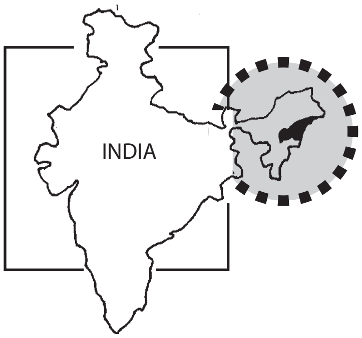
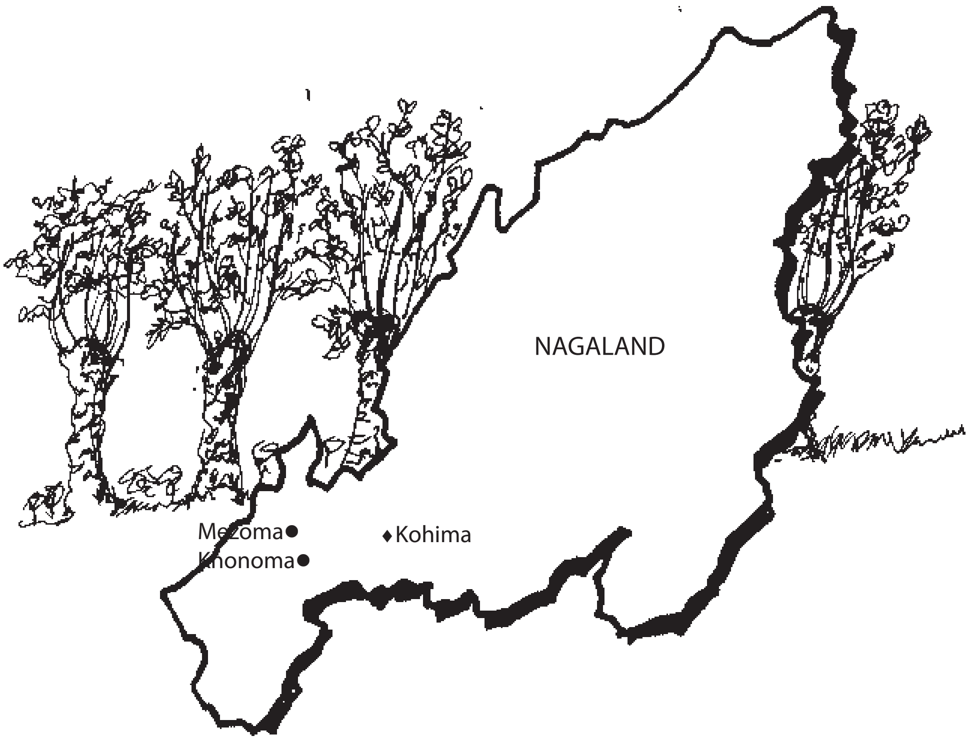
Resource book produced through a participatory writeshop organized by IFAD, IDRC, CIIFAD, ICRAF and IIRR.

Managing Alder for Improved Shifting Cultivation in Nagaland, India

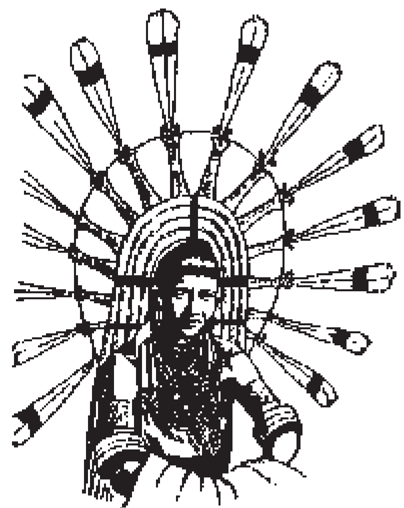




Khonoma and Mezoma are two villages located about 20 km west of Kohima, the capital of Nagaland. Located on the north-east fringe of India, Nagaland is a mountainous and heavily forested state. Khonoma and Mezoma are sister villages located on opposite sides of a valley. Even before the days of British rule, both were historically renown for warfare and the people often collaborated in inter-village raiding and, later, in opposing British pacification of the Naga Hills.

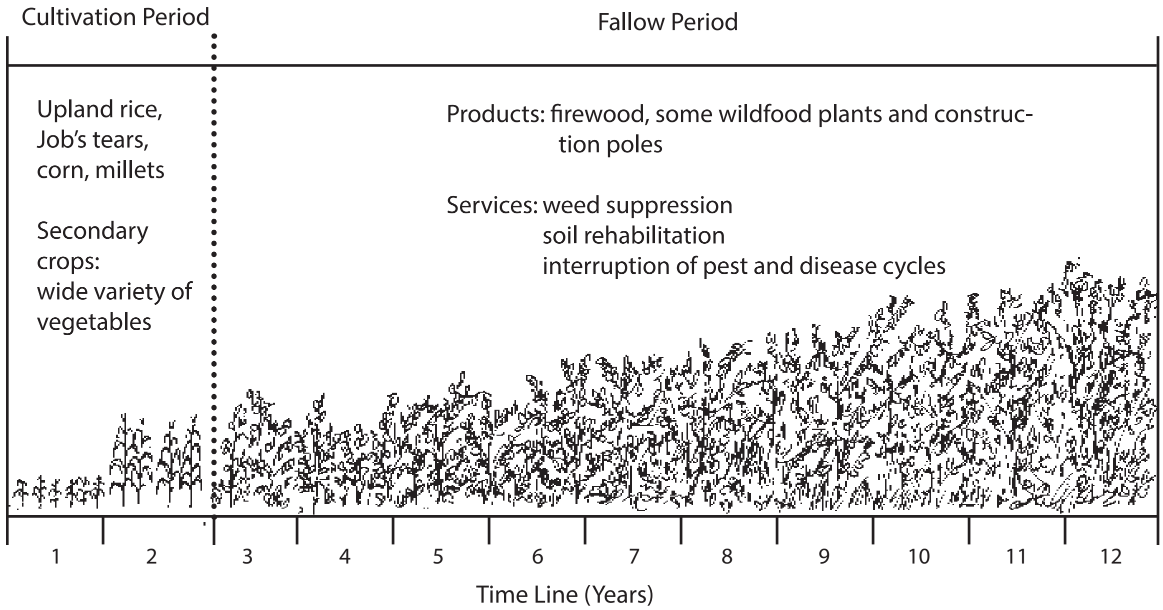
The people of both Khonoma and Mezoma belong to the tribe of the Angami Nagas. This is one of 16 major tribes of Nagaland. While each tribe has its own culture and dialect, Nagamese is the common language between tribes.

Both villages have well-irrigated terraced fields for growing rice. They also plant corn, millet, Job's tears (Coix lachrymajobi), vegetables and root crops. Jhum or shifting cultivation is practiced in both Khonoma and Mezoma. However, their jhum systems differ from each other.



An Argami Naga chief with traditional headgear

A diagramatic representation of a typical jhum cycle in absence of alder fallows



The people of Mezoma plant for one to two years then allow the land to fallow. The length of the fallow period varies from seven to nine years, bringing the jhum cropping cycle to some 10-12 years.

A typical jhum cycle for Mezoma is as follows: (a) clearing of vegetation although not all trees are cut; (b) burning; (c) planting mixed crops by dibbling or broadcasting after a ritual offering of an egg or fowl; (d) weeding for 2-3 times; (e) harvesting, and (f) fallowing after the second year of cropping.

Alder-based swidden cultivation

The inhabitants of Khonoma, on the other hand, practice a cropping system that has a distinct feature. The people grow and manage alder (Alnus nepalensis) as a means of improved cropping and fallow systems.

Alder swidden fields in Khonoma have been developed over generations, creating a wide variation in individual tree age within the alder stands. There is no standard tree spacing although 6 x 6 meters appears to be the most common. Most alder-based jhum fields are terraced by placing logs across the slopes or with permanent rock walls.

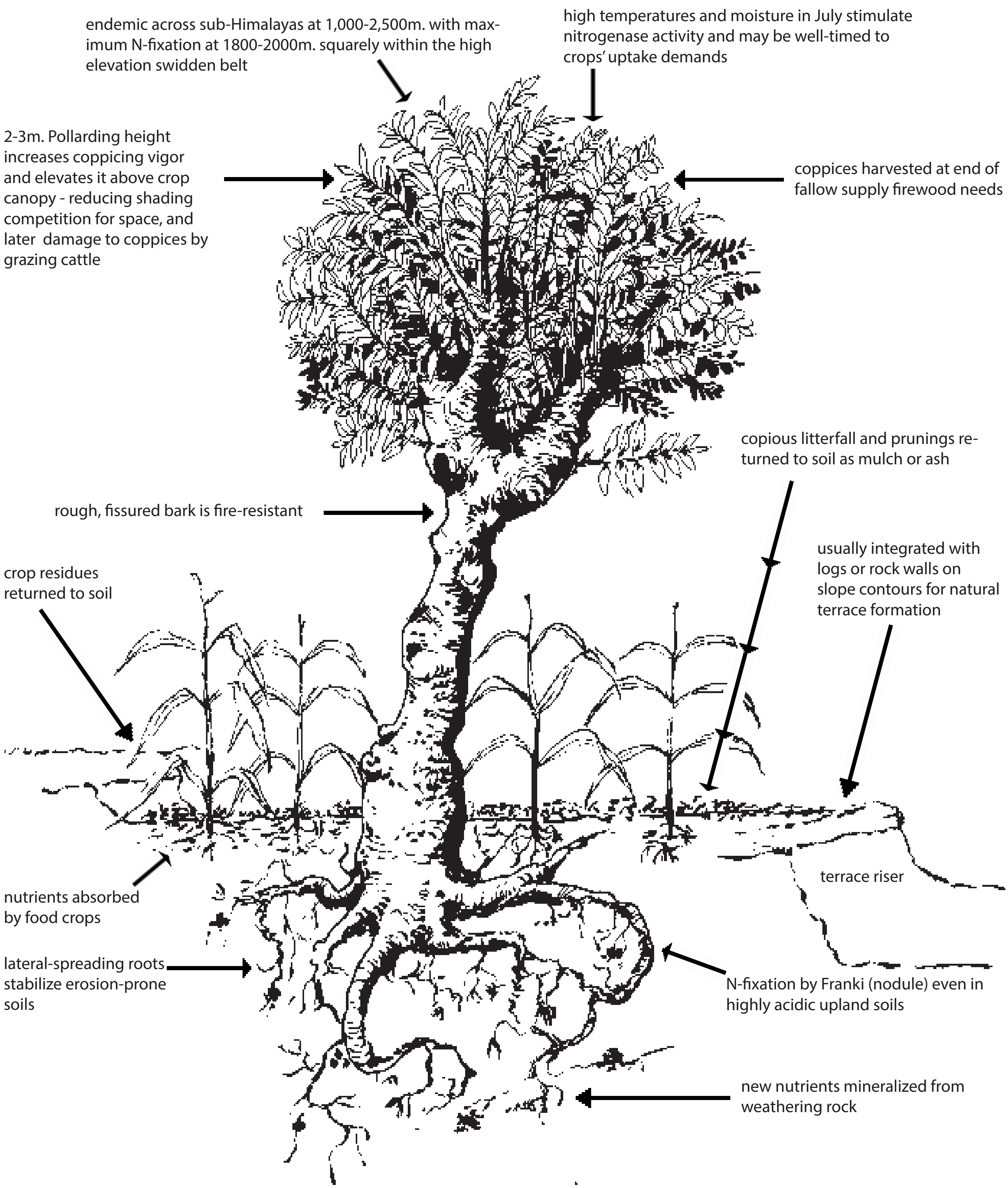
Why pollarding is done at 7-8 ft above ground?

- To minimize/prevent damage from cattle and other herbivores
- To minimize competition with adjacent crops for sunlight and space
- To ensure coppice vigor as observed by farmers over the years (In Nagaland, this is the ideal height for pollarding.)

First pollarding of alder

Young trees are pollarded for the first time when bole sizes reach 70-80 cm and the barks develop rough fissures. This is usually at about 6-10 years. Pollarding is done during December-January by cutting horizontally across the trunk at about 7-8 ft above the ground. The boles must be cut clean avoiding any cracking.

Schematic representation of alder's hypothesized role in jhumming system



Some characteristics of alder:

- Widely distributed in many areas and has a fast rate of growth
- Can grow on highly degraded and unstable soils
- Has extensive root system that fixes atmospheric nitrogen, even in acidic soils
- Has synergistic relationship with intercrops
- Has quick decomposing litter
- Has favorable C/N ratio in underlying soil
- Has multiple uses: poles, firewood, pulp, etc.
- Grows in full light and is moderately tolerant to shade
- Withstands pollarding and frequent pruning of coppice
- Rough, fissured bark of older trees is fire-resistant
- Has no serious pests and diseases in Nagaland
- Long-lived with some reaching more than 200 years old.
- Relatively non-palatable to free-ranging livestock

Fresh mud is applied over the cut portion to avoid desiccation. A stone is then placed on top to protect the tree from frost damage and ensure that new coppices will sprout from the sides.

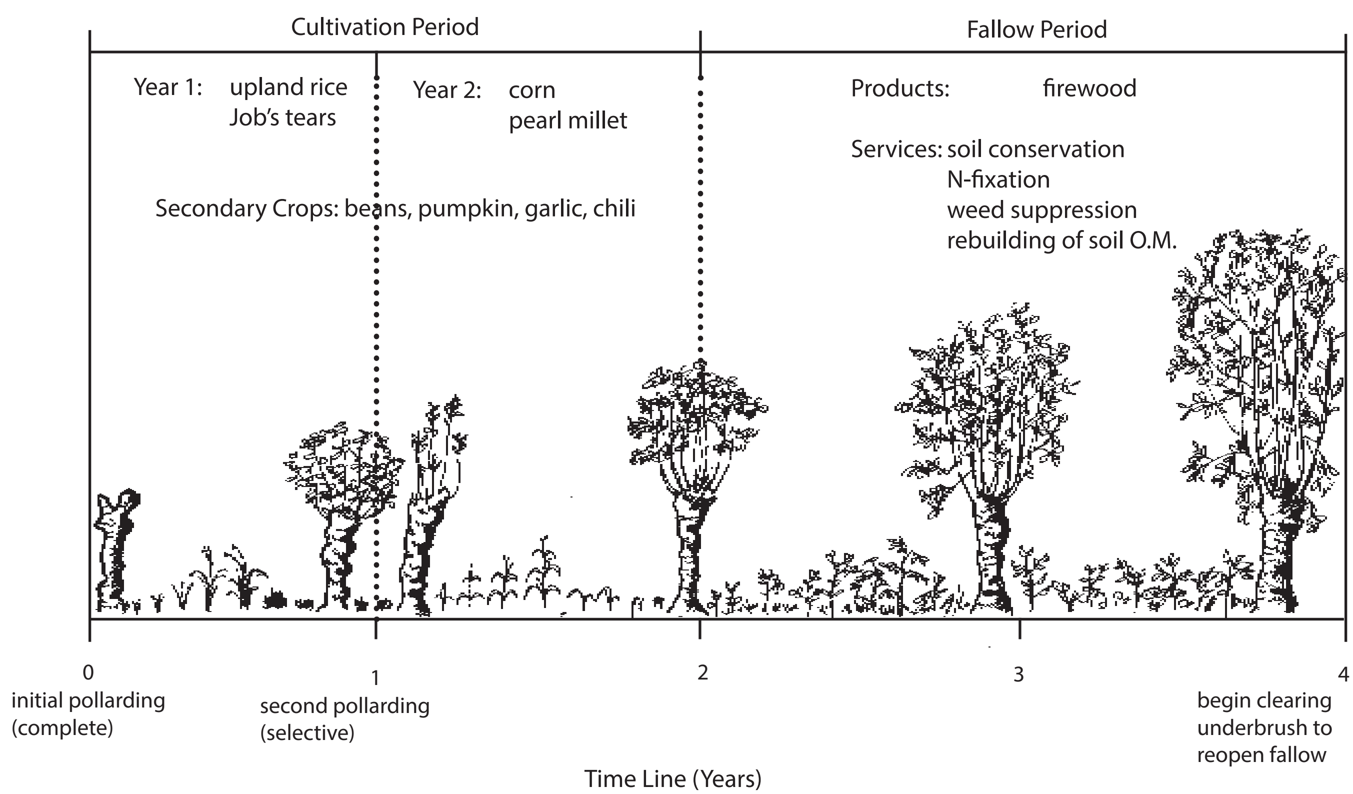
Alder management and the jhum cycle

Being swidden cultivators for centuries, the people of Khonoma follow a cycle of cultivation where the management of alder trees plays an important role. The swiddeners plant for two years then allow the land to fallow for another two years.

Reopening the fallow

The fallow is reopened after the field had been rested for two years. Field operation begins in November when the farmer cuts the vegetation underneath the alder trees. From December to January, he moves from tree to tree, cleanly cutting each coppice flush with the trunk. He carefully avoids splitting at the cross section of the cuts.

A diagramic representation of phases of alder management in swidden cycle



The leaves are removed from the felled branches, and the latter are then either set aside to be used for construction or cut into firewood. A hectare of alder jhum field (about 84 trees) can yield firewood worth Rs. 10,000 (US $220).

Other roles of alder in the sub-Himalayan regions and Southeast Asia:

- As canopy species in large cardamom plantations in Sikkim, India; eastern Nepal and southern Bhutan; in tea gardens of Yunnan, China; in cinchona plantations across sub-Himalayan region.
- As fuel wood plantations in under-utilized farmlands and as canopy species in silvi-pastoral land development with fodder species in Nepal.
- For reforestation of abandoned swidden areas in northern Myanmar, Philippines and Vietnam.
- For soil conservation along the stream banks in Nepal.
- For prevention of soil erosion and landslides, and reclamation of mining areas.
- Leaves used as green manure and compost in China, and for livestock bedding in Nepal.

Cropping phase

During the first year, farmers usually plant upland rice intercropped with chillis, cucurbits, beans, or taro. Most crops, except tubers, are usually harvested by October-November. During the 12 months since the alders were completely pollarded and the fallow reopened, the alder trunks sprout 50-150 new coppices. These trees are again pollarded in December, this time selectively leaving 5-6 coppices at the top of the trunk. These retained coppices are trimmed of side branches and foliage, and a few leaves are left at the tips. The coppices are then left to grow, creating a tree canopy during the next fallow.

The pruned coppices are converted into firewood. The leaves and smaller branches are piled, dried and burned to prepare for the second year cropping of maize and millets. After harvest of the millets in October-November, the field is left to fallow for the next two years.

Fallow phase

During the two-year fallow period, the coppices generally reach up to 6 m in length and 15 cm in diameter, eventually forming a full canopy if left undisturbed. Pollarding actually accelerates fast growth of coppices.

Cyclical pollarding, as developed by the Angamis of Khonoma, allows crop cultivation with amazing productivity, as compared to the yields of the non-alder jhum fields of Mezoma. Corn yield was 17% higher, and Job's tears produced 8% more in Khonoma than in the other village. The presence of alders in the swidden fields right from the beginning of the fallow regrowth phase accelerated nutrient cycling.

Villages practicing alder-based swiddening like Khonoma, have substantial areas of irrigated terraces for wet-rice cultivation, although production is not sufficient to meet consumption needs. In contrast, villages with no or little wet-rice production are not managing alders in their swiddens. This pattern suggests that farmers may invest time and labor in integrating alder into their sloping fields as improved fallow management practice if they are sure that rice can be grown productively in irrigated terraces.

Lessons learned from alder fallow system in Nagaland

OPPORTUNITIES	CONSTRAINTS
■ Possible direct extrapolation of technology to other acid upland soils, between 1000-2500 m asl, with subtropical monsoon climate where shortened fallows lead to swidden degradation. ■ Identification of superior provenances and breeding to further improve alder's performance in agroforestry applications. ■ From variations in farmer management of alder fallows, identify superior practices for possible refinement and wider dissemination. ■ Clarifying the preconditions that have led to adoption of alder fallows may lead to insights on how improved fallow husbandry may be promoted on a wider scale. ■ Scientific principles underlying its management may have application across other species, farming systems, and ecozones. ■ Flexibility to evolve into a wide scope of alternative management options. ■ Could maintain agricultural yield with amazing consistency every alternate two years, due to nitrogen fixing properties	■ Labor inputs may be considerable. ■ Requires high degree of management, eg, pollarding timing and technique. ■ Benefits are longer terms at the initial stage (not until 6-10 years). ■ Not likely to be adopted on communal swidden lands. ■ Alder does not prosper in low altitudes or drought or frost-prone areas. ■ Timber is less valuable and durable than other species that do not have its soil-building properties. ■ Expanded monoculture use may lead to increased insect/disease problems. ■ Early successional trees are generally more subject to insect herbivory. ■ Susceptible to wind damage. ■ Trees live more than 3-4 generations, although reported to be relatively short-lived in Nepal and die for no apparent reason. ■ Short seed viability (4 months) under uncontrolled conditions.

Discussions with the Mezoma community indicate that they have not adopted the (obviously successful) practices of the Khonoma farmers simply because thay are a different community (though they are from the same tribe). Cultural and other constraints to adoptionof such practices are further discussed in Catalyzing Innovation in Shifting Cultivation Communities: Experiences from Palawan, Philippines, pages 326-334.

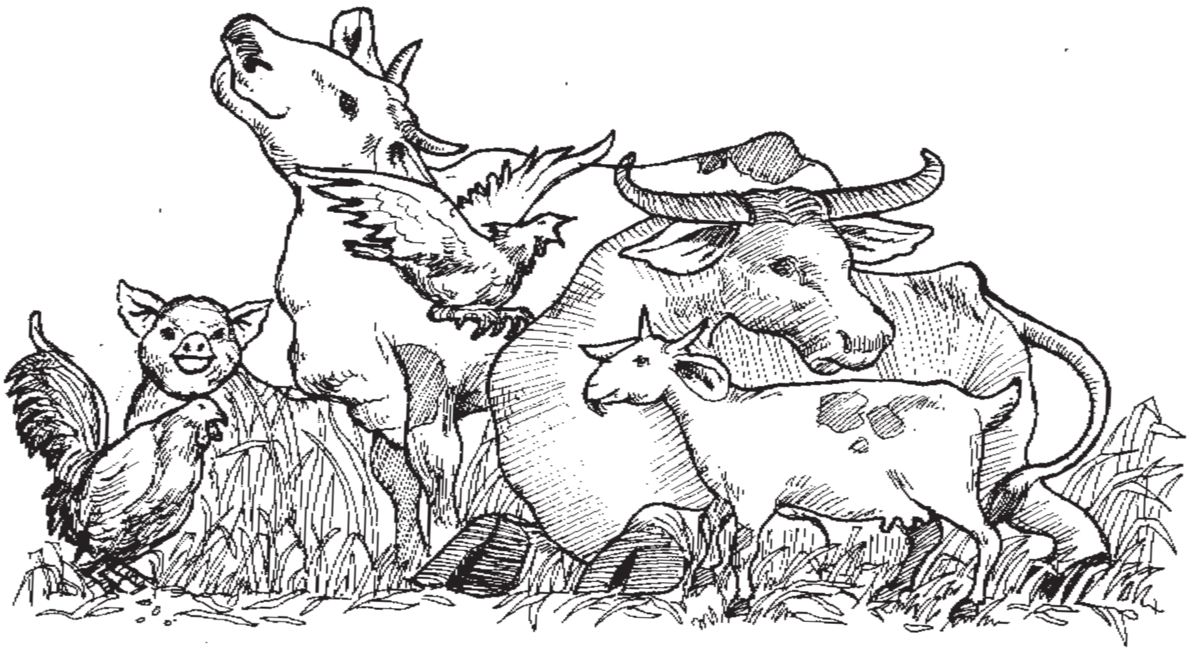
Reference:

Cairns, Malcolm, Supong Keitzar and Amenba Yaden. "Shifting Forests in Northeast India:: Management of Alnus nepalensis as an Improved Fallow in Nagland."

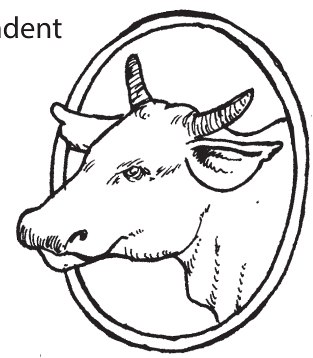
Prepared by
Vincent T. Darlong

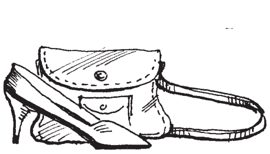
Resource book produced through a participatory writeshop organized by IFAD, IDRC, CIIFAD, ICRAF and IIRR.

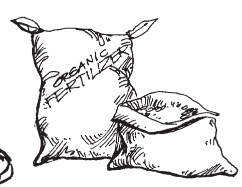
The Role of Livestock and Forage Management in Stabilizing Shifting Cultivation in Lao PDR

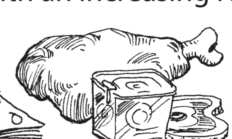


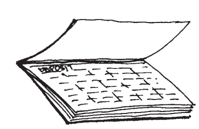
Farmers in the shifting cultivation areas of northern Laos are strongly dependent on livestock for the security of their livelihood (also see Crop-Animal Systems in the Hilly Regions of Lao PDR, pages 128-132). This dependence on livestock is usually felt in times of inadequate supply of rice, which is a common occurrence (either annually or as a result of frequent but irregular climatic catastrophes). Traditionally, farmers have dealt with these shortages by drawing on their natural capital in forests (hunting and gathering) and growing other less preferred food crops (especially maize and cassava). These products are converted to cash by selling the produce. However, the harvest from these sources is insufficient. In addition, resources are becoming increasingly unavailable, the population continues to increase and local residents are being resettled away from their traditional forest resource areas. This leaves farmers with an increasing reliance on

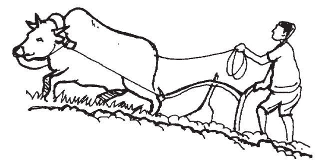












Benefits from raising livestock:

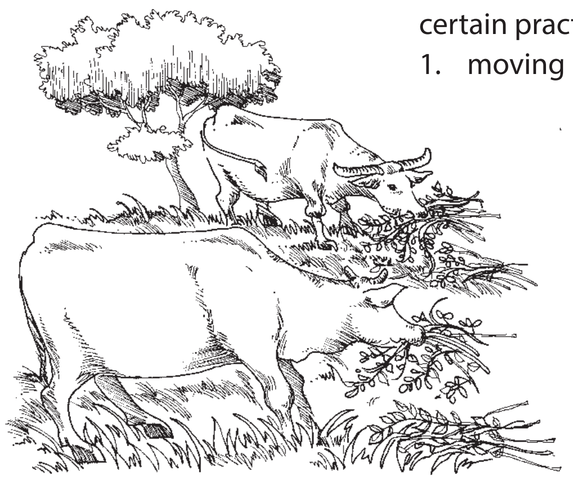
- sure market with relatively stable prices;
- livestock can be raised independent of infrastructure
- relatively low labor input;
- provides additional income;
- utilizes natural resources (grass, rice straw, tree leaves) that are otherwise wasted; and
- valuable source of manure that can be used for irrigated rice fields and home gardens

livestock as a source of cash income.

Among the obstacles encountered in livestock raising, scarcity of the traditional feed resources in shifting cultivation areas is the more immediate concern.

Causes of the decline in yield of traditional feed resources:

- increase in livestock population, resulting in an over utilized feed resource (grassland, rice straw, forest);
- expansion of agriculture into traditional grazing land;
- reforestation of grazing land; and
- reduction in the productivity of native grasses.



In their desire to address these problems, the local farmers employed certain practices:

1. moving livestock between wet and dry season grazing areas;
2. storing/reserving rice straw for dry season feeding; and
3. cultivating grasses on fallow land to provide cut feed for penned animals.

The first two of these strategies are already well developed throughout the region. However, the third strategy (managing forages) is rapidly emerging and has significant potential for development in partnership with farmers. The interest at village level is mostly centered on cultivating forage species to provide cut feed for penned animals and improve grazing areas for the use of community managed herds of cattle at strategic times.

Through a partnership of farmers and development workers, introduced forage species are currently being developed into technologies that can help stabilize shifting cultivation in northern Laos. This is happening in two ways:

1. Comparing indigenous feeding strategies (such as cutting and grazing) with the same strategy using introduced species
   In the regional evaluation of more than 70 forage species in Laos, eight broadly adapted and robust species were identified. The species are now being evaluated by approximately 100 farmers in three northern provinces for their potential in cut-and-carry or grazed systems.

At this stage, evaluations are informal and without replication, to encourage farmers to participate in this innovation.

2. Developing new ways of incorporating introduced forages within existing shifting cultivation systems

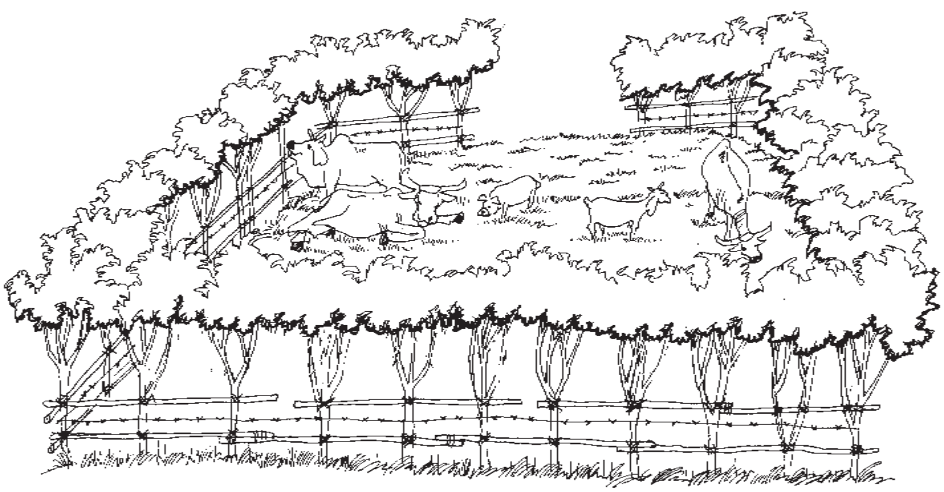
   Farmer-managed trials are in progress for the evaluation and adaptation of three potentially useful innovations suggested by researchers.

   a. Forage tree species for fence lines

      Livestock damage to crops is a major and constant concern for farmers in the upland areas of northern Laos. Farmers have been using some living fences, mainly Jatropha curcas, to either keep their animals fenced in or to fence animals out of their fields.

   b. Stylosanthes guianensis CIAT184 oversown into upland rice

      Informal (and formal) trials with farmers have commenced with oversowing Stylosanthes guianenses CIAT184 in upland rice fields after the first round of weeding. The species responded positively



      in other trials because of its rapid establishment, low impact on rice yields (if sown late enough) and ability to grow well on poor soils. Several other legume species are being considered for this purpose.

This innovation has the potential of improving subsequent fallows and providing benefits (reduced weeding, improved fertility) for the subsequent rice crop.

However, farmers hardly use this system because:

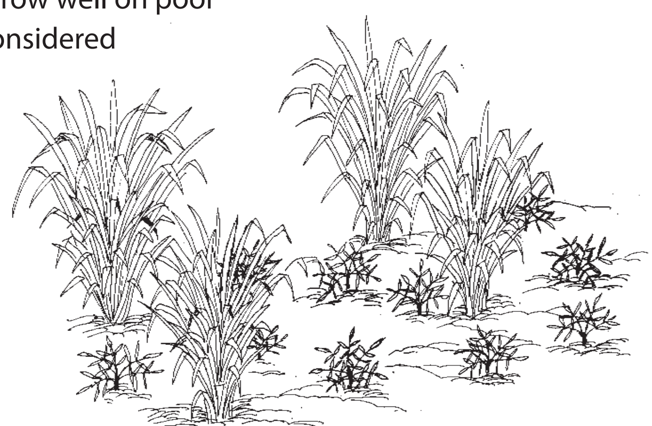
- There is a need to establish informal oversowing trials with farmers to discover what aspects of oversowing appeal or do not appeal to farmers, and

Species under evaluation:

- Brachiara brizantha currently cv Marandu with other lines soon to be tested
- Brachiara decumbens cv basilisk
- Brachiara humidicola CIAT6133
- Brachiara ruziziensis cv Kennedy
- Andropogon gayanus cv Kent
- Panicum maximilliani T58
- Paspalum atratum BRA9610
- Stylosanthes guianensis CIAT184

Live Fences

In other areas,especially those managed by H'mong people, a huge amount of effort is spent building solid, semi-permanent fences from wood, wire and bamboo. Living fences incorporating Gliricidia sepium, Leucaena leucocephala (on better soil) and Calliandra calothyrsus (in the higher areas) have large potential to ease (from a technical perspective) this burden and provide supplementary feed.



also gain insights into what treatment should be investigated in subsequent formal trials.

- Sowing fallow fields with forages means then being able to protect them from uncontrolled grazing by animals. Fallow improvement with the farmers of Houay Hia village would almost certainly fail because of the lack of sturdy fencing. However, in H'mong areas where individual fallow fields are often sturdily fenced , the potential is much higher.

c. Centrosema pubescens oversown into maize.

In several areas of northern Laos, farmers have complained about the burden imposed by weeding maize fields. This is especially true in areas of poor soil where the weeds outgrow the maize. Learning from the success of the farmers in Makroman village, Indonesia several legume species (including Centrosema pubescens, Stylosanthes guianensis CIAT184 and Chamaecrista rotundifolia cv Wynn) are being evaluated in informal trials oversown into young maize.

While acknowledging the complexity and diversity of shifting cultivation systems, substantial role of livestock in stabilizing these systems should not be overlooked. In stabilizing these systems, farmer groups can provide an opportunity for development workers to strengthen the local feeding technologies. However, these need to be evaluated by farmers and development workers together, to elicit the technical advantages and limitations of the technology from the farmers' perspective and the development workers' technical point of view.

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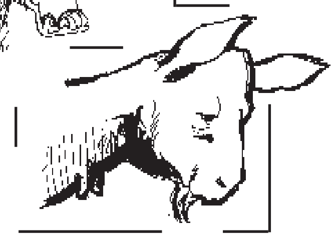
The Role of Ruminants in Shifting Cultivation Changing Perspectives



It is commonly agreed, that the main focus of the shifting cultivation system is to grow food crops. As such, a huge amount of research is done on the cropping phase, like how to improve the crop yields, either with or without manipulation or conversion of the fallow vegetation. Relatively little information exists on the role of livestock in shifting cultivation systems. There are, however, many of examples in South East Asia (e.g. Laos, Thailand, Indonesia), where livestock, domesticated or wild, plays an important role in the livelihoods of the shifting cultivators. In particular, the introduction of ruminants has been used to stabilize shifting cultivation systems.

Traditionally, ruminants are related to shifting cultivation systems in many ways:

- As means of transportation for crops and people.
- As draft power for the swidden field in flat lands.
- As economic asset since it gives relative high profit compared to labor-input. The animals store "wealth" that can be "cashed in" whenever needed (see The Role of Livestock and Forage Management in Stabilizing Shifting Cultivation in Lao PDR, pages 244-247, for more information).
- As sacrifice during rituals for crop protection and production

- To produce manure to improve crop production
- Ruminants are relatively less dependent on infrastructure (It walks itself to the market). This makes livestock an option for shifting cultivation communities.
- Ruminants graze in harvested fields and young fallows.
- They help suppress potentially difficult weeds like Imperata cylindrica, leading to the modification of the vegetation succession.
- They provide milk , meat and other products for the family. Surplus can be sold.

The most important animals in terms of economics are pigs, chickens, horses, goats, cattle and buffalo. In some South East Asian countries, like Indonesia, cattle has been successfully introduced in shifting cultivation systems to strengthen soil fertility through the addition of manure and the growing of leguminous fodder plants and trees.

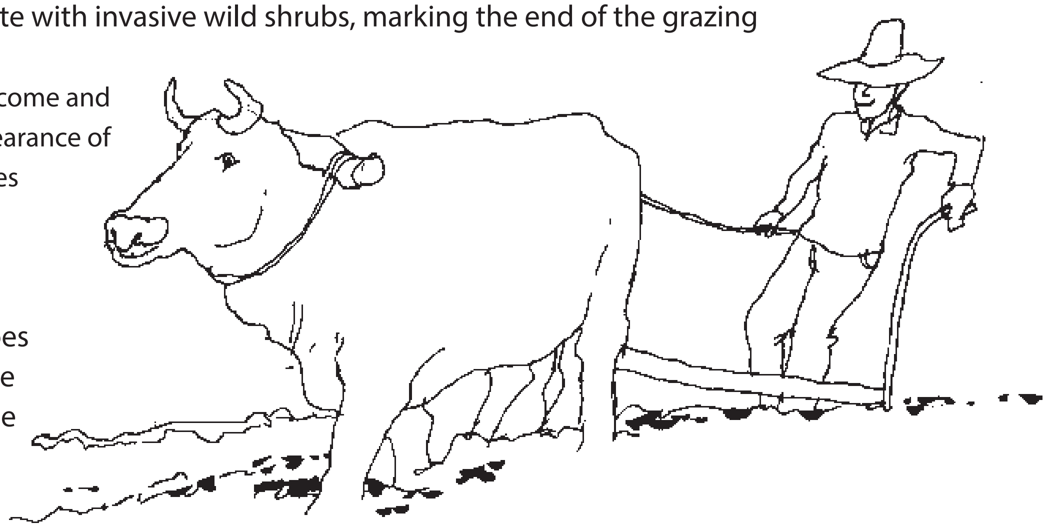
There are, however, drawbacks in shifting cultivation systems for ruminants:

- Ruminants can cause serious damage to crops, therefore, the cost for fencing of crop fields may be a major constraint.
- Intensive grazing could delay or hamper the regeneration of the fallow vegetation, as young shoots and trees are grazed as well, thereby promoting imperata grasslands.
- Fallow vegetation may provide few high-quality feed resources.

The role of cattle in shifting cultivation: The Karen in Thailand

Buffaloes are mainly used to plow the field. Since fields are opened almost every year, each family has fields of different age, and the cattle can graze in fields of different stages in fallow regeneration. During the first and second years of fallow, farmers usually let the buffaloes in to graze on the crop residues and the young grasses. During the third and fourth years, Imperata cylindrica develops and provides further roughages for the cattle as well as roofing materials for the village. In the fifth year, the grasses will be overshadowed by the closing canopy of the trees and will have to compete with invasive wild shrubs, marking the end of the grazing land.

Cash income and disappearance of buffaloes



People shifted from buffaloes to cattle because

buffaloes were being replaced by motorized hand plows in many parts of Thailand. Today, beef cattle are kept to provide cash income through the sale of the animals.

Preventing damage to the crops

Buffaloes are not allowed in the fields during the cropping phase because most of the fields are not fenced. However, the fields of Karen farmers have fire-breaks. While fire-breaks provided enough protection against buffaloes in the past, fencing is now becoming an important issue for two reasons:

- Beef cattle can jump over the fire break.
- As the herd of beef cattle increases, the probability of free-roaming cattle breaking into nearby crop fields intensifies.

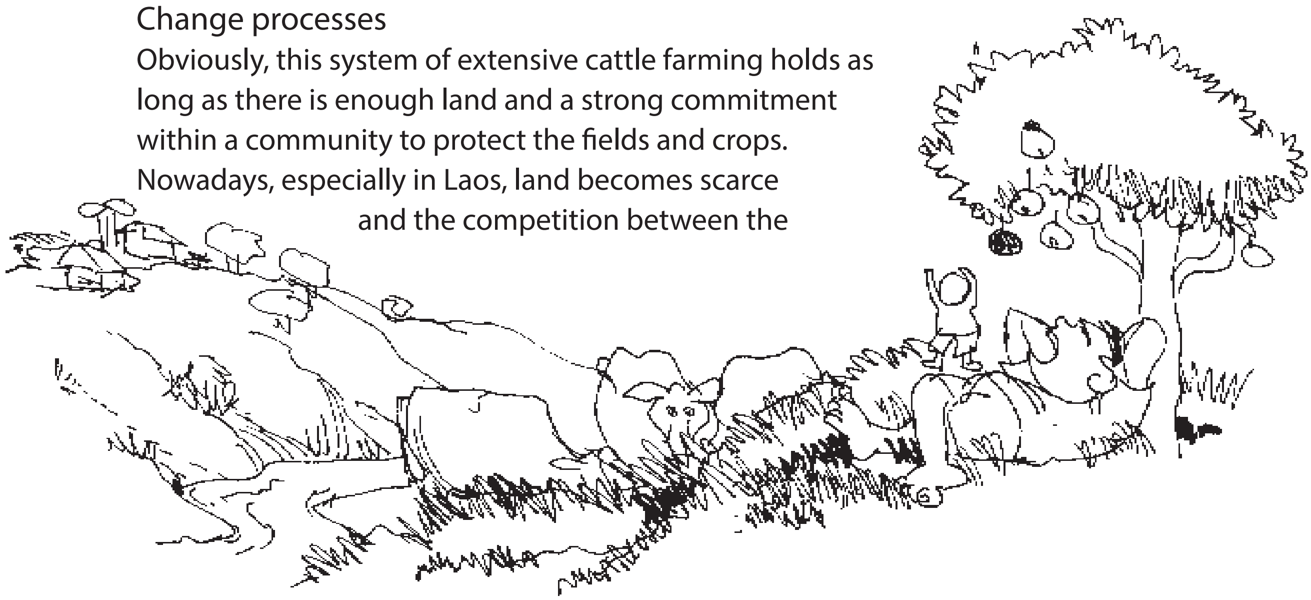
Herding cattle

The Karen farmers in Northern Thailand developed a system of herding cattle during the growth season of rice. Between July and November, cows are allowed to graze on areas far enough from the fields to prevent damage to the crops. The site or grazing area, about two to three hours' walk, is normally near a river with enough grass.

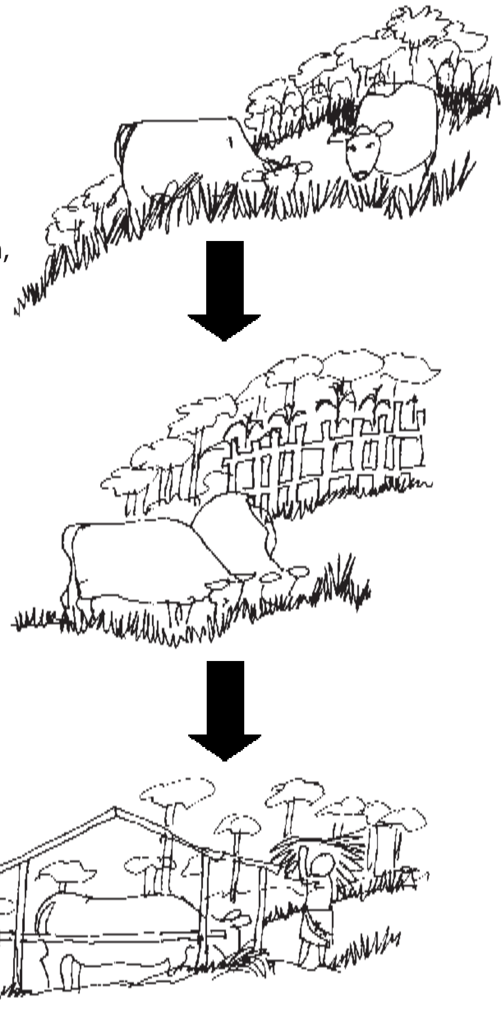
Each cattle-owning family sends one or two children along with the cows. Since this is usually done on a village-level, this group of youngsters herds the cattle of the entire village. A few elders join during these months to guide the young villagers. For the youngsters, this is also a period to learn to live in and from the forest, and learn about edible products and how to prepare them.

Change processes

Obviously, this system of extensive cattle farming holds as long as there is enough land and a strong commitment within a community to protect the fields and crops. Nowadays, especially in Laos, land becomes scarce and the competition between the



different land uses increases.



Besides the fencing problem, more cattle means more intensive grazing of the young fallow vegetation. Overgrazing may hamper the fast regeneration of the fallow vegetation. This, in turn, may lead to declining crop yields and decreasing fodder availability for the cattle. There will be a growing need to produce on-farm fodder. At the same time cattle and the cropping systems should be more integrated, spatially as well as functionally.

Successful integration of cattle in shifting cultivation: A case study from Indonesia

In Laos P.D.R., eight forage species are being evaluated for their potential in the cut and carry feeding system for cattle. Other strategies like growing forage trees as fence, and planting Stylosanthes guianensis with rice, seek to boost on-farm fodder production (see The Role of Livestock and Forage Management in Stabilizing Shifting Cultivation in Lao PDR, pages 140-143, for more information).

The Amarasi System in West Timor

South of Kupang, the capital city of West Timor, Indonesia lies the small kingdom of Amarasi. Here, farmers have counteracted problems of competitive land use between food cropping and cattle farming. The indigenous law system, the Adat, was employed to successfully integrate shifting cultivation and cattle farming.

In 1912, under Dutch encouragement and the local Raja's support, cattle was introduced into the area, partly to eradicate poverty among shifting cultivators. However, it did little to the majority of the farmers, as the cows were given to the local rulers and heads of villages, who did not

Adat is an indigenous law system developed by and for the village. It governs how the people interact with the land and with each other in the community.

distribute the animals to the villagers. Although this group together with rich families consisted of only 2-5% of the population, they owned all the cattle in the region. Free-grazing was practised, exploiting the communal lands at the expense of the shifting cultivation communities who could not use these lands anymore. Therefore, the shifting cultivators were pushed into ever decreasing areas. A degradation of the environment occurred, as a result of overgrazing and a degrading shifting cultivation system. Under pressure of the local leaders, the Dutch colonial Government had to find solutions for the environmental and agricultural problems in the area.

Leucaena has a major pest, the jumping lice or psyllid (Heteropsylla cubana) which may destroy the whole stand of trees. This happened in Amarasi in 1986, leaving the farmers with nothing. This exemplifies the danger of over-dependence on a monoculture. Therefore, these systems should try to establish fodderbanks/ fallows based on multiple species, like Leuceana with Calliandra and similar species.

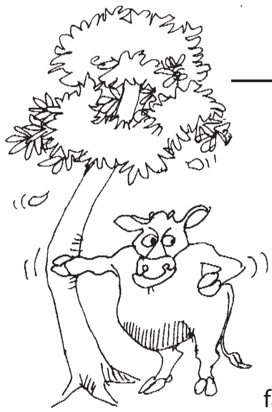
The Dutch colonial government introduced Leucaena leucocephala for several reasons:

- Stop the spread of the exotic species Lantana camara, which had invaded the pastures, and decreased fodder supplies for cattle. Leucaena was said to be able to overgrow this species.
- As a fallow species in shifting cultivation systems, to improve soil fertility, to serve as a fodder, and to regreen degraded hill areas.

The role of local leaders and Adat

The great influence and authority of the local leaders and Adat have been essential in successful adoption of this system. They were also indirectly responsible for a fair redistribution of cattle in the area because of the regulations to stabilise the shifting cultivation systems and increase cattle farming. The local leaders established rules to guide cattle fattening, by extending the farming area and reducing the grazing area.

Cattle were allowed to enter the agricultural area, as long as they were tied and farmers would practice zero grazing (cut and carry system). Outside the farming zones they were allowed to graze freely, but had to be corralled once a week. The large cattle owners could no longer continue their practice, as cattle fattening had become a highly labour intensive system. Cattle were given "in management" to shifting cultivators as a source to earn an extra cash income. For this purpose, the government started a program in 1971, known as paronisasi.
The divisions in land use and the type of cattle farming promoted required the establishment of fences. To save on fencing costs, a village would fence off one large agricultural area, which could than be managed by the community. Within this fenced area, crop rotation systems using Leucaena



The system of paronisasi
The government buys bulls from cattle owners and gives them to farmers who have no animals but have adequate fodder sources. Once the cattle is ready for slaughter, it is sold. There are two systems of sharing the profit. If the farmer bought the cattle from the government, the farmer gets 85% of the income. If the farmer did not pay for the cattle but will just take care of it until it is sold, he gets 42.5% of the earnings and the rest goes to the government.

with corn were developed by each household. Besides being a fallow crop, the Leucaena trees served as a fodder bank for the cut and carry system of the cattle. The new measures were supported by a complex system of fines and retributions to ensure the success of the system. Through this system, the integration of shifting cultivation with cattle fattening has given farmers an income which was said to be one of the highest in West Timor.

Integration of cattle can be a very attractive option for either stabilising or intensifying shifting cultivation, especially when:

- Communities are far from markets, as cattle can walk long distances to the market.
- Soils are degraded. Leguminous trees or green manure may strengthen soil fertility and provide fodder in fallow rotation systems. The manure gives additional benefits.
- Cattle can provide the household with needed cash income and nutritious (protein-rich) food.

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Biological Rejuvenation of Jhumland Soils

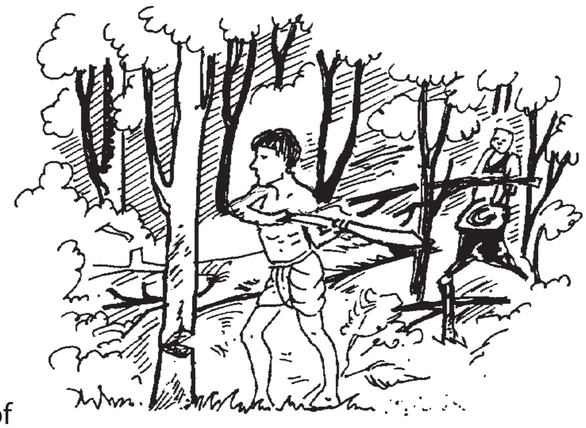
Shifting cultivation (Jhum) is of transient nature both in time and space, since the area cleared and even the dwellers concerned, shift the zone of operation after a certain period. Jhumming is charcterized by a steep fall in soil productivity in a short span of time depending on site condition. Shifting cultivators (Jhumias) usually use the slash-and-burn method of clearing mostly secondary forest for food crops. Repeated burning and cropping leads to a decline in the biological rejuvenation processes. Fallows occur between periods of food crop cultivation giving opportunity for the biological rejuvenation of the soil. Therefore, one of the approaches toward sustainable management of shifting cultivation may be to look at those critical components where intervention may enhance the biological rejuvenation of jhum land.

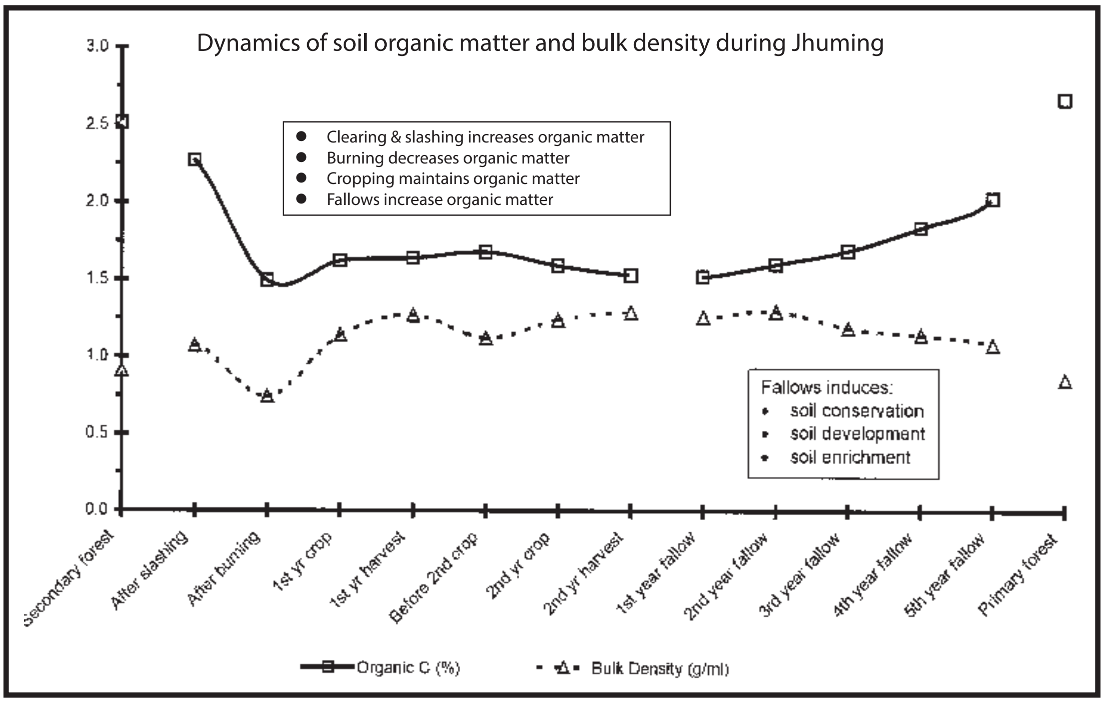
Dynamics of soil properties during shifting cultivation

Slash and burn method of cultivation involves four main stages namely (a) slashing and clearing (b) burning (c) cultivation and (d) fallow. Soil properties are dynamic in nature and changes with each major activity during shifting cultivation. The following paragraph describes the changes in soil properties during shifting cultivation. The study was carried out at Silonijan in Karbi Anglong district of Assam, India (Singh and Bora, 2000, and Jacob and Chakraborti, 2000).

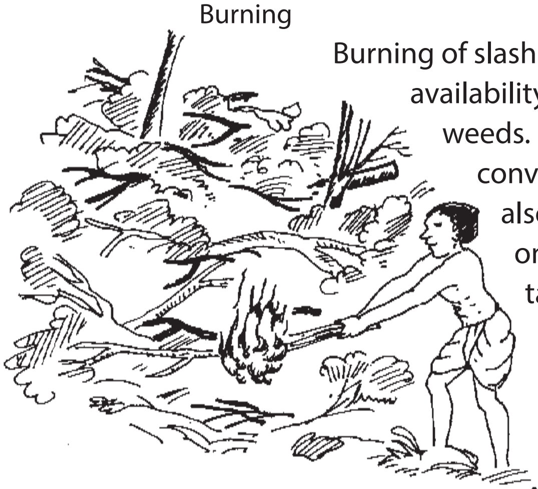
Slashing and clearing

In the slash and burn method of cultivation, slashing and clearing of bushes and trees are done to make tillage operation less labor instensive, remove unwanted weeds and other vegetation from the field and allow sunlight to reach the ground for cultivation of annual crops. This causes soil compaction resulting in high bulk density of the top 15 cm. soil. During slashing, part of the organic residues are incorporated with the soil, thereby increasing the organic carbon content of the soil.

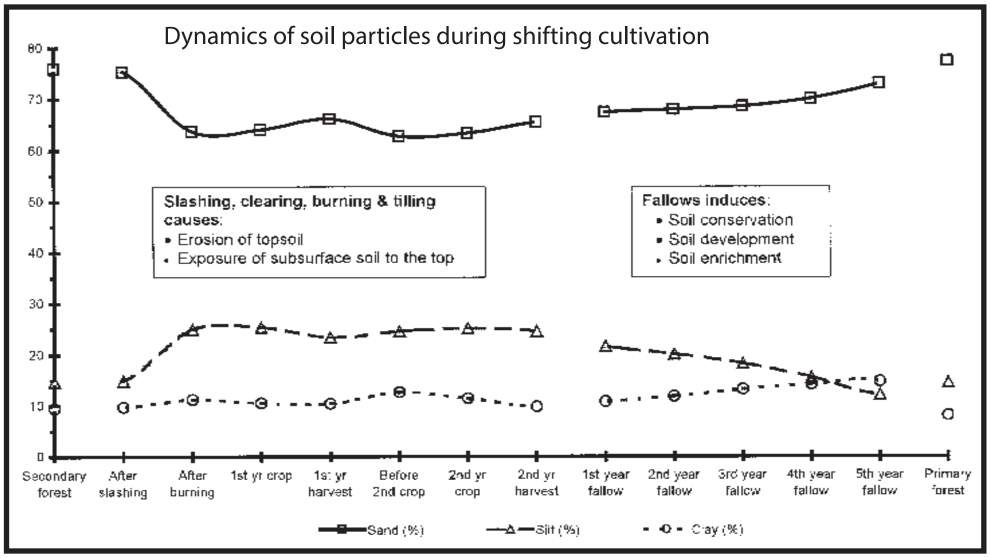




Burning



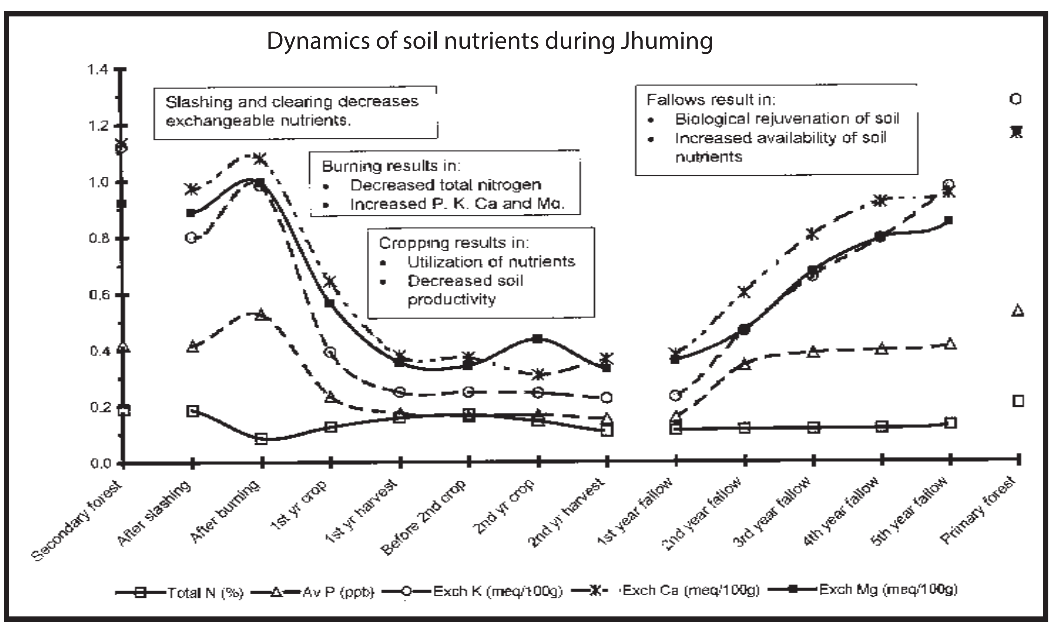
Burning of slashed and cleared vegetation is done primarily to increase the availability of nutrients, besides eliminating insect pests, pathogens and weeds. The burning operation destroys organic carbon. Nitrogen is converted to oxides and escapes into the atmosphere. Burning also eliminates useful soil fauna and flora along with harmful ones. This is the stage when maximum soil surface erosion takes place, primarily due to disturbance and tilling . Due to soil erosion, sandy surface soil are removed and a sub-surface layer having increased content of silt is exposed.



Cropping

During cropping, three to five seeds are dibbled using a bamboo stick in each hole and covered with soil. A mixed crop of cereal, pulse, oilseed, vegetable and root crops are planted with rice and maize, as dominant crop in the first year, and millets in the second year. Nutrients made available by burning are utilized by the crops grown on these soils. With repeated cropping, soil loses its fertility and productivity. This results in very low food crop yield.

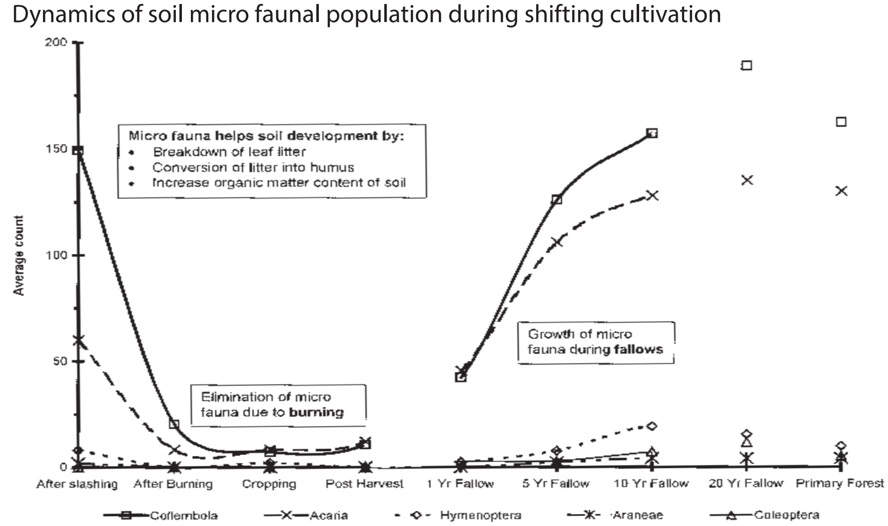
It may be wise to abandon cropping on jhum land when food production from a particular land decreases by half from the initial food production from that particular land. This will help the soil for early rejuvenation to its original or near original productivity.



Fallows

In earlier times when lands were plentiful, it was possible to have long fallow periods in shifting cultivation to restore the productive capacity of the soil. As population pressure increase, fallow periods diminish, thereby shifting cultivation becomes unsustainable. Once the jhum land is abandoned after cropping, biological rejuvenation of the soil starts. Microfauna which breakdown leaf litter, incorporates organic matter to the soil, and assist in the formation of humus. Roots of secondary vegetation and incorporation of organic matter reduces bulk density and opens up the soil for infiltration of water and exchange of gases from the soil. Humus acts as storehouse of nutrients such as nitrogen, phosporous, potassium, calcium, magnesium and other minerals.

Dynamics of soil micro faunal population during shifting cultivation



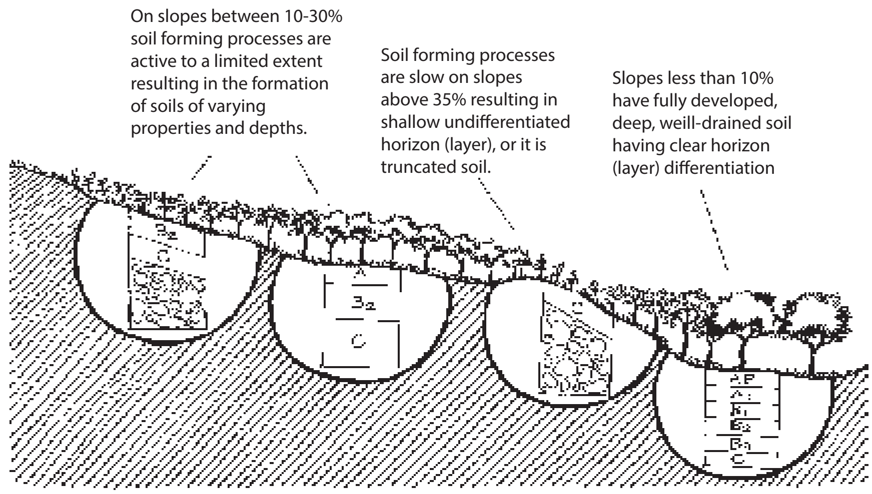
Recognizing the fact that jhum cycle has reduced from 20-25 years to five to six years, it is suggested to have a rotation of one year cropping followed by four to five years fallow before the next cropping-fallow cycle.

Acceptance of the proposed cycle of four to five years fallow and one year cropping may be possible for the following reasons:

- The jhuming cycle has already been reduced to five to six years, hence, it will not be difficult to convince Jhumias to adopt the four to five years fallow and one year cropping cycle.
- The second year cropping is not as rewarding as it used to be. Therefore, many jhumias have already started thinking of taking only one crop from the jhum land.
- The clearing of vegetation after the four to five-year cycle will not require intense manpower and can be managed by a small tribal family. This way, pressure on high value secondary forests may also be reduced.
- Adoption of the biological rejuvenation principle of Jhum land may be more sustainable than the one presently practiced.

Studies carried out in the Western ghat of India revealed that when vegetation is removed in the slash and burn system, the top soil erode. This brings the compact illuvial horizon at the surface and in extreme cases, the parent material itself may come to the surface.

Clayey, high bulk density top soil hampers the natural regeneration of vegetation. This truncated soil may also induce moisture stress inspite of relatively high water holding capacity because most of the rainwater goes out of system as surface run off in areas devoid of vegetative cover.



Trees are known to increase infiltration and percolation of water.

Source: Singh et.al. (1985); Singh et.al. (1986).

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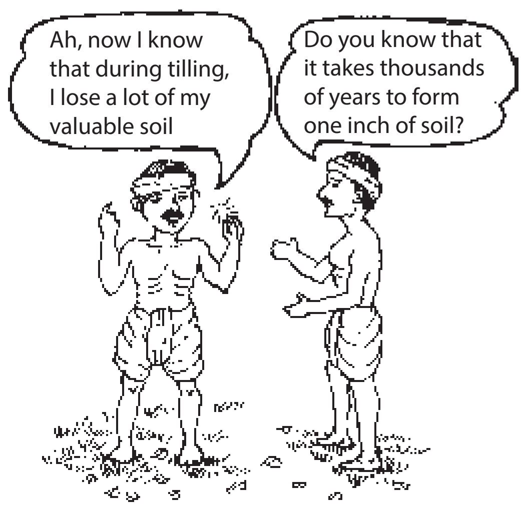

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Putting the Nutrient Access Idea Into Practice

Role of organic matter

It is fairly easy to see that shifting agriculture farmers will most easily be able to put the nutrient access concept into practice if they use large amounts of organic matter (o.m.). Organic matter provides small amounts of nutrients over a long period of time, and in balanced quantities. It improves the soil structure, so roots can reach the soil's nutrients better, and makes those nutrients more accessible chemically. It also increases the Cation Exchange Capacity (CEC) of the soil, so the nutrients will not be lost.

> The nutrient access concept, as described in Changing Our Understanding of the Fertility of Tropical Soils: Nutrient Banks or Nutrient Access?, pages 65-71 in this resource book, states that "maximum plant growth can be best and most inexpensively be achieved in the tropics by:
>
> - the constant supply of soil nutrients (most inexpensively achieved with fairly low quantities)
> - a healthy balance between the nutrients
> - maximum access of plant roots to these nutrients (with, for instance, the maintenance of good soil structure and/or mulches).

Advantages of organic matter for improving the soil

1. Provides low to medium amounts of nutrients, over a long period of time.
2. Provides nutrients in well-balanced quantities, including micronutrients.
3. Improves soil structure.
4. Makes the other nutrients in the soil more chemically accessible to plants.
5. Improves the pH, making acid soils less acidic, and alkaline soils less alkaline, and this changed pH also makes other nutrients more accessible in balanced quantities.
6. Holds the nutrients so they don't escape too deep into the soil.
7. Feeds earthworms and other soil animals and plants that plow the soil, prevent crop diseases and improve soil structure.
8. Makes the soil soft and easy to work.
9. Makes the soil soft so rainwater can infiltrate it, and holds the water in the soil so it stays moist longer.
10. Can be produced locally at a very low or zero cost.

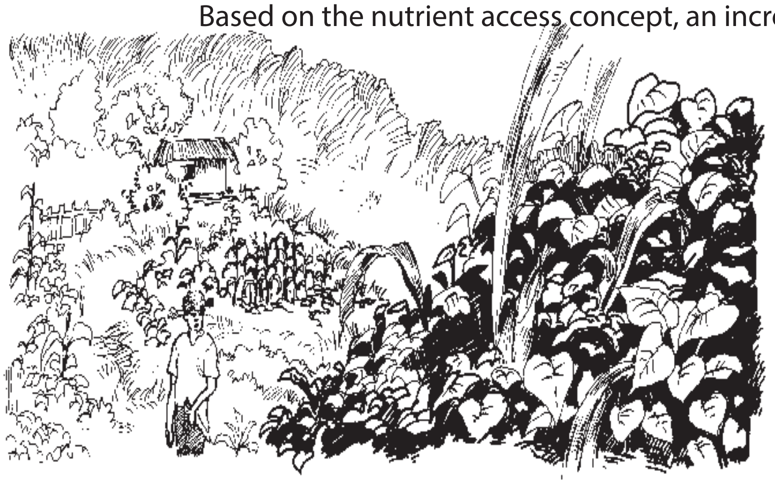
Thus, o.m. helps provide a constant supply of nutrients with a good balance, and then helps make those nutrients accessible within the soil. Thus, it single-handedly goes a long way toward fulfilling all of the conditions the nutrient access concept requires to have a very productive soil.

Both field experience and scientific research show that the best way to apply o.m. in the tropics in order to achieve the above effects is to apply it to the soil surface. The only time the application of the o.m. to the surface might not be effective is with a heavily degraded soil - usually one that has very little o.m. in it already. If a farmer wishes to improve a degraded soil, he or she can leave it to fallow for eight or ten years, and then start applying o.m. to the surface. If, however, a farmer wants to improve degraded land immediately (or if the forest will not grow back), he or she will probably have to plow large amounts of o.m. under the soil surface (never more than 20 cm deep) during the first year or two. After the first two or three years, all o.m. should be applied to the soil surface.

While the nutrient access concept certainly gives o.m. an important role in achieving soil fertility, it does not necessarily mean that farmers should completely quit using chemical fertilizers. What the idea does is to show the way farmers can achieve good yields while using greatly reduced amounts of chemical fertilizer. Basically, it encourages farmers to use only those chemical fertilizers that are necessary to replace lost or removed nutrients (mostly P), thereby attaining sustainability over the long term.

The five principles for maintaining soil fertility

Based on the nutrient access concept, an increasing number of institutions involved with shifting agriculture have begun to use some or all of the five principles for maintaining soil fertility.



1. Maximize organic matter production

   Very frequently, shifting agriculture farmers can increase dramatically the amount of o.m. they produce in their fields while maintaining or even improving their yields and increasing costs only slightly, if at all. In fact, many green manure/ cover crops (gm/cc) and agroforestry systems reduce the amount of labor required for controlling weeds, thereby increasing the over-all o.m. production while at the same time decreasing costs.

Farmers can increase their o.m. production in many ways that will be explained in a later article on gm/cc's. In drought areas, more o.m. will be produced if farmers use some simple way of capturing water so they irrigate their crops during the droughts.

Obviously, the more vegetation farmers produce in their fields, the more they can apply to the soil, thereby making sure their crops have a constant supply of nutrients. If farmers also have animals, this extra vegetation can often be used to feed animals, especially during the dry season when they often most need the food. With more vegetation that serves as fodder, each animal will produce more manure, or the farmers can raise more animals. Either way, the amount of manure for the fields is increased.

2. Keep the soil covered

Soil exposed to the tropical sun produces more weeds, which reduce farmers' yields and cause a lot of work. Unprotected soil also becomes very hot, causing a whole series of problems for the soil. O.m. in and on the soil decomposes much faster, thereby often ending the supply of nutrients before the crops have completely grown. O.m. on top of the unprotected soil also loses a lot of nitrogen, which escapes to the air. When crops grow without any shade at all, their productivity may be reduced. And when the soil is too hot, many beneficial animals in the soil, including microorganisms, die. It is interesting to note that virtually every system of improved fallow or gm/cc's that farmers have developed by themselves in Southeast Asia have increased both soil cover and the over-all amount of vegetation, as compared to the more traditional shifting agriculture systems they used before.

Two problems, more than any others, force shifting agriculture farmers to leave their fields in fallow. One is the reduction in soil fertility, and the other is the increased growth of weeds that are difficult to control. Once production of o.m. is increased and the soil is covered (the first two principles), both of these problems will have largely been solved. The need to stop farming the land after only two or three years is thus eliminated.

Keeping the soil covered is obviously consistent with the nutrient access concept because it slows down the decomposition of o.m., thereby better ensuring a constant, longer-lasting supply of plant nutrients.

3. Use zero tillage

Most shifting agriculture systems traditionally use zero tillage. However, these systems are not very productive after the first year because the amount of o.m. decreases, the earthworms die, the soil structure is gradually destroyed, and the soil gets very hard. Plant roots can no longer penetrate the soil. Thus, if a plow is not used to open up the soil to let crop roots in, crop production will be very poor. If, however, the farmer is producing a lot of o.m. and keeping the soil covered, then the supply of nutrients will continue and the soil will stay soft, just as it does in the forest, so the nutrients in the soil will continue to be accessible to the crops' roots. Thus, with little o.m., zero tillage systems rapidly become unproductive. But with plenty of o.m., zero tillage systems can be very productive for decades. Consequently, zero tillage systems save farmers all the tremendous amount of work and expense that it costs them to plow their fields.

Why do zero tillage systems work? Probably the most important reason is earthworms. A good population of earthworms can move more soil in a year than a tractor can move in one ploughing with a moldboard plough.

The best time to initiate zero tillage is when a field is being cleared from the forest. If the farmer does not burn, or does a very light burn, and then immediately starts growing crops and gm/ccs on the land, he or she can avoid plowing the soil. If the soil, however, has been farmed two or three years and its o.m. content has been lost, it will take some time to increase the o.m. content of the soil to the point that one can get good yields without going to the trouble of plowing the soil.

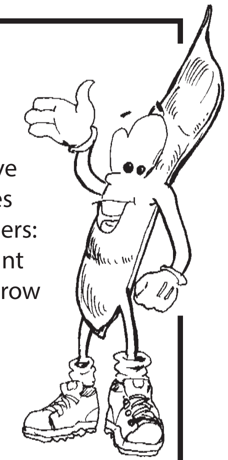
Many people think that if a farmer never plows, he or she will have a serious problem with weeds, and will therefore have to do a lot of hoeing or use a lot of herbicides. However, if the soil is kept covered, most farmers no longer have to use herbicides at all, or only very rarely.

The relationship between the nutrient access theory and zero tillage is close, because tillage both destroys soil structure and increases the rate of o.m. decomposition. Furthermore, tillage uncovers the soil (principle #2) and incorporates the litter layer, thereby destroying it (principle #5).

4. Maximize biodiversity
   This means that farmers should try to keep changing the types of plants they grow and avoid using herbicides. Maximizing biodiversity is important because it helps reduce the number of diseases and insects that attack crops, and will, over many years, help maintain a good balance in the nutrient crops access.

5. Feed the crops through the litter layer
   If farmers have been applying enough o.m. and using zero tillage, they will have a litter layer in their fields. And just as in the forest where the litter layer feeds the trees, the litter layer on the farm will supply nutrients for the crops. This source of nutrients is especially important because many shifting agriculture soils in Southeast Asia are very acidic, with too much aluminum and very hard layers beneath the soil surface. Thus, crop roots have a difficult time growing in these soils, even when the soils are fairly soft. Therefore, it is better for the roots to get their nutrients from the soil surface, where the litter layer is. Crop plants, just like forest trees, can grow a very closely woven mat of roots just under a litter layer, so they, too, can access the litter layer's nutrients, as long as it remains moist. In this way, they can grow very well.

Some advantages of the five principles for shifting agriculture farmers



In addition to the advantages these principles have for all farmers, these five principles provide a series of special advantages for shifting agriculture farmers:

- Although some shifting agriculture farmers want long and frequent fallow periods so they can grow trees and other long-term plants, many prefer having as many years of cropping as possible before fallowing. Using the above principles, farmers extend the cropping period up to five or ten years, or even longer, if they wish.
- Using the above principles, farmers will get harvests just as about as good, if not better, each year they crop, rather than harvests that decrease dramatically from one year to the next.
- Shifting agriculture farmers using the above principles will be able to grow every year the high-value crops they often grow now only the first year after fallow. That is, they will be able to grow rice or soybeans for several years, instead of having to grow maize or cassava in succeeding years because the poor quality of their soils will not permit them to grow a more valuable crop.

Some people have a lot of doubts about whether using these principles will really increase their yields a lot and make it possible to maintain such yields year after year, even on a poor soil. Others suspect that farming the soil year after year will harm the soil. Nevertheless, these principles have been used by thousands of farmers, and the results have shown that they can increase their yields over many years, while improving their soils at the same time.

Another important piece of evidence in favor of the nutrient access concept is the tropical forest itself. Forests have existed for thousands of years, and the forest soils never wear out. These forests, year after year, produce tremendous quantities of vegetation, even on soils that originally had a very low CEC. How do they do it? A tropical forest maximizes o.m. production and biodiversity. It keeps the soil shaded almost all the time, and feeds the plants through the litter layer. And, of course, no forest ever needed to have someone plow its soils. Thus, the forest uses the very same five principles that were described above.

If the forest has shown that it can grow vigorously, for centuries, without damaging the soil, why can't farmers also raise crops that grow vigorously, for centuries, without damaging the soil? To do this, all we have to do is follow the same rules the forest does. And because we know so little about how the chemistry and biology of tropical soils works, by imitating the forest, the farmer can have some assurance that his or her farming system will, in fact, be sustainable.

Additional impacts of the nutrient access concept

The nutrient access concept can provide a good deal of new hope for resource-poor and shifting agriculture farmers. According to the banking concept of soil fertility, most shifting agriculture farmers are in serious, if not insurmountable, trouble. Their soils are very poor and getting worse. They have no hope of even maintaining present fertility with organic matter. Nor have they any hope of ever buying enough chemical fertilizer to improve their soils. But given the nutrient access idea, even the poorest farmers with the most depleted soils should be able to increase their yields significantly with very little increase of knowledge, a handful of new seeds, and a willingness to change their agricultural practices.

Furthermore, the nutrient access idea makes it possible for farmers to live better, using totally sustainable farming systems, on less land, leaving more forest intact, and using fewer pesticides.

Case Study: The Ikalahan Day-og

The Ikalahan of the Philippines must occasionally rehabilitate soils, which are covered by landslides caused by typhoons or earthquakes. They call their technique DAY-OG.

They first dig a large hole about 30 cm deep, removing any stones and placing the soil beside the hole. The hole is then filled with vegetative materials such as grass, sawdust or crop residues mixed with animal manure, if it is available. They then replace the soil on top of the vegetative material and plant the new crops on the soil almost immediately.

The prepared area, thus, can produce a crop on the first year, although crop harvest will be better on the second year.

A series of tests with Obi (Ipomea batatas) indicated that although using grasses in the day-og improved production somewhat in the first year, the improvement was more pronounced with Compositae species. Production was improved even more by mixing animal manure in the day-og with the leaves. However, a day-og with only manure and no leaves can depress production in the first year.

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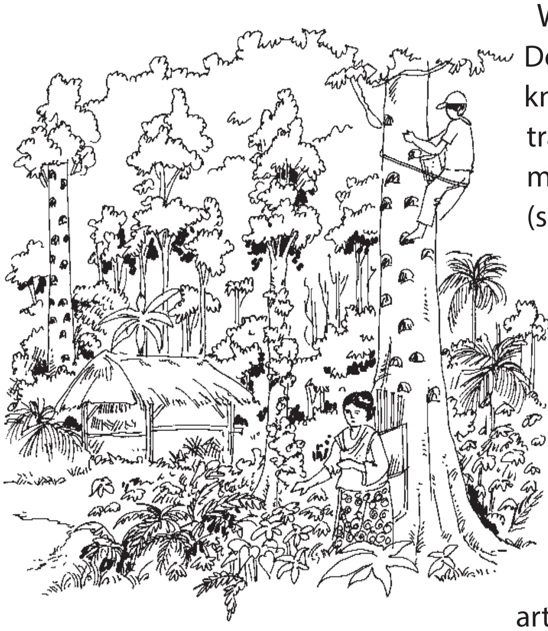
Domestication and Cultivation of Non-Timber Forest Products (NTFPs) in the Uplands of Asia

Non-Timber Forest Products (NTFPs) refer to biological products and related services derived from forests and related land use systems. These include medicinal plants (see also Guidelines for the Commercialization of Medicinal and Aromatic Plants (MAPs) in Shifting Cultivation Areas, pages 232-237, and Medicinal Plants for Sustainable Management of Uplands in South and Southeast Asia, pages 225-231), canes and decoratives, among others. It includes small poles, fuel wood and fodder sourced from forests and similar lands.

Importance of NTFPs in Livelihoods

- Source of income;
- Satisfies household needs such as fuel, medicine, shelter, and supplementary food;
- Source of traditional agricultural inputs such as leaf litter, fodder, small tools and water;
- Source of supplementary foods such as roots, tubers, vegetables, fruits and grains; and
- Source of employment in small enterprises.



What is domestication?

Domestication is the judicious use of human skills, scientific knowledge, physical and natural inputs, as well as the traditional knowledge of local people in the production and management of NTFPs inside and outside their natural habitats (see also Domestication of Three Non-Tradiitional Species by Shifting Cultivators of Northeast India, pages 98-104).

It has recently been accepted as applicable to development of NTFPs in areas outside their natural habitats. Domestication of NTFPs can be promoted to match the success of the much-heralded Green Revolution of food crop plants in the plains.

To domesticate NTFPs is to naturalize the species to artificially created conditions that copy the natural habitats of the species to be domesticated. This may involve human-induced changes in the genetics and silviculture of a plant.

Issues and options relating to domestication in shifting cultivation areas

Common issues

Shifting cultivators are mostly rural and marginal farmers. They operate in dispersed conditions spanning a large area within a particular geographical region. Many of these farmers are share croppers of the land owned by landlords, clans or the government. They often lack technical knowledge and skills, as well as cash constraints.

Options

Shifting cultivators have to master the art of cultivating NTFPs based on their age-old, tried and tested experiences of the traditional fallow management systems. Agroforestry research has the potential to transfer suitable technologies and information to the shifting cultivators to modify their slash and burn systems through participative approaches.

Undeniable access rights to land and secure usufruct rights to forest products are keys to the success of the domestication process.

> Non-timber forest products (NTFPs) are allowed by governments to be used as usufructs by the local inhabitants. They do have high commercial potential but due to weak links to formal marketing systems, they are not generally cultivated and managed by the farmers.

Techniques

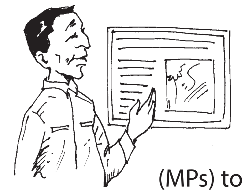
Domestication of NTFPs should rely on simple and cost effective techniques as in the uplands. Likewise, it should be primarily be a crop management strategy.

Domestication techniques should be selected on the basis of local needs; ecological conditions of the area concerned; traditional knowledge and practices; and economic choices.

Suggested design

The participatory design of an upland agro-ecosystem based on NTFPs in which domesticated species are grown involve plant selection, reproduction, crop management techniques and processing.

Silvipasture, Agroforestry and Agri-silvi-pasture models may be the basic structures of NTFP-based forest-farming system in the uplands suitably modified to suit local socio-cultural practices and microclimatic conditions.



Some Practical Guidelines

The common attributes of high-value medicinal plants (MPs) to be domesticated are as follows:

- MPs should yield products that have become more sought after by both the domestic and export markets, changing consumer income, tastes and preferences.
- They should be relatively cheap and easy to cultivate and market in comparison to other species.

The suggested approach should be useful to local healers and health service practitioners. However, it does not guarantee the long-term survival of either the species from which a product is derived, or the market for the products thereof.

Agro-ecosystem-based approach

An agro-ecosystem perspective to the domestication of NTFP species could provide the approach to choose from and lead to evolution of various techniques and processes acceptable to the local communities. The system of domestication selected should also consider pertinent socio-political and institutional dimensions affecting shifting cultivation communities and their socio-economic life. There is a critical need to identify and establish backward and forward linkages with markets and micro enterprises.

Domestication of NTFPs as practiced in Dhungkharka, Nepal

The test village, Dhungkharka, is located in central Nepal. It is characterized by intensive agriculture practiced by small farmers. Forest resources, especially non-timber products, are considered as integral parts of agriculture. These are managed by the religious under Nepal's community forestry rules. They provide nutrient, animal feed and wood for small tools and implements. The community showed overwhelming interest in growing NTFPs to earn cash income, which they argued are needed to supplement their meager food production.

Priority Species Identified by the Village

Botanical name	Local name	Use
Zanthoxylum armatum	Timur	fruit for stomach disorders
Cinnamomum tamala	Dalchini	bark as spices and medicines
Valeriana jatamansi	Sugandhwal	whole plant for aromatic & medicinal oil
Cinnamomum glaucescens	Sugandha kokila	above ground parts as medicine
Matricaria camomilla	Chamomille	whole plant as medicine
Cymbopogan citratus	Lemon Grass	leaves for medicinal oil
Phyllanthus emblica	Amala	fruits as hepatic protectant
Dioscoria deltoidea	Bhykur	leaves, flowers & fruits to produce medicine

In their collective decision making system, they followed the following steps in the domestication of NTFPs:

- Assessment of the resources and management scenario: The stakeholders collectively assessed the resources and decided that cultivation was the only alternative. The species were decided based on the information about the market, prices and usage. They have likewise decided on the list of priority species.
- Technology Assessment: The group felt that the technology adopted should not be complicated. They stressed the need to have simple, cost-effective and user-friendly methods of domestication.
- Training: Training needs on packaging the assessed technology, activity planning and NTRP cultivation were identified.
- Economics and Returns: The farmers felt that the expected return per unit land area should be significantly higher than the existing economic returns.
- Markets: Assured and profitable markets, according to the cultivators of the NTFPs were the driving forces behind the acceptance and rejection of the domestication by upland farmers (Developing and Marketing Non-Timber Forest Products: Methods an Used in Protected Areas in Vietnam, pages 269-275, and Practices in Marketing Forest and Agricultural Products: Lessons for Resource Managers, pages 281-288, also discuss marketing of forest products).
- Trade-offs: Upland farmers are also sensitive to trade-offs between food production and MAP production. They prefer to maintain the production of food, vegetables, fruit, fodder and fuelwood at the current level. Thus, they decided to cultivate NTFPs as an associate/inter crop rather than a sole crop replacing the food crops.

Conclusion

Domestication of NTFPs is an important area of research, extension and development to address the growing imbalance between supply and demand of raw materials for industrial use. Collection of NTFPs from in-situ resources are becoming increasingly inadequate and unsustainable. Domestication and cultivation in ex-situ conditions are therefore essential. A clearly planned domestication may help strike a balance between the in-situ and ex-situ resources and lead to a sustainable management of shifting cultivation areas.

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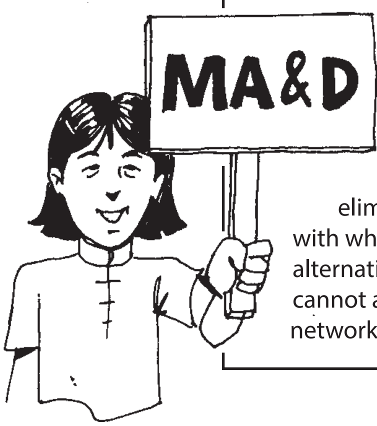
Developing and Marketing Non-Timber Forest Products Methods Used in Protected Areas in Vietnam

Within the range of methods for dealing with NTFP marketing there are two basic approaches in general use and one special-purpose adaptation:

three interrelated objectives: 1) biodiversity conservation, 2) livelihood improvement and 3) market development.

Type	Methodology	When to use
1	Conventional market analysis methods that start with the market in which NTFPs will be sold.	When you already know who the producers are and you are not very concerned about environmental or social impacts but just want to identify which products have high demand and can give best profits.
2	A new generation of socially and environmentally sensistive methods that start in the villages where the NTFPs originate (e.g. the MA&D methodology – see box).	When your objectives are to bring economic benefits to village entrepreneurs or to develop marketing strategies that avoid environmental damage.
3	Special purpose adaptations of type 2 methods that start with an analysis of conservation threats and then proceed to develop village livelihood improvement and marketing strategies that support the achievement of conservation objectives.	When working with forest dependent populations (usually hunter-gatherers or shifting cultivators) living in or adjacent to National Biodiversity Conservation Areas or other protected areas where conservation objectives are paramount.

Marketing Analysis and Development (MA&D)



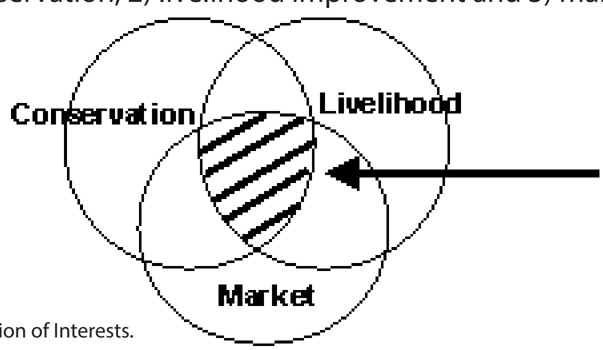
This is a Type 2 methodology that has been developed by the Community Forestry Unit of FAO in Rome and the Regional Community Forestry Training Center (RECOFTC) in Bangkok (see Lecup and Nicolson 2000 for the latest resource materials). This internationally recognized approach, which is gaining momentum in development circles, starts with an analysis of the village situation and contains safeguards that ensure that products with a risk of causing environmental damage or harm to socially disadvantaged groups are eliminated from consideration before going on to the formal market analysis stage. Beginning with what is happening in the village it also tends to emphasize lower-risk product development alternatives that are suitable for projects with small-scale village producers and entrepreneurs who cannot afford to take large risks. RECOFTC offers courses on MA&D and is currently organizing a network of MA&D practitioners in Asia.

Often, when market forces are brought to bear on NTFPs, the result is the over-harvesting and rapid depletion of the resource. It has also been observed that when market forces become active in rural communities, the result is often that the rich get richer and the poor get poorer. If you want to have a different kind of outcome then you have to be very careful about how you link market forces to the local situation. It requires careful planning and a methodology that specifically avoids these pitfalls.

Many shifting cultivators live in isolated areas of the type that tend to become National Biodiversity Conservation Areas. Increasingly, enlightened conservationists are developing protected area management plans that recognize indigenous populations of such areas (usually hunter-gathers and shifting cultivators) as natural components of the ecosystem and allow them to remain within the reserved areas and their buffer zones. For NTFP development and marketing work in these areas we need a proactive approach to the linking of market mechanisms to conservation objectives. The following is a description of a such a Type 3 methodology that was developed for the use of the Vietnam-IUCN Project on Sustainable Utilization of NTFPs in buffer zones of protected areas in northern and central Vietnam.

Background

The NTFP Project design placed a strong emphasis on the use of a "market systems analysis" to identify viable NTFP products that would enhance the livelihood of the inhabitants of the buffer zones and that could be sustainably produced. Thus, the project wanted to address three interrelated objectives: 1) biodiversity conservation, 2) livelihood improvement and 3) market development.



The Intersection of Interests.

The idea is to identify those developments that will not only be viable in the market but will also help meet livelihood and conservation objectives. In practical terms, solutions which only address one or two of the objectives might also be acceptable as long as they have no negative impact on the other objectives, but those addressing all three objectives should receive highest priority.

When market forces are brought to bear on NTFPs the result is often over-harvesting and rapid depletion of the NTFPs, and when market forces become active in rural communities the result is often that the rich get richer and the poor get poorer. If you want to have a different outcome then you have to be very careful about how you link market forces to the local situation. It requires careful planning and a methodology that specifically avoids these pitfalls.

The best solutions will have the following characteristics:

- Conservation effectiveness
  Can be effective in supporting the conservation or sustainable utilization of threatened resources

- Livelihood compatibility
  Can help improve household livelihoods in ways that are compatible with household opportunities and limitations,

- Market viability
  Has a high probability of succeeding in the marketplace.

Methodology

To arrive at an overall intervention strategy for achieving all three of the project's objectives it was decided to develop a participatory "Strategic Analysis" module for starting work at the pilot sites and then to use the MA&D methodology to carry out the subsequent market analysis and development work. The starting point for the Strategic Analysis was the recognition that the situation at the pilot sites required a nested approach, as depicted in Figure 1.

For more information and discussion on the commercialization and marketing of various forest species and products, please refer to Domestication and Cultivation of Non-Timber Forest Products (NTFPs) in the Uplands of Asia (pages 265-268); Medicinal Plants as Solutions for Sustainable Management of Uplands in South and Southeast Asia (pages 225-231); Guidelines for the Commercialization of Medicinal and Aromatic Plants (MAPs) in Shifting Cultivation Areas (pages 232-237); and Domestication of Three Non-Traditional Species by Shifting Cultivators of Northeast India (pages 98-104).

The context of the NTFP marketing strategy is the total Household NTFP Strategy, which includes non-market uses of NTFPs in the household economy. The context of this is the total Household Livelihood Strategy, which includes non-NTFP components. Since the household lives within the jurisdiction of a Protected Area Authority, the context of the household economy is the Conservation Strategy for the Protected Area. Somehow all of these must harmonize to achieve a sustainable situation. The text within each box

Logic of the strategic analysis phase

Conservation strategy for protected area

What are the main conservation threats to the protected area?

Who are the people associated with these threats?

What are the possible strategies for mitigating these threats?

What supportive land use and livelihood changes could be made?

What kinds of NTFP products and marketing strategies could play a supportive role?

Household land use and livelihood strategy

What is the household's overall land use and livelihood strategy?

How do they meet their basic needs for:
- cash
- food
- fodder
- energy
- shelter
- medicine
- materials for cottage industry

What problems do they face in meeting their objectives? What are the causes? Existing strategies for solving problems? Alternative intervention points?

Total household NTFP use strategy

What is the household's degree of forest dependency?

What is the role of NTFPs in the household economy (subsistence, cash income)?

Which NTFPs can be:
- substituted,
- domesticated,
- sustainably harvested,
- processed, and
- sold?

Household production, processing and marketing strategies?

NTFP marketing strategy

Pick up standard MA&D methodology at Step 5 (Phase 1) to:
- assess the existing products, markets and means of marketing;
- identify and assess potential products, markets and means of marketing that support the identified livelihood and conservation strategies;
- develop enterprise strategies and sustainable business plans; and
- follow up and backstop implementation.

Figure 1. The nested logic of the Strategic Analysis which precedes and forms the context of the Market Analysis in the NTFP Project's methodology.

presents the basic questions that need to be answered to define or discover the strategy for that level of the strategy hierarchy. To use this logic one works through the boxes from largest to smallest.

The following table shows the steps of the field methodology, with detailed examples of the actual field procedures for the strategic analysis phase. (See the MA&D documentation given in the references for guidelines on the MA&D methods used for the market analysis.)

Phase 1. Strategic Analysis of the Existing Situation

Analytical steps	Actual procedures applied in the field
1. Preliminary strategic analysis of conservation-related issues	Meetings and key informant interviews with district, commune, village and protected area officials to get overview of area, identify access regulations and conservation threats, NTFP use patterns and relevant population groups and develop a preliminary strategic analysis to use as a working hypothesis to focus the subsequent work.
2. Prediagnostic overview and selection of target areas	Used key informant interviews with commune officials and villagers to get an overview of the selected communes and understand livelihood and NTFP use patterns
3. Identification and characterization of interest groups and households	Group exercise to develop a detailed estimate of major household income sources including NTFPs (cash + subsistence use) Ranking of village households based on: 1) intensity of NTFP use; and 2) investment in agroforestry gardens. Selection of sample households (HH).
4. Diagnosis of household economies	Open-ended interviews with selected HH on land use and livelihood using a standard checklist: ■ What are the household's resources and labour force? ■ What is the household's overall land use and livelihood strategy? ■ How does the household meet its needs for cash, food, fodder, energy, shelter, medicine and raw materials for cottage industry? ■ What is the role of cash income in the household economy? (main sources and expenditures) ■ What is the role of NTFPs and the degree of forest dependency in the household economy? Diagnosis of problems and causes: ■ What are the household's economic objectives? ■ What problems do they have in meeting these objectives? ■ What strategies are they pursuing to solve these problems?
5. Strategic analysis of conservation and development constraints and opportunities	Refine the preliminary strategic analysis (Step 1) in corporating the findings of Steps 2-4 with attention to: ■ Target groups for priority attention (areas, household types, interest groups) ■ Analysis of conservation threats and causes ■ Analysis of household economy problems and causes Output general specifications for: ■ A strategy for mitigating both livelihood and conservation problems ■ The product types and marketing strategies that would support such strategies

Analytical steps	Actual procedures applied in the field
6. Consultations with local experts on intervention strategies and products for the market	Consolidated a list of specific products arising from previous PRA/RRA work in relation to the identified interventions. Presented this list to reliable technical experts with good knowledge of the target area and asked them to identify any obviously needed changes. This step is intended to eliminate gross technical infeasibilities, or add overlooked but promising possibilities as a preliminary to the main screening process with target villagers.
7. Participatory rapid appraisal (PRA) consultations with villagers on strategies & products for the market	Assembled a focus group (half men, half women) representing the interest group(s) that the project my be targeting (those villagers with the greatest interaction with the NTFP resources of the protected area) Presented the revised list of the products/species for each intervention emerging from the previous step, asked the group to make needed eliminations or additions Then presented the criteria and the scoring system for rating the products; discussed with the villagers and ask them to modify the criteria as needed; then consolidated a final list of criteria. Next, facilitated the group to discuss and rate each of the products on each of the criteria, with close attention to the discussion; this is rich information. (The main point is to use the rating procedure to focus discussion. Total scores are of secondary importance and can be tabulated later.) Then asked the group to select the "best choice" products for each category (1^{st}, 2^{nd}, 3^{rd} as needed). This is a "free choice" ranking activity, regardless of the scores of the rating exercise (which might be thought of as a "warm up" exercise).
8. Short listing of products for marketing feasibility study	Taking account of all inputs (the strategic analysis, the expert consultation and the local PRA), the team exercised judgment in narrowing down the products to a feasible short list. Market chains can be long and difficult to follow, so if time is limited it may be important to avoid spending too much time on unimportant market channels. The degree of shortlisting should be a function of the difficulty of following the market channels for specific products (not eliminated if not difficult, eliminated if low priority and difficult). The most important criterion for elimination of a candidate product was a low rating by the villagers. However, since the villagers knowledge was not complete (they had many unanswered questions about the markets for many products), the field team made an effort to retain on the list any product for which there was any reasonable chance that there would be a good market.

Note: The methods for accomplishing each analytical step always need to be adjusted to meet the requirements of the specific application. This is a participatory rapid appraisal methodology that requires flexible and intelligent guidance by the external facilitators and good participation from the local participants.

Phase 2. Market Analysis

1. Analyze the marketing channels and identify opportunities.
2. Build on the opportunities to select the most promising products and develop marketing strategies.

   (See Lecup and Nicholson 2000 for details of the MA&D methodology)

Output: Specific product recommendations that fit the land use interventions and support the livelihood and conservation strategies.

Phase 3. Project Implementation

1. Form interest groups around the land use/livelihood interventions and products.
2. Provide training and support to interest group members and help them negotiate arrangements with larger community.
3. Provide enterprise development and business support as needed (mainly for new products, processing activities and enterprises; not needed for land use improvements with simple marketing requirements).

Output: Viable household economies and enterprises based on sustainable livelihoods and profitable marketing of NTFP and other products in a way that supports protected area conservation.

References:

Lecup, Isabelle and Kenneth Nicholson. 2000. Community-based Tree and Forest Product Enterprises: Market Analysis and Development. FAO & RECOFTC. Rome & Bangkok.

Raintree, John B., Le Thi Phi and Nguyen Van Duong. Multi-participant market analysis and development: some methods used in buffer zones of nature reserves in Vietnam. International Symposium on Montane Mainland Southeast Asia II: Governance in the Natural and Cultural Landscape. July 1-5, 2000. Chiang Mai.

Prepared by
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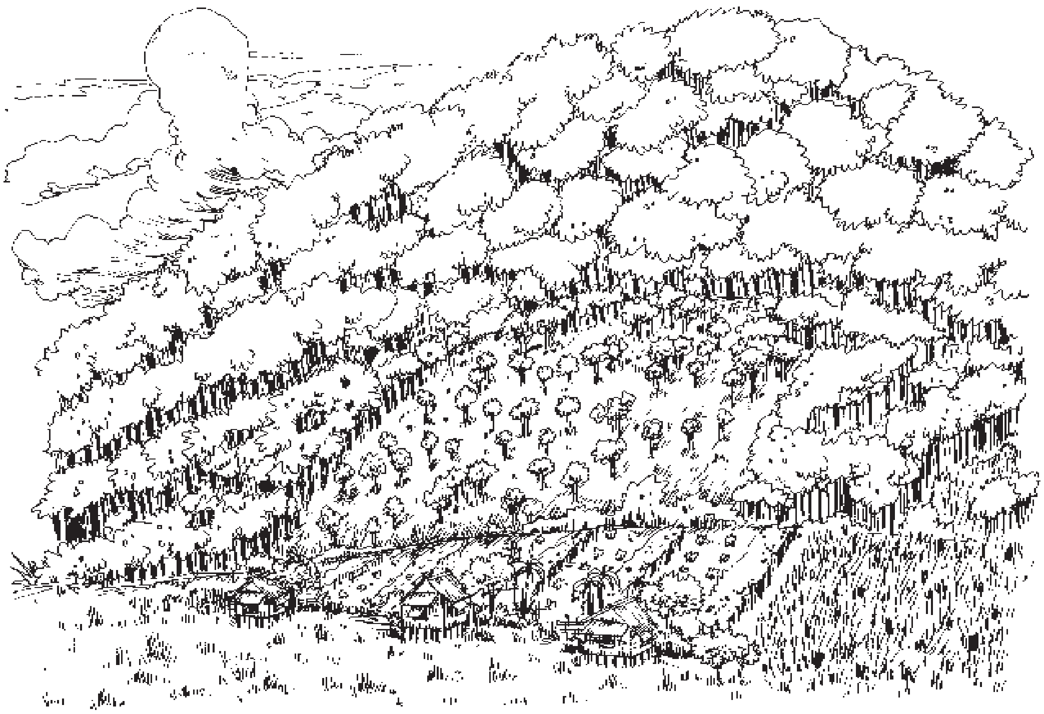
Resource book produced through a participatory writeshop organized by IFAD, IDRC, CIIFAD, ICRAF and IIRR.

Forest Improvement Technology (FIT) An Alternative to Logging



The present concern being shown for the welfare of the shifting cultivator often stems from a deeper concern for the needs of the forest. The concern is critical because the forest contains the basic machinery for maintaining the world's atmosphere and the world's water supply.

A forest is very complex. The trees are the largest individuals in it but there are many more shrubs and grasses than there are trees. A forest also includes many large and small animals and even microscopic animals and plants. The tropical rain forests in the Philippines usually contain between 100 and 200 species of woody plants per hectare plus many smaller plants, grasses, ferns and fungi.

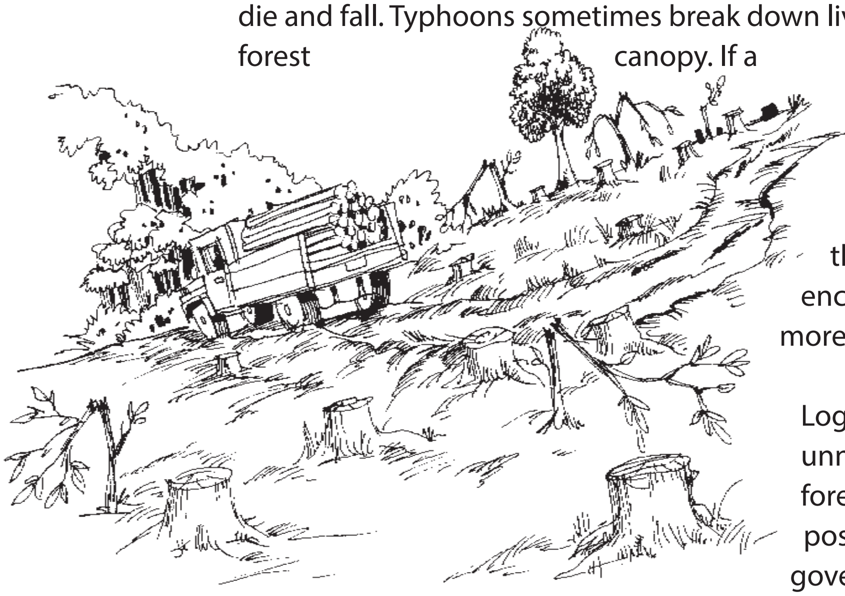
Each plant and animal in the forest has its own role to play. Some of the fungi gather nutrients for the trees, while others decompose the limbs that are broken off by typhoons. Live trees provide fruit for birds and bats. Dead trees provide homes for them. Some insects pollinate blossoms to provide more fruit for the animals. Other insects eat the over-ripe fruit and produce fertilizer for the forest plants. Large trees provide shade needed by smaller ones and uphold the orchids and canopy ferns. Beetles and ants eat the waste of the animals. The entire complex produces soft litter on the ground which absorbs the rain so that it can percolate into the soil. Rotifers beneath the soil purify the water and it comes out months later as clean spring water.

A forest has a climate that is felt as soon as a person enters it. The air is rich in oxygen and moisture. This micro-climate is essential to the forest because it eliminates the extremes, both hot and cold, wet and dry and enables the more sensitive forest animals and plants to survive and helps regulate the climate for the rest of the world.

An orchard is not a forest. It contains trees but they usually produce only one or two kinds of fruit. The ground in an orchard is usually hard and clean and cannot absorb rainfall like the forest floor. It is not a good watershed because it does not have good percolation.

A plantation is not a forest either. It contains trees and they may be timber trees but it does not have the rich biodiversity that characterizes a forest. The trees in a plantation are usually all of one kind called crop trees.

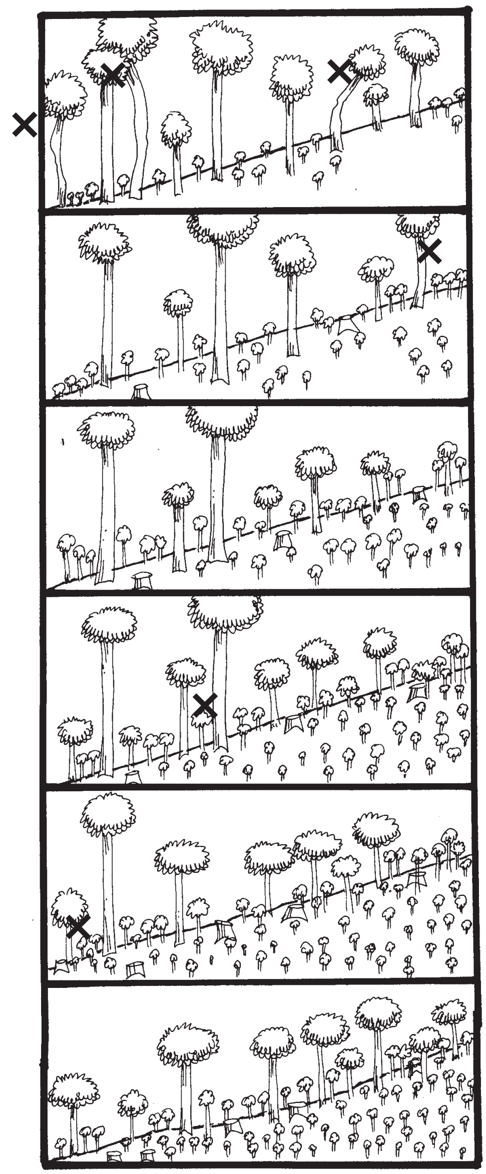
Natural culling takes place all the time in a forest. Large, over-mature trees sometimes die and fall. Typhoons sometimes break down live trees leaving an opening in the forest canopy. If a falling tree damages adjacent trees, the opening may be quite large. Enough shade always remains, however, so that the forest micro-climate stays the same and the increased sunlight through the newly opened canopy encourages the young seedlings to grow more rapidly to fill the gap.



Logging, on the other hand, is a very unnatural process. When a logger enters a forest, he must cut as many good trees as possible so he can earn more money. Some governments have a "selective logging" policy that require the logger to leave a few big trees as "mother trees" to replant the forest. Even if the logger follows the rules carefully, which is not always the case, logging still changes the forest. The remaining trees are too few to provide the micro-climate needed by the next generation of trees. Shade loving plants and animals cannot survive because there is not enough shade. The entire ecosystem is therefore changed. Pioneer species must grow first to restore a suitable micro-climate for the climax species to grow. It takes many years, even in the best managed forest, before the climax species will grow well again.

After the proper micro-climate has been re-established by the various pioneer species, the ecosystem slowly changes and becomes suitable again for the survival of climax species. As the climax species grow, they slowly restore the micro-environment of the forest and the original biodiversity, both plants and animals, may partially recover except for those species that were completely killed by the logging. It requires many years for the forest to return after logging.

A forest area that has been logged cannot be a good watershed because the rate of percolation is usually very low and erosion is high for ten years or more until the various grasses and pioneer species are well developed. The area will become a forest again after the pioneer species stabilize the soil and encourage the growth of the cover crops.



FIT in the Kalahan reserve.

Timber Stand Improvement (TSI), is a technology promoted by most government foresters and departments to improve the harvest of timber by loggers. It is culling that is done once in about 30 years to improve the harvest of crop trees. The technology does not do very much, however, to restore the forest. It even damages the biodiversity in order to increase the size of the "crop trees".

Forest Improvement Technology (FIT), as developed by the Kalahan Educational Foundation (KEF, also described in The Role of Homo sapiens in the Forests,pages 47-52), is very much like natural culling. It is not limited to a single activity done only once in 30 years. It is done almost every year by a local resident whom we call a Forest Farmer.

The forest farmer first checks the forest for crooked, damaged or crowded trees that need to be removed to improve the forest. When these are removed, they are sawn into lumber. It may not be first class but it can be used or sold. Only simple equipment is used in the forest and the sawdust, tops and limbs are left to rot. They restore fertility to the forest soil and help maintain biodiversity. The forest farmer does not separate the potential crop trees from the other trees because he knows that all trees have a role to play in the forest. His goal is to improve the forest, rather than to merely improve his income although, in the long run, his income will also be greatly improved.

Forest Improvement Technology (FIT) Field Guide		
Begin at the first question. If the answer is YES, go to the question number indicated under "Yes." If NO, go to the question indicated under "No." Continue from question to question until the guide indicates "CUT" or "RETAIN."		
	Yes	No
1. Is the forest canopy closed?	2	8
2. Which mature tree can be removed to open the canopy?	3	-
3. Is it diseased or misshaped?	4	5
4. Are there two other mother trees of the same species within 30 meters of the tree?	Cut	Retain
5. Is it still growing rapidly?	Retain	7
6. Could some other trees be removed?	2	Cut
7. Is it providing needed shade for seedlings?	Retain	Cut
8. Is the tree diseased and likely to damage or infect other trees?	4	Retain
Kalahan Agro-forestry Program		
Imugan, Santa Fe, Nueva Vizcaya		

After waiting for another year or two, the forest farmer again checks the forest to determine if any more trees need to be removed to further improve the forest. If so, he removes them. If not, he checks to see if the canopy is closed. A closed canopy makes so much shade that the natural tree seedlings cannot grow. The best way to make the seedlings grow faster is to choose one mature tree that has stopped growing and remove it. This opens the canopy and the seedlings near the opening will begin to grow faster. Removing that tree will not damage the micro-climate. It is just like a natural wind-fall. The tree that is removed, however, will produce first class lumber.

If this is done to the forest every year, the forest will continue to develop and improve. The removal of individual trees in this way does not hurt the forest or its environment.

Sometimes, the forest farmer must start with an area that has already been severely damaged by previous logging or by someone who burned the grass every year to make a pasture. If this is the case, he will have to plant some pioneer species first. While the pioneer species are growing, he may still need to cut an occasional tree. He can use that tree for short lumber or for fuel and earn a little money from it if he wants. We do not recommend planting agricultural crops between the trees, however, because they would bother the other plants that need to grow to make a good forest.

The forest farmer may want to increase the population of one or two species of large or small plants. If so, he may want to do enrichment planting. That would be very good although he should be careful not to turn the forest into a plantation.

While the forest is growing, the biodiversity will continue to improve. Many species of insects, small animals, grasses and other plants will move in. This is good because all of these species will help each other and the improved biodiversity will help the forest to grow faster and be healthier. The forest farmer will only cut a small amount of what grows so that the forest gets bigger every year. As the forest develops, however, he may need to remove more.

When the forest finally has its proper amount of wood which is approximately 270 cubic meters per hectare in the Philippines, the farmer can begin to remove the total growth rate of 15 to 20 cubic meters per hectare each year. He will have to do that to allow the seedlings to grow. Even if he does that, it will not change the character of the forest. Even a good forest cannot support more wood than that.

The growth rate presently expected in Philippine forests, according to the Forest Master Plan, is about 4.5 cubic meters per hectare per year. Under proper management, using the FIT the forest may produce as much as 20 cubic meters per hectare per year. Such a forest still retains the characteristics of a forest. It is not a plantation. It still has high biodiversity and is an effective watershed with a high percolation rate. It will also be the sanctuary for many kinds of wild orchids, animals, birds and insects.

If each forest farmer cares for 5 hectares of good forest, he may harvest up to 80 cubic meters of first class lumber every year without damaging the forest. That would provide him with a higher cash income than many professionals and he would still have plenty of time to produce his own food on the farm. Once the forest has developed, it will be sustainable indefinitely.

The forest farmer may still maintain his own swidden farm to produce food for his family but it will be small because it will only produce food, not products for sale. If his swidden farm is close to his forest he will probably not need to worry about pests bothering his vegetables and fruit because the predators which live in his forest will keep them under control.

Community forestry is the best way to implement this technology. The forest farmer will probably know which of the trees to remove to improve the forest but it is still wise to have a forester help him to be sure that cutting the tree will truly benefit the forest and not just his pocket. One forest farmer could not give enough salary for such a forester. A community, however, could easily afford to have one of its own members trained in forestry to serve the community as a whole.

With a forester, the community could either subdivide the forest into forest lots of 5 or 6 hectares each, one for each family, or the community could have its forester mark the trees that need to be removed and allow the forest farmers to cut them when it is convenient. The community members should make a "community land use plan" to guide them so that they are all working together in the same same way.

When all members of the community work together with the forest in this way, the forest will develop as described above and the community as a whole will benefit because all of the members will have good air, good water and a good income.

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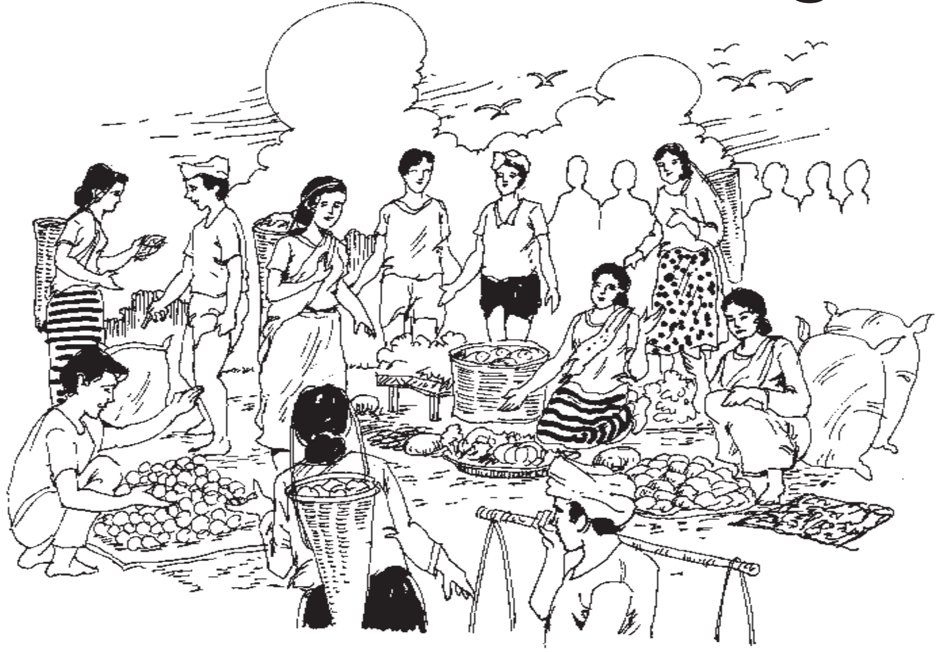
Resource book produced through a participatory writeshop organized by IFAD, IDRC, CIIFAD, ICRAF and IIRR.

Practices in Marketing Forest and Agricultural Products Lessons for Resource Managers



As shifting cultivation intensifies and cash needs of the collectors and producers increases, more forest-based and agricultural products will reach the local, regional, national and international markets. Non-timber forest products (NTFPs) are especially promising in this regard.

Factors accelerating the process

- Cultivators and local traders will sell the produce to earn cash income.
- More and more varied products will be sought after as the consumer income, taste and preferences increases and changes.
- Produce will have potential to be sold in niche markets as most of the shifting cultivation areas are rich in biodiversity and can produce high value specialty products, e.g., red rice from Thailand and the Himalayan morel mushroom (Morchella conica) from Nepal.
- Pressed with revenue shortage, national, state and local governments will increasingly tap new products to boost export earnings.
- As a result of globalization of economies and cultures, producers and traders will explore marketing of new products in international markets.

The best practices in marketing will be a key component of the sustainable management of the shifting cultivation areas in Asia. For a discussion on commercializing medicinal and aromatic plants, please refer to Guidelines for the Commercialization of Medicinal and Aromatic Plants (MAPs) in Shifting Cultivation Areas, pages 232-237.

Key characterisitics of markets for shifting cultivators

Based on the experience gained in the last few years, the following factors are found to characterize many of the markets which might be accessible to shifting cultivators.

- Market demand depends upon the availability of a large range of products of good quality, required quantity, appropriate time and convenient places.
- While attractive prices will be the strongest incentives for producers, harvesters and processors to participate in the market, competitive pricing will be one of the strongest advantages to attract consumers to the market.

- Buyers of the perishable products and industrial raw materials will invariably apply monopsonic practices (only one buyer) or develop monopolistic relationships with the sellers to avoid paying high prices to producers, collectors and local traders.
- The sellers' ignorance about markets, prices, and marketing strategies (as well as not having organizations, financial and infrastructure support) invariably results in 'distress' selling.
- Low prices given to sellers are sometimes justified by buyers who cite the poor quality of the material supplied and the practice of some sellers who cheat on weights by adding stones, etc.

Government policies usually:

- favor the traders, as the existing policies allow outsiders to enjoy concessions to the forest;
- impose unscientific royalties and collection restrictions which poor collectors are not able to manage; and
- government officials find it easier to deal with a few large traders than with a large of number of small traders in exporting forest products.

Best practices in promoting marketing for shifting cultivators

- The land and tree tenure rights should be unambiguously handed over to a designated local community with detailed management guidelines. The national forest laws should be amended to prohibit giving all kinds of proprietary rights to outside concessionaires' and exclusive rights for transporting and marketing.
- Collectors and growers should be provided with credit, storage facilities and transport subsidies. (While, in principle, we are against all forms of subsidies, in shifting cultivation areas until such time as the shifting cultivators and local traders are on a level playing field with private traders who are well established and networked, it may sometimes be necessary to offer some form of initial subsidy or grant to meet the high cost of transport).
- Fixing minimum floor prices of major marketable products also works as a strong incentive for collectors and growers as they can work toward achieving a certain level

of income through marketing. For products with well established niche market, however, producers and collectors should be encouraged to try to capture the maximum profits possible, as usually, the products sell in high-end markets.

- Fair trade practices can be encouraged by assisting in the establishment of quality standards to be used in quality-based price negotiations between sellers and buyers.
- Although expanding markets for both raw materials and finished products can contribute to overexploitation of resources, especially NTFPs, government should take a strategic approach to maintaining a balance between backward and forward linkages.
- Governments should not put an outright ban on export of raw materials from shifting cultivation areas such as the ban enforced by the Indonesian government on export of raw rattan. This policy has only helped powerful local furniture manufacturers and big traders gain greater control over the rattan trade and industry, and suppressed the raw material price. It has also given a serious setback to the efforts to mobilize local communities in sustainable forest management due to disincentives related to loss of local control over NTFP resources.

Role of market support services

Local communities and the local traders find it difficult to obtain reliable market information. The understanding of market dynamics and emerging trends is important. The resources and capacity that exist at the local level are inadequate.

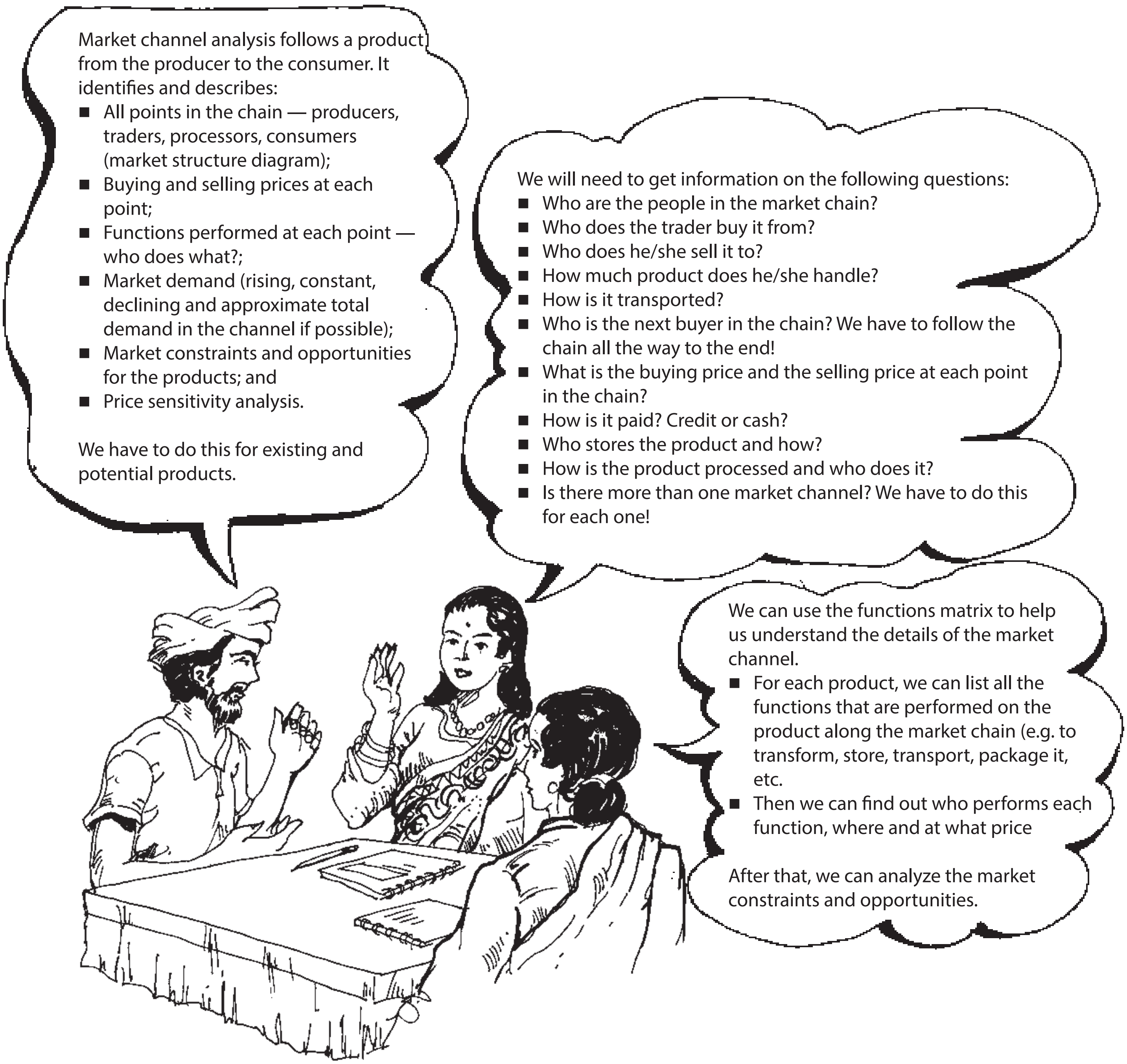
Development of suitable market support services is therefore an essential part of sustainable development of the uplands in Asia. The needs can be identified through a participatory process of market system analysis such as the Marketing Analysis and Development (MA&D) method developed by the Regional Community Forestry Training Center (RECOFTC) and the Food and Agriculture Organization's Community Forestry Unit in Rome (Lecup & Nicholson, 2000) to generate information needed for sustainable management, fair prices, and efficient markets.

Development of marketing infrastructure including basic communication facilities, simple storage, and primary processing facilities can provide the local traders and enterprises to profitably market their products.

Another critical area where outside support is necessary for the community is in the area of building minimum working capital as cushion finance to avoid distress selling. Outside supporters can also help to setup small local trading enterprises to provide links to the market.

In Nepal, Appropriate Technology International (ATI)-Washington and ANSAB-Kathmandu have arranged to provide a minimum capital by establishing a revolving equity fund administered by a local NGO. The revolving equity fund can also assist the collectors (individually or in groups) to establish businesses based on the collection and processing of NTFPs and other natural resources. Increased access to market information and the establishment of processing enterprises has resulted in increased market competition. This situation has become beneficial to the collectors, providing higher prices for the raw material at source (Subedi & Bhattarai, 1999).

Checklist for market channel analysis



Sample market constraints

- There are no buyers or there is only one buyer (monopsony).
- Required volume for sale cannot be reached.
- There is insufficient or declining demand.
- There is a falling price trend.
- There is a risk of price volatility.
- There is a trend toward substitution by other products.
- Market entry is difficult.
- Market is too competitive for participation by small village-based enterprises. Others can produce cheaper, control distribution or market the product more effectively.

Production and processing constraints

- The product cannot be produced profitably.
- The product cannot be processed profitably into a form that can be marketed .

Transportation and storage constraints

- Transport costs are too high.
- There is a storage risk (spoilage).

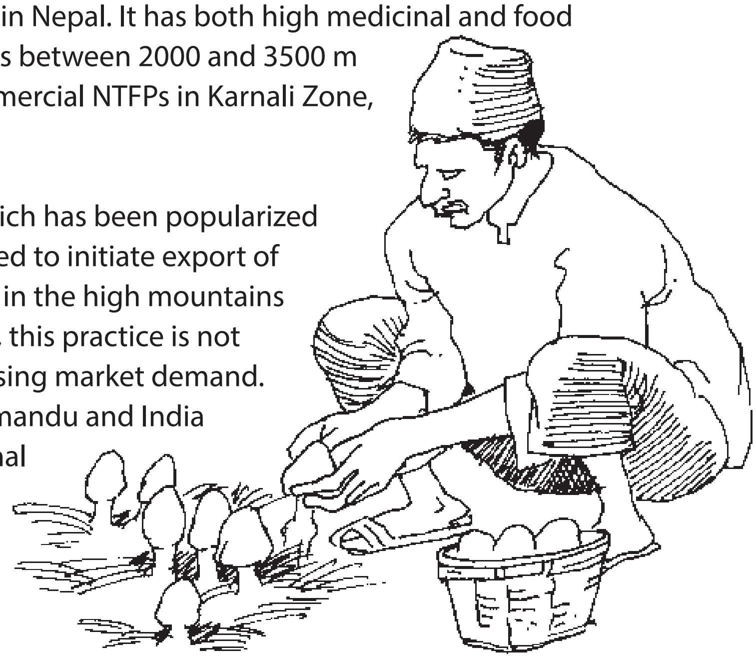
Other constraints

- Legal/regulatory.
- Finance. It is difficult to get credit.
- Market information is not available.

Success stories in Asia

1. Marketing of wild mushroom from Nepal

A unique Himalayan wild mushroom called morel mushroom, locally known as Guchichyau, with unique medicinal and food value is found in Nepal. It has both high medicinal and food values. It is found in the western Himalayas between 2000 and 3500 m altitude and, is one of the high value commercial NTFPs in Karnali Zone, Nepal.



Guchichyau is an expensive food item, which has been popularized by French and Japanese visitors who helped to initiate export of this mushroom. Traditionally, local people in the high mountains harvested Guchichyau as a food. However, this practice is not common nowadays because of the increasing market demand. It is now mostly sold to traders from Kathmandu and India and ultimately exported to the international market. Guchichyau is sold as a gourmet natural food from the Himalayas to the high-end markets of Europe and Japan.

Present marketing trend

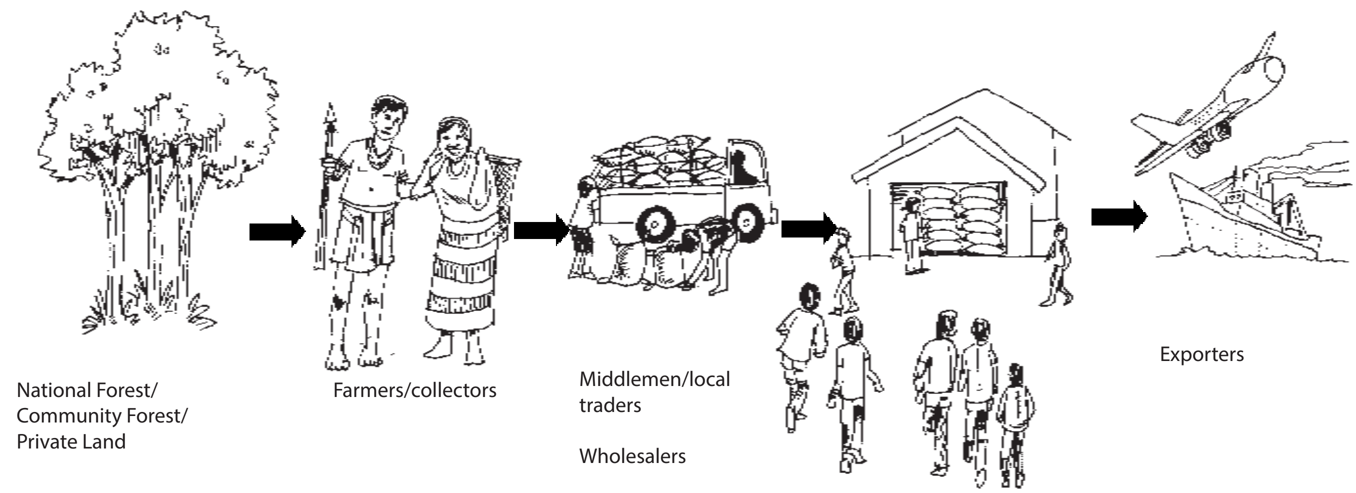
Guchichyau trading started recently. According to the traders, more than five tons of dry mushrooms can be easily collected per year from the Karnali Zone for marketing. Because of its increasing demand in international markets, more and more traders from Kathmandu and other parts of Nepal are scouting the area to increase their supply for export. Obviously, the selling price is increasing but is way below the potential price the buyers could get.

Market price per kg (in US dollars)	
Collectors	Avg 39.34 35.24 - 52.86
District Trade Center	Avg 56.37 52.86 - 59.91
Dang/Nepalgung (Wholesalers)	Avg 65.20 63.44 - 70.48
Delhi/India	Avg 70.48 67.66 - 73.30
Current trend:	
Price	Down
Market Demand	High

2. China Bamboo sector
(Source: Maogon et al 1996 as quoted in Belcher 1998)

Bamboo is one of the most important forest resources in China. There is a long history of bamboo plantations in the country especially in the mountain

Current Market Chain



regions and degraded lands. Beginning in the 1980s, a series of economic policy reforms have led to large increase in bamboo-based industries triggering unprecedented activities related to trade and commerce.

The case study looked at a thriving bamboo sector in Anji county of Zhejiang Province in China. With only 0.054 ha of per capita arable land, agriculture is of subsistence nature. Rural people depend much on forest products, with bamboo occupying 30% of the forest area and accounting for 51% of the total production of the country.

Bamboo culm production reached 30,000 tons in 1995, along with 3,200 tons of bamboo shoots and 6-8,000 tons of bamboo by-products. Bamboo industry outputs contribute 50-80% of total industrial production of the townships and earn 30% of the county's revenue.

The key participants in the market trade are: farmers, traders, product manufacturers, sub-contractors, domestic wholesalers and foreign trade companies. Triggered by the incentive oriented policy changes, which lifted land ceiling and production quotas in China, levels of production and productivity of culms, shoots and by-products have increased rapidly over the last 15 years. Processing industries expanded rapidly due to infusion of cash and technology from expatriate Chinese families and good market response from domestic and international markets.

Critical findings

The lessons learned from this case study are many.

- The new open market policy, which removed price and trade controls, and monopoly marketing, had a dramatic effect on the market. In 1984, policy was changed, permitting private, collective and joint investment in the Bamboo sub-sector. Trade volume jumped from less than 2 million culms traded privately in 1983 to 16 million by 1994. In the period 1985-1995, the number of bamboo-based enterprises from from 154 to 527. Of these, 61% were privately operated and there were 18 joint venture companies. The collaboration between domestic and foreign companies was crucial to get access to new technologies and capital to create new products. In 1994, export of bamboo products earned USD 117 million for the county. Since 1990, exports have grown by 320%.

- Rapid expansion in the volume of production has been matched by dramatic improvement in quality as well. Production has shifted from agricultural tools aimed at low-end markets to consumer goods for the high-end export market. Products like mats, panel boards, floor-boards and high quality handicrafts now dominate the sector, along with a range of processed bamboo shoot products.

- Farmers have been allowed to capture 100% of productivity increase in land rent above the historical trend. As a result, primary production of bamboo has risen from 9.5 million culms in 1981 to 17.3 million in 1995.

- Although prices paid for raw materials have increased by more than 250% in real terms since 1980, scarciy of raw materials is one of the biggest problems faced by the sector. Manufacturers of bamboo shoots in particular are operating below capacity due to lack of sufficient raw materials.

- Regulation of bamboo harvesting to promote sustainable management has led to drastic fluctuations in raw material prices. Among the emerging institutional solution is the practice of forward buying to guarantee raw material supply and prices. Some factories have diversified and others have modified production systems, such as round-the-clock operations during bamboo shoot seasons and new operations for canned bamboo shoots.

General conclusion and implications

Markets and marketing provide opportunities to upland farmers to earn cash income and add value to their traditional knowledge. However, in the current marketing scenario of green products, there is a lack of transparency, equal opportunity and incentives. Also, the powerful local and outside traders have distorted the markets.

- Information on price and markets is key to the collectors and small-scale producers to make appropriate decisions.
- Support services such as communication, storage, organization and transportation and credit facilities play a critical role in enhancing local benefits through marketing.
- Small and micro enterprises in which stakeholders participate can create markets and enhance price for the local products.
- Government policies should not allow access by outsiders to harvest, transport and market forest resources in the uplands.
- NGOs and donor agencies can play a major role in developing capacity and facilitating marketing process in the uplands.

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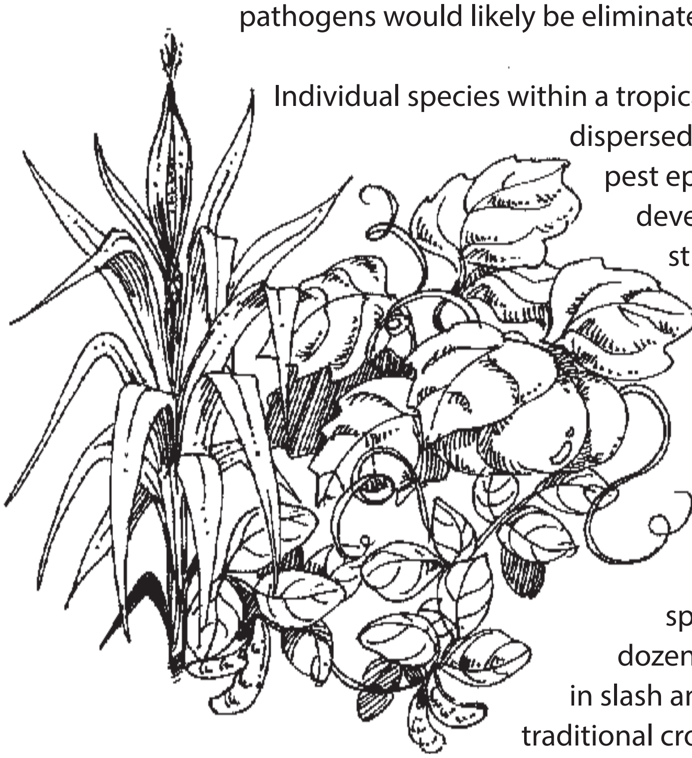
Pest Management in Shifting Cultivation Systems

Thousands of references on slash and burn systems frequently mention fallowing and rotation as traditional pest management practices that have been used for centuries. The type or mixture of vegetation during the fallow and the length of fallow have differing effects on disease severity. Fallowing is a highly effective practice for managing many pests and pathogens, especially in combination with crop rotations.

The use of fire in slash and burn systems is another important indigenous pest management practice that manages weeds, insects, fungal diseases, nematodes, and other pests. Nematode populations found in "modern systems" have been found to be larger than those found in traditional slash and burn systems. One investigator found that burning a 10 cm leaf litter layer destroyed root-knot nematodes to a depth of 9 cm and sheath nematodes to a depth of 19 cm. Differences among the reported temperatures reached during burning are probably due to variations in the amount and quality of the material burned, its moisture content, wind velocity, the duration and intensity of the burn, and soil type. Sometime large piles of dry branches several feet high are burned and soil sterilization under such conditions would probably be quite thorough and deep, and thus many soil pests and pathogens would likely be eliminated.



Individual species within a tropical forest are generally rather uniformly dispersed, and this strategy is also useful in preventing pest epidemics. Much of the traditional agriculture in developing countries involves multiple cropping strategies, and innumerable crop combinations are used in shifting cultivation. The combination of maize, beans, and squash is still commonly used by traditional farmers throughout the Americas and Africa. Using a diversity of species in shifting cultivation provides a degree of protection because pests and pathogens are seldom able to build up to destructive proportions on the few isolated plants of each species. The literature worldwide cites the many dozens of different kinds of plants that are grown in slash and burn fields. Intercropping is found in most traditional cropping systems. Many examples in the literature illustrate the importance of multiple cropping and provide evidence on the prevalence and importance of intercropping in shifting cultivation systems.

Numerous references in the literature report decreased disease in mixed cropping associations. Air movement, temperature, humidity, and light are factors that may be affected in the micro environments produced by intercropping, and all these factors may affect disease incidence and development. Intercropping cassava with maize or melons reduces soil splashing by raindrops and significantly reduces the severity of cassava bacterial blight. Mulches also reduced the severity of bacterial diseases by preventing soil splashing. The association of maize and beans is one of the most common crop associations in the tropics. Comparisons of bean monocultures with beans grown in association with maize showed that beans grown with maize usually had fewer diseases and insect pests.

Weeds are probably the most important pest management problem in shifting cultivation systems. Farmers in some countries may spend up to half of their time in weed control and many of these farmers have shifting cultivation systems. In most shifting systems, successive crops are harvested until the plot is left to fallow or abandoned because weeds have become unmanageable. Finally, weeds and other pest problems make the cleared plot uneconomic. Weeds are the major pest problem in slash and burn agriculture.

Shifting cultivation plots mimic tropical forest ecosystems in at least two ways that influence pest problems. A great diversity of crops is grown, which provides a degree of protection because pests and pathogens are seldom able to build up to destructive proportions on the few isolated plants of each species. Secondly, the shade produced by the closed or partially closed canopy consisting of some trees that are left standing, and tall crop species such as bananas and papayas, reduces the severity of the weed and some of the plant disease problems. The effects of shading are highly complex, and there is a need to better understand its action relative to plant disease. Shade trees affect not only light intensity and quality, but also air circulation, soil and air temperatures, soil moisture, and deposition of dew and rain. Shade trees also protect plants beneath the canopy from hail and strong winds. Several diseases are less severe under shade than in full sunlight.

The tapado system is a slash/mulch system, another shifting cultivation practice that is commonly used in the wetter areas of the tropics. Early Spanish chroniclers in tropical America described the use of a slash/mulch system for maize, beans, and other crops. Indian civilizations living in humid tropical forests invented the practice. The practice is also found in Africa. One of the most common tapado systems is the frijol tapado (covered beans) system. Bean seeds are broadcast into carefully selected weeds, the weeds are then chopped with a machete so the broadcasted bean seeds are covered with a mulch of weeds. A semi-determinate type of bean, between a bush and a climbing bean, is planted. The beans grow through the mulch and eventually cover it. This combination of mulch and bean plants effectively prevents weed growth and appears to conserve soil moisture. In addition, the mulch prevents soil splashing, which was found in a Costa Rican study to be the most important source of inoculum of Thanatephorus cucumeris, which causes a severe bean disease called web blight.

The control or management of some of large pests such as birds, rats, monkeys, wild pigs, baboons, and elephants is especially difficult in shifting cultivation systems. In Africa bitter cassava is sometimes planted around plots of other crops and its unpleasant taste discourages animals from entering the plots. Gliricidia sepium is known as Mata Raton (rat killer) in Latin America. Some people use Gliricidia to kill rats. Roland Bunch has seen the following done in Honduras. A few good-sized pieces of bark are stripped from the tree and boiled in water with about 20 pounds of corn. The corn is then tossed into the fields. Both rats and mice are killed by the treated corn. It is not as effective as regular commercial rat poison, but it does work and is less lethal in case of an accident. It takes a day or two before they start finding dead rats and mice in the fields. More research is needed on this promising method on controlling rats.

More attention should be given to pest management in shifting cultivation systems. Scientists seem to have neglected this important aspect of shifting cultivation systems.

Lessons learned

- Long fallow and frequent rotation practices reduce pest problems
- Intense fires can kill weeds, insects, and pathogens, but there may be trade-offs due to increased soil erosion and loss of soil fertility after the first season
- A diversity of plants and multiple cropping reduce losses due to pests
- Manipulation of shade intensity can manage diseases and weeds
- Mulching vegetation produces numerous pest reduction benefits
- Convert to a slash/mulch practices where conditions warrant

Prepared by
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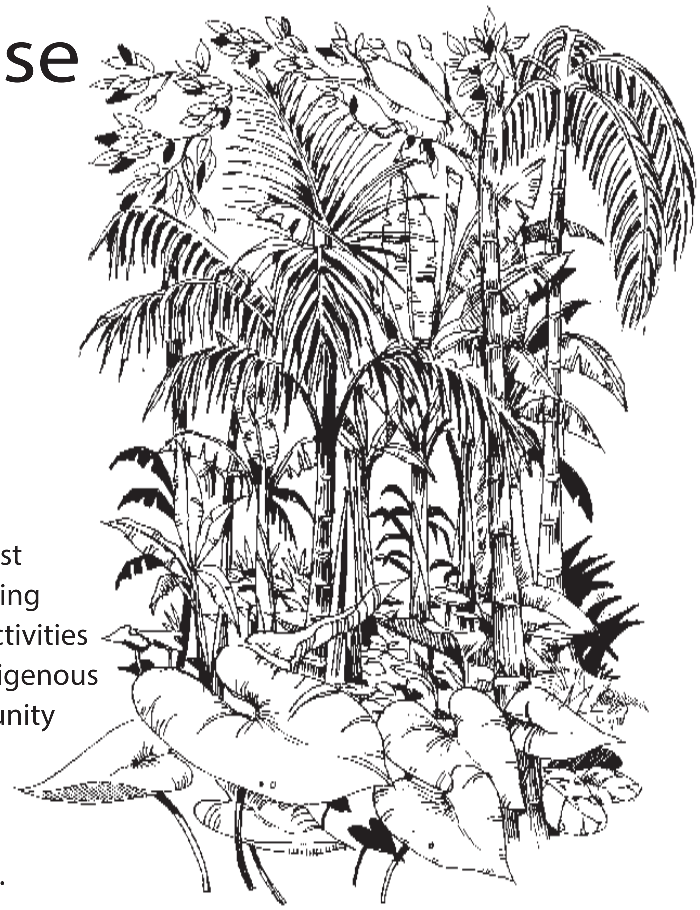
Resource book produced through a participatory writeshop organized by IFAD, IDRC, CIIFAD, ICRAF and IIRR.

Adaptive Changes in Upland Mindoro, Philippines Intensified Land Use among Buhid Shifting Cultivators



Shifting cultivation is still the main source of livelihood for many upland communities in Southeast Asia. It is complemented by animal husbandry, hunting and fishing, gathering, crafts or wage labor. These activities are usually closely interlinked, especially among indigenous communities. While the pattern in a specific community reflects its adaptation to the specific environmental conditions encountered, such activities at the same time manipulate – and often profoundly change – their environment, both natural and social.

Human intervention in the natural environment is quite conspicuous among shifting cultivators, like in all forms of agriculture. The natural vegetation cover and ecosystemic processes are considerably altered. These changes impact on other spheres of the livelihood system—like hunting or gathering—and in a feedback loop again, induce adaptive changes. Similarly, the social environment may also trigger changes in swidden practices, which again impact on other spheres of the community's livelihood system.

Among the Buhid of South-central Mindoro, considerable changes have taken place in their shifting cultivation practices during the last 30 years. In the upper Fay valley, which lies several hours hike from the nearest road, a considerable intensification of land use and a more refined fallow management has occurred. These changes were brought about by drastically altered conditions including demographic, economic, technological and political factors. Similar processes can be observed throughout Southeast Asia. Ultimately, it simply meant: a scarcity of swidden land.

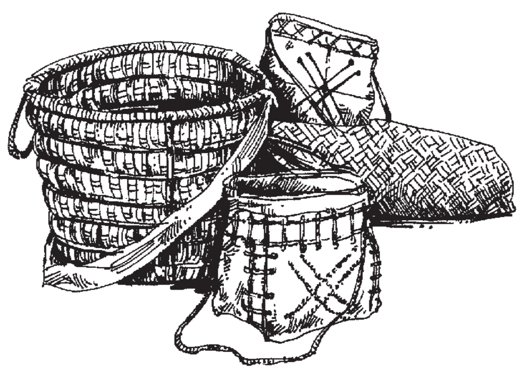
Improvement of fallow management and the establishment of agroforest

Fallow is an intrinsic part of shifting cultivation. But for many decades, outside observers – even trained agriculturalists – have misunderstood its function and value. Fallow land was often seen as "abandoned land." The cultural bias of lowlanders and other foreigners prevented them to understand that the fallow has a function similar to a leguminose crop on a former corn field in the lowlands: to restore fertility. But fallow in shifting cultivation has many more functions which have been overlooked.

Since the Buhid shifting cultivation household usually creates one or more new fields every year, it possesses a number of fallow fields of different ages, and therefore at different stages in the natural succession of the forest plant community. Thus, the diversity of available useful resources is very high, probably even higher than in an undisturbed forest. This is because typically, the fallow vegetation is actually managed and that the field is anything else but "abandoned."

Importance of fallow

- Restores fertility and rejuvenates soil
- Eradicates weeds
- Provides forage for livestock
- Source of domesticated, semi-domesticated or wild food plants, and of protein from large or small wild animals
- Source of herbal medicine
- Raw material for all kinds of crafts.



Process versus Capital

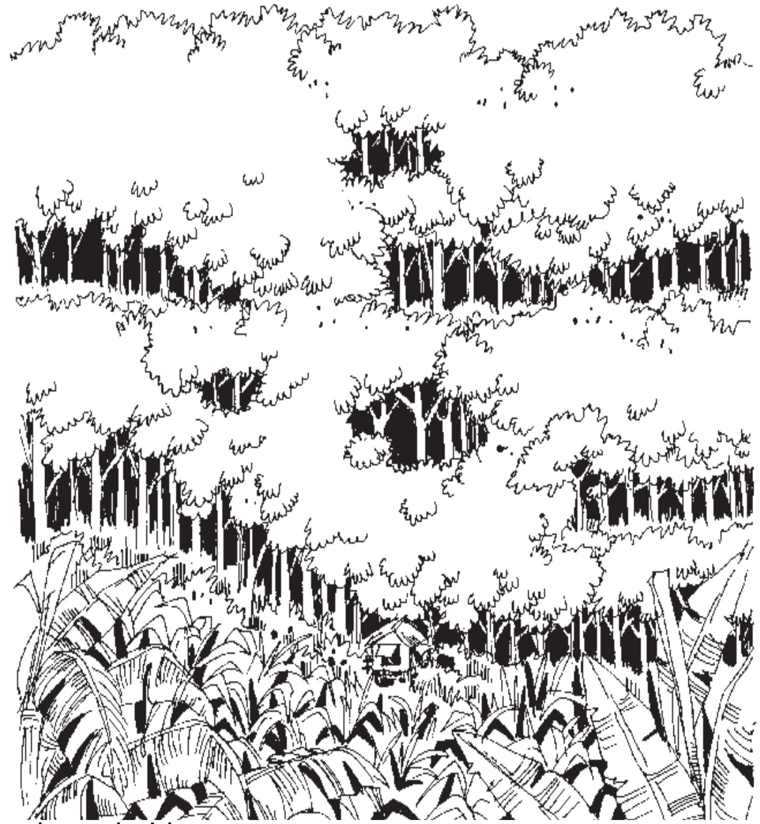
Shifting cultivators depend on processes associated with natural plant succession. Natural processes which maintain or restore soil fertility are at work in all farming systems. But many farmers planting in rich alluvial soils in the tropics (or deep soils in temperate regions) can also – and often do – rely too much on a capital of nutrients or organic matter accumulated over millennia. Most shifting cultivators in Asia, however, live on comparably poor upland soils and cannot draw on such a capital. They depend much more on continuing natural processes related to plant succession. A good fallow management, therefore, is vital.

Reduced labor requirements

Among the Buhid of the Fay valley, the transition from a new swidden field to a fallow vegetation ready to be cleared again is characterized by a gradual decrease of management, i.e. investment of labor.

For them, a newly cut and burned field is called námay. It remains a námay until the cereal crop – rice or maize – is harvested. Although the Buhid have more specific terms for the subsequent stages of a field, these are generally classified as talun, from a sweet potato dominated root crop field (which may be called talun kamotehan – from kamote for sweet potato) to all stages of fallow vegetation even up to that of a mature secondary forest. The succession is manipulated by the farmer, more intensively in the early stages, when the field is regularly weeded and increasingly less as it grows older and when human intervention may be confined to an occasional clearing of competing natural vegetation to enhance the growth of a fruit tree or to maintain a banana or plantain patch.

Over time, some Buhid farmers have transformed their swidden fields into agroforests which in some cases consist of an association of several perennial plants with a forest-like structure. It is a form of talun which is the result of a continued, planned manipulation of the "succession" on a swidden field, replacing the original natural forest with an entirely man-made forest. Such talun not only provide food (Tania - Xanthosoma sp. - plantains, fruits) but also the much cherished betel nut and leaves as well as coffee or other cash crops like cacao, or building material like bamboo.



Presently, in the Fay valley, the Buhid usually cut two small fields, thereby spreading the risk and making use of different micro-conditions for crops, which together measure on average about 0.3 ha per household.

Compared to past practice, now only a small area of land has to be cut annually for new fields for the following reasons: the Buhid rely mainly on highly productive root crops and plantains for their diet; the planting of fields with perennials keep them productive for a longer time, well into the "fallow" period; and some fields have been transformed into agroforests (also see The Basics of Shifting Cultivation Systems, pages 24-28).

The differences between the extensive and the intensive forms of swidden farming which evolved over

Shifting Cultivation	Extensive form	Intensive form
Cropping pattern (sequence)	Maize/rice – sweet potatoes + some Vegetables + other root crops – fallow	Maize/rice – sweet potato + vegetables + other root crops– Tania/plantain/banana/ fruit trees – fallow or transformation of fallow lot into agroforest.
Perennials	Some bananas/plantains and fruit trees are planted in settlements.	Some fallow fields are transformed into agroforests plots, with a mixture of perennials, among others coffee for cash.
Subsidiary activities	Hunting important; fishing and gathering of wild plants important.	Hunting less important; fishing and gathering of wild plants important.
Husbandry	Extensive pig and chicken husbandry.	Extensive pig and chicken husbandry.

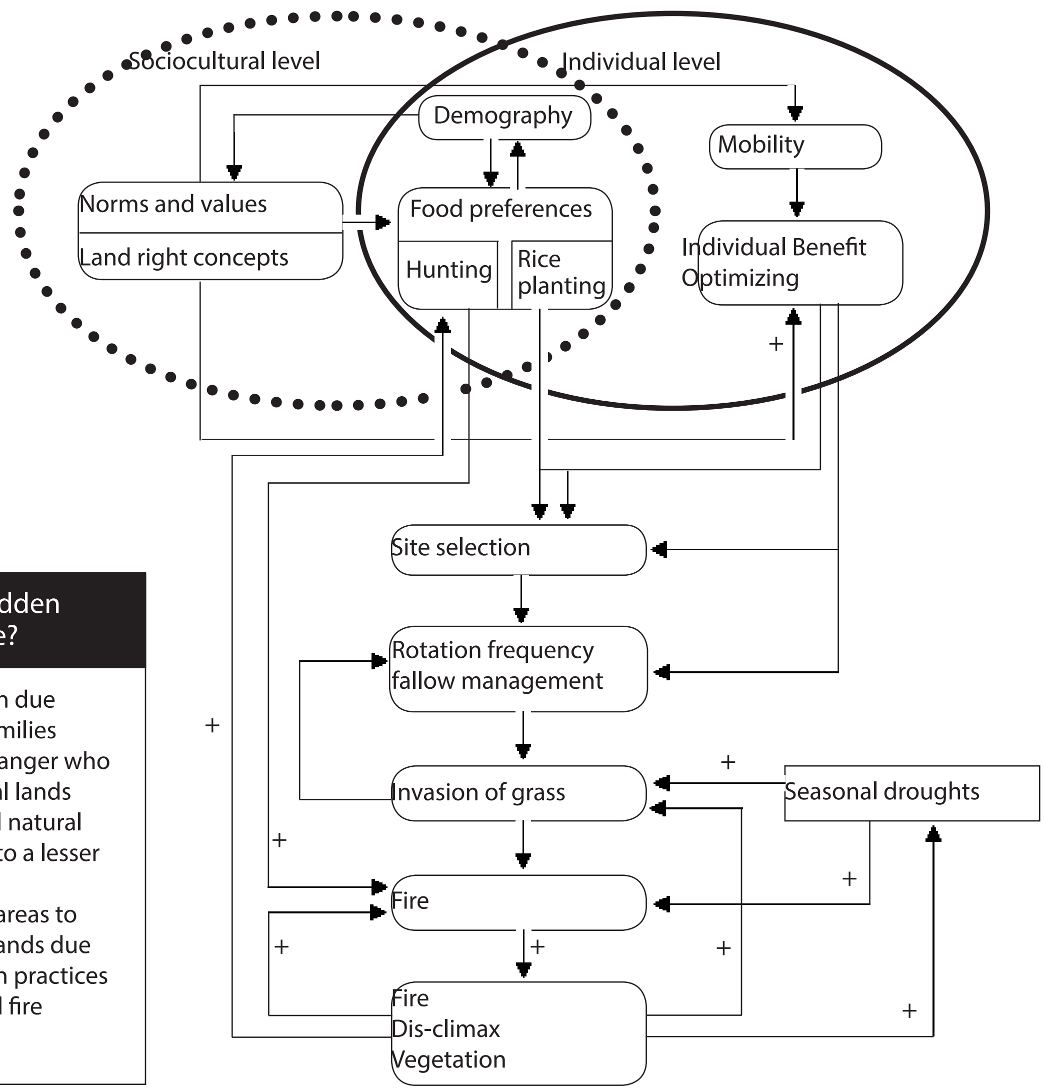
the last three decades can be summarized as follows:

Factors contributing to changes in Buhid land use

The Buhid have traditionally been highly mobile and a family's response to scarcity of resources was to move elsewhere. With rich resources, a rather opportunistic shifting cultivation strategy prevailed: forest and other resources were apparently unlimited; only few permanent crops were planted and little attention was given to the prevention of the invasion of imperata or the outbreak of fire in fallows and grasslands.

As options to move elsewhere became few, other responses were developed in some communities. A few created paddy fields in suitable locations, while for most families intensified land use consisted of a more intensive form of shifting cultivation. A conscious fallow management has been adopted in which the growth of woody vegetation is encouraged and the spread of fire to fallow land prevented.

Some factors affecting SC of the Buhid (+ = positive effect)



Why have Buhid swidden lands become scarce?

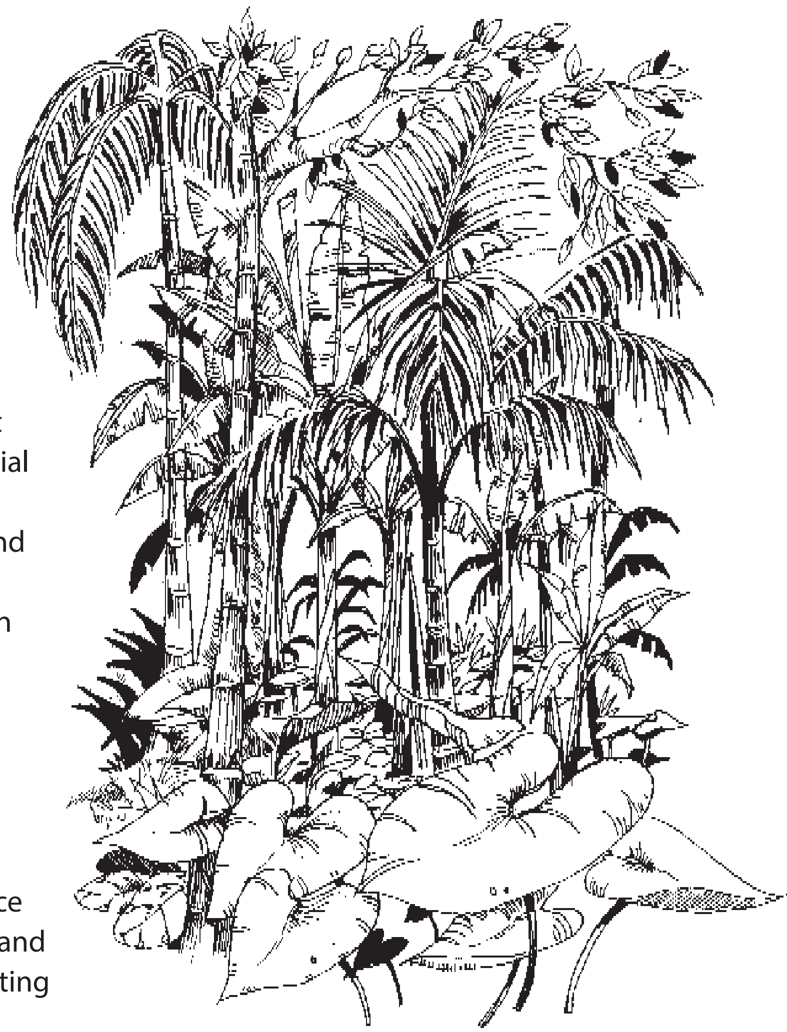
1. Increased population due to immigration of families (evicted by a cattle ranger who claimed the ancestral lands of these people) and natural population growth, to a lesser extent.
2. Conversion of large areas to unproductive grasslands due to extensive swidden practices with poor fallow and fire management.

The Buhid began to be more concerned with the prevention of the invasion of imperata and the proper establishment of woody fallow vegetation. While initially the expansion of grasslands created more favorable conditions for some animals – like deer, traditionally hunted by the Buhid – it also attracted the interests of cattle rangers who, until the late 1980s, controlled large areas of the ancestral lands of the Buhid.

In addition, a more intensive cropping pattern is practiced. The cropping period has been extended, new crops were introduced and agroforestation contributed significantly to both food self-sufficiency and cash income.

Favorable environment

- The climatic conditions in the central and eastern uplands with almost year-round precipitation which allows almost year-round root crop production;
- The flexibility regarding crop preferences, which means: with the absence of a culturally prescribed rice-preference, the crops best suitable to the particular conditions were introduced. The bulk of calorie intake comes from root crops and plantains. Rice for ritual and social purposes is purchased from other farmers with more suitable soils or from the lowland markets.
- There were access to new crops and a keen interest in experimenting with them.



New varieties and species

Crucial for a more intensive planting of perennials was the introduction of a more productive and hardier variety of plantain, called sab-a. This variety tolerates the presence of trees, above all their shadow, much better and is therefore very suitable for enrichment planting in fields to be left fallow.

At around the same time, about 30 years ago, Tania was planted for the first time and spread rapidly among the communities living in higher and therefore moister reaches of the Fay creek. Tania is a perennial plant producing starchy tubers which now play a considerable role in the diet of these communities. It also tolerates semi-shadow and is often planted in the forest along creeks. But it is above all planted in later stages of the cropping cycle of a swidden field, sometimes in combination with plantains and fruit trees.

Changing land rights

The development of improved fallow management and the establishment of permanent agroforests went hand in hand with a changing land rights concept. Over time, there was a move from weakly defined communal land rights, that were close to an open access regime, to individual rights. The increased investment in the land by planting perennials was both a reason and a means for transforming the land rights concept. According to traditional law, it was not land but only plants that can be owned by an individual.

A more conscious fallow management—which implies self-restriction and therefore can be seen as an "investment" because of its short-term opportunity costs—will only work if others can be prevented from using the land while it lies fallow. Planting of perennials is, and was, used as a means to establish indirect control over land since swiddening a piece of land with young perennials requires the permission of the owner.

Eventually, the concept of individual land holdings prevailed. In the early 1990s, the new and the traditional concept of land rights were competing, which led to considerable disputes. In most areas, individual land rights over swidden land are now fairly well established. All this happened entirely within the indigenous law over the last three decades or so.

However, land resources in the Buhid ancestral domain have been contested by outsiders (which means the State, through the Regalian Doctrine). The Buhid have managed to retain or regain control over a large part of their ancestral domain. Some land in the plains and the foothill areas has been lost to settlers, but that claimed by pasture lease holders were regained.

Since June 1998, the Buhid have a Certificate of Ancestral Domain Claim (CADC) for the entire ancestral domain (94,000 ha) and have now applied to have it turned into a Certificate of Ancestral Domain Title. Unfortunately, this has not yet been granted. The recognition of the right to their ancestral domain is of course a precondition for the Buhid to maintain their own land use rights and to strengthen and further develop comprehensive sustainable resource management regimes (Similar experiences are described under The Cultural Cost of the Forest Conservation on Palawan Island, Philippines: Sacrificing People for the Trees, pages 175-181 and Shifting Cultivation Practices of the Hanunoo Mangyans: Mindoro Island, Philippines, pages 163-168).

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Linking Livelihoods and Conservation How are Human Needs Integrated with Biodiversity?

There is a growing interest in linking livelihoods of people living near natural resources to the conservation of those resources. It is normally assumed that if local people can benefit economically from the biological resources that they manage or control, they will take action to counter threats to these resources. There have, however, been few attempts to really measure or understand these linkages. This article attempts to come up with a method to measure the linkage between livelihood and conservation. This explains to some extent the complexity of links between livelihoods and conservation strategies of the local community. Links, often assumed to be straightforward, may in fact not be that straightforward or may not even exist at all.

This study was undertaken by N. Salafsky and E. Wollenberg as a result of the disappointing effectiveness of their interests in the mixed record of effectiveness of ICDP (Integrated Conservation and Development Proejcts)., which implied that they link conservation and livelihood objectives. Their works are based from experiences of the project partners of the Biodiversity Conservation Network (BCN).

Relationship of livelihood and conservation

The central question is: if the biodiversity of a site is damaged, what will happen to the livelihood activity? The underlying thought is that some livelihoods are more linked to biodiversity than the others.

Five dimensions of linkage

There are five different kinds of linked activities that can be distinguished. Within and between categories, these links vary from weak to strong.

1. Species dependence

   This involves the degree to which the livelihood activity depends on the use of different plant and animal species at the site. Does the activity depend only on just one or several species, on its standing value (e.g. ecotourism), or is the species used in situ to attach cultural meaning to a livelihood practice (the burning of fragrant wood to ensure a good hunt)?

   The idea is that, the more species an activity depends on, the greater is the degree of linkage to conservation aspects.

2. Habitat dependence

   This link refers to what extent the species itself, as used by the villagers, depends on the habitat it grows/lives in. Observed types of link were; (i)always available outside the natural habitat (low linkage in this group; for instance the forest product can be grown on the farm, making the link with the forest smaller); (ii) usually available outside the natural habitat; (iii) available outside the natural habitat, but not at economic competitive costs; (iv) technically available outside the natural habitat, but with great difficulty and expense; and (v) not available outside the natural habitat (high linkage with conservation).

   An example given is on rearing butterflies in captivity and hand feeding them the plants they depend on. On the other hand, ranching is a practice whereby the plants are grown which attract butterflies from the wild. This latter practice has a higher linkage with conservation.

3. Spatial dependence

   The larger the proportion of the overall site on which the livelihood activity depends on, the greater is the degree of linkage. For instance, if people mainly use a certain forest area for rattan harvesting, they will only protect the site where the rattans are found and not the whole forest. What percentage of the total forest is actually used/needed for satisfying rattan demand within a community?

4. Temporal dependence

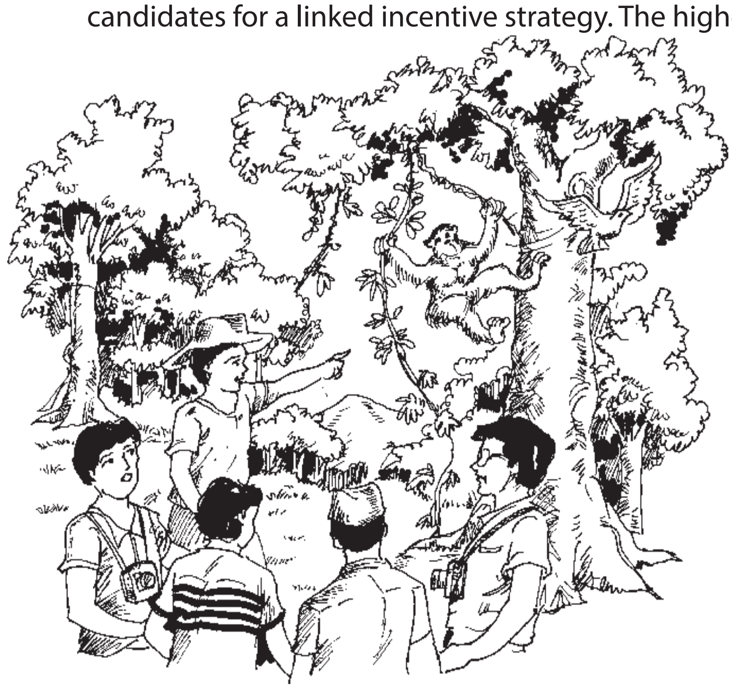
   There are more linkages with biodiversity protection, if the livelihood activities move from only a one-time use of the site towards a continuous use of the site for the livelihood activities.

5. Conservation association

This involves the degree to which the livelihood activities depend on its association with conservation as a whole. In other words, the degree of linkage with biodiversity conservation increases from low to high, when the potential for a "green" market increases (i.e. certified timber species and organic tree products). The success of the livelihood depends directly on the conservation of the forest.

In practical terms, some examples are mentioned to determine what these linkages mean to the activities in the field:

- Generally, it seems that non-timber forest product harvesting have low linkages, since it depends on only one or a few species. With increasing economic value, there may be strong pressure to increase active management of the products, either from protecting the forest towards active planting within the village boundaries. They may, therefore, maintain the population of the focus species, but may have no impact on the overall habitat conservation.
- Timber production and butterfly harvesting are more linked, and are thus, better candidates for a linked incentive strategy. The highest rankings are timber and animal product harvesting. Timber uses a number of species and has a strong habitat linkage. Animals need a certain habitat for their survival, making the conservation aspect of the total ecosystem more viable.



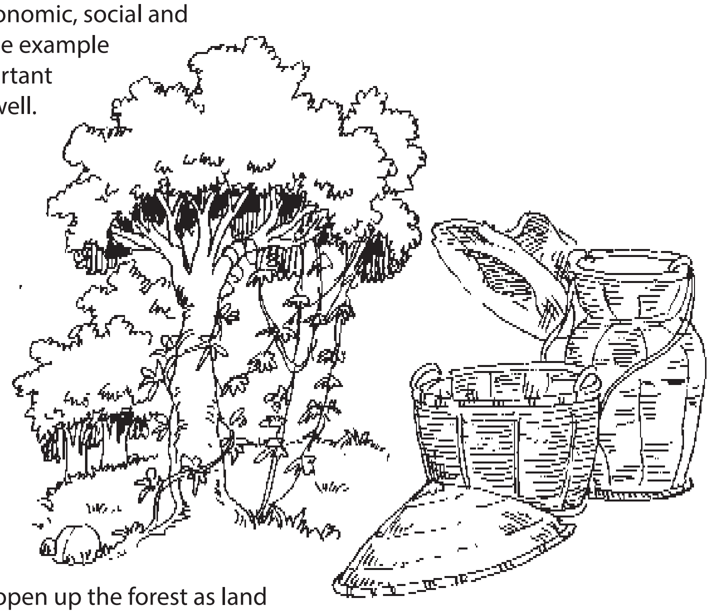
- Livelihood activities that make use of ecological services have the highest linkage rankings, owing to the high number of species used and their dependence on the habitat. A good example is ecotourism, wherein people go to the forest not to see a plantation but to see nature in all its aspects.

Discussion: Whose linkages?

The article from which this ideas were taken, generated an interesting discussion on the complexity of planning programs that integrate livelihoods with conservation. However, success depends largely on the perception that local people have about linkages with conservation. What outsiders perceive as linkages (e.g. economic gain from conservation), may not exist within the minds of the community. Therefore, they may not see any link between their livelihood activity and conservation.

In some areas of Sarawak, natural rattan became scarce. However, instead of developing sustainable ways to harvest it, the high economic value of the product lead it to disappear even faster. On the other hand, in the Philippines, one communitiy stopped cutting trees because they found a highly valuable vine that was climbing them. These vines are used for making bags and baskets, among others, thus, making it a good source of income. In this case, there was indeed a linkage between conservation and livelihood activities, supported by the villagers. However, this may change if the market and supply for this product declines and/or changes.

All these activities are linked to the biophysical, economic, social and political context in which such project operates. The example was brought forward where land tenure is an important issue for communities to conserve biodiversity as well. This will influence a household's behavior to either continuously use the site, or just once.



Another issue was brought forward: relocating households away from activities that use or depend on the forest will increase conservation. In this regard, there seem to be two possible pathways:

1. If households do not depend on the forest for any livelihood activity, they can just leave the forest as it is. Therefore, there is a strong link with biodiversity conservation.
2. On the other hand, they may lose interest in saving the forest, since it is not useful to them anymore. Further, they may decide to cut down trees in the forest to build houses, or open up the forest as land investment or grow cash crops.

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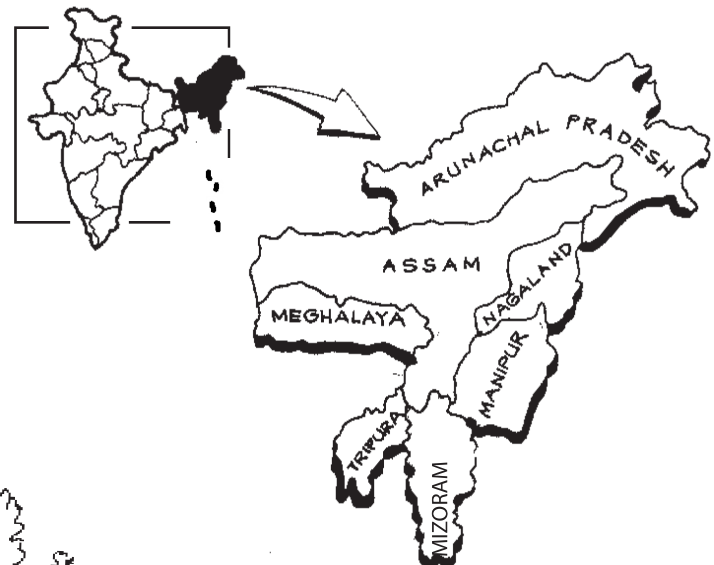
Adapted from Salafsky,N. and Wollenberg, E. 2000. Linking livelihoods and conservation: a conceptual framework and scale for assessing the integration of human needs and biodiversity. In" World development, vol.28, no.8, pp. 1421-1438.

Agroforestry Options for Shifting Cultivators in Northeast India



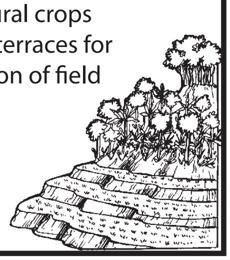
Up to now, research workers, institutes, government and private organizations continually seek appropriate solutions for the sustainable management and development of shifting cultivation in northest India. They generally aim to promote socially equitable, ecologically viable and economically efficient modifications and alternatives to shifting cultivation. Several agroforestry models have been developed as possible solutions for this concern. Some of these models are already being employed in Northeast India while others need further study, preferably through multi-disciplinary analysis.

Existing agroforestry models

1. Pure silviculture

- It consists of pure block of trees and shrubs and raised as mini-block of energy plantation on hill tops and slopes.
- It may contain one species: Pinus kysiya, Schima wallichi, Cryptomeria japonica, bamboo or,
- A mixture of two species: Pinus + Schima, Pinus + Symingrtonia populnea, Schima + Acacia mangium/A. mearnsii.
- Bamboo plantations are an excellent example.

Indian Council of Agricultural Research (ICAR) has suggested the three-tier system
A – Trees on hilltops
B - Horticultural crops
C - Opening terraces for cultivation of field crops



Advantages:

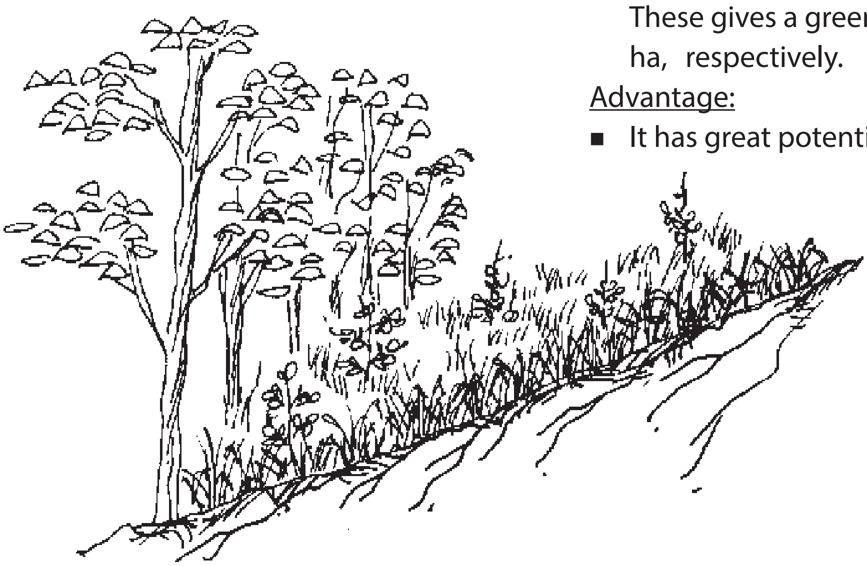
- It is highly productive.
- It conserves soil and improves soil fertility.

2. Silvi-forage

- This is appropriate for non-arable areas with high slopes (> 30%) and shallow soil depth (<0.6 m).
- It is best managed with suitable tree and grass combinations.
- The by-products of crops and fodder raised on bunds and terrace riser provide additional income.
- Legumes and Perennial grasses such as: Nandi (Setaria sphacelata), Napier (Panicum polystachon), and Stylosanthes guyanensis are good for terrace risers. These gives a green matter yield of 81, 65 and 20 tons/ha, respectively.

Advantage:

- It has great potential for forage production.



3. Silvi-horticulture

- Multi-Purpose Tree Species (MPTS) like Alnus nepalansis and Acacia auriculiformis are planted in half moon terraces on hills with 30-60% slope and intercropped with pineapple in contours in paired row.

Advantages:

- It is highly productive, and
- This model gives considerable cash returns within a short period.

4. Agri-silviculture

- It combines MPTS with various tree + crop combinations.
- Farmers readily accept this as one of the most common and age-old farming systems.
- This system consists of line planting of terrace risers, intercropped with rhizomatory crops.

Advantages:

- It offers a good solution to the food and fuel shortage or timber production.
- Soil moisture is conserved and harsh climatic conditions are ameliorated.

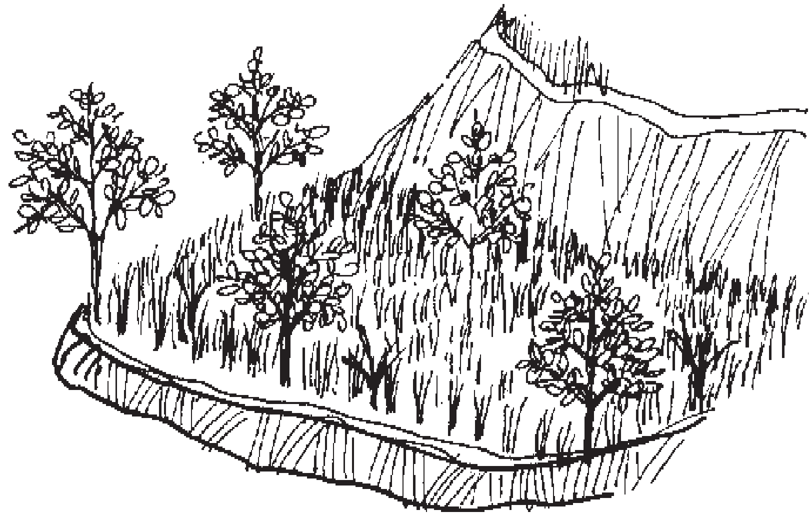
Most common species used for Agri-silvi-culture are
- Celtis australis, Grewia optiva, Ficus spp., Schima wallichi

Rhizomatory Crops
- Ginger, turmeric, colocasia

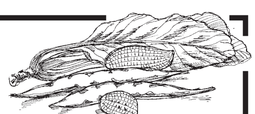
Ginger has comparative response, in terms of cash units, in this model, followed by guava with a yield of 8.5-9.4 tons/ha.

5. Agri-horticulture

- It is a readily accepted agroforestry model by farmers.
- Agricultural crops with fruit plants are cultivated in the first two years.
- Groundnut, ginger, soybean and turmeric are intercropped with mandarin orange and guava which, at the same time, provide food and suppress weed growth in orchards.



French bean,



groundnut followed by mustard crop sequence yielded a net income of Rs. 25,800/ha (US $586) from this system.

6. Agri-sericulture

- One of the most potential models in the region.
- It combines mulberry (1.5 m x 0.6 m) with crops under rainfed condition.

Advantages:

- Good crop sequencing could help on augmenting the farmer's income.

■ It helps suppress weed growth.

7. Seri-horti-forage

- It is ideal with mulberry (0.9 m x 0.9 m spacing), guava/Assam lemon/ pear (6 m x 4 m) with pineapple in paired rows and grasses on bunds.
- The hill slope should be 30-45% and soil depth, 0.6 – 1 m.

Home gardens are found to be ecologically and economically efficient and able to meet the diverse needs of many communities.

Advantages:

■ This system provides high returns, as high as Rs. 35,155/ ha (US $770) starting on the 2nd year onwards.
■ This system creates employment.
■ It produces sufficient grass to feed the livestock.

Potential agroforestry models

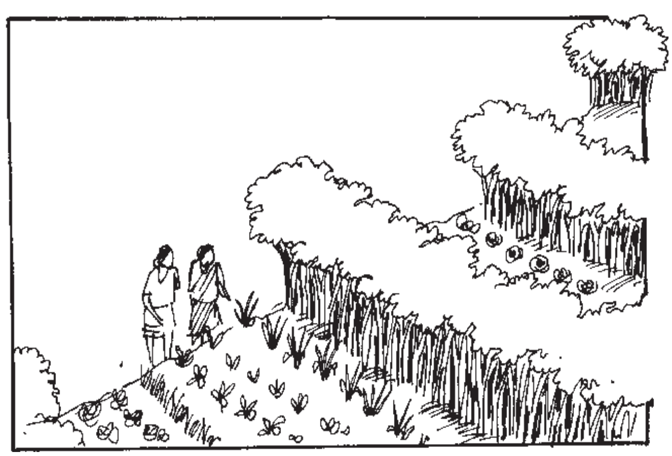
Aside from the existing agroforestry models, other models may be tried for the rehabilitation of shifting cultivation land in the region.

Note:
■ It is important that farmers be encouraged to experiment and adopt these models to their own condition.
■ It is often important for the farmers to understand the underlying principles and processes.

1. Intensive hedgerow (alley) cropping on Jhum Land
   - Trees or shrubs are planted in rows, along contour line in slopes.
   - Trees/shrubs alley are managed as hedgerows by periodic cuttings and prunings.
   - Crops, fodders etc. are grown in alleys

Advantages

■ Improvement of the soils nutrient status and other properties
■ Moisture conservation and decrease in soil erosion.
■ Maximize site productivity.



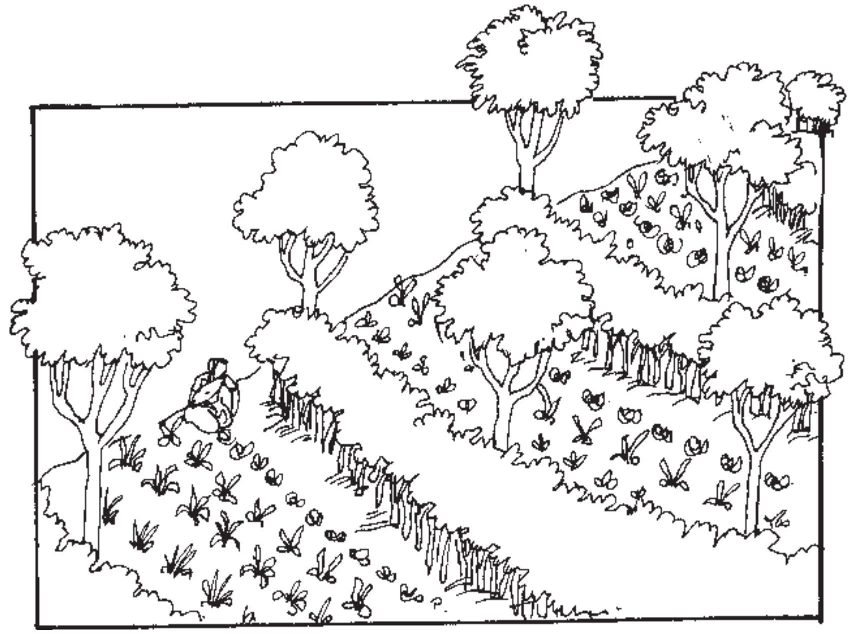
Advantages

- Improve soil fertility
- Reduce soil erosion
- Improve fodder production in previous Jhum lands

between shrubs/trees.

2. Alley cropping and planting of nitrogen fixing tree species

- Nitrogen fixing tree species are planted in bunds.



- Crops grown in rows.

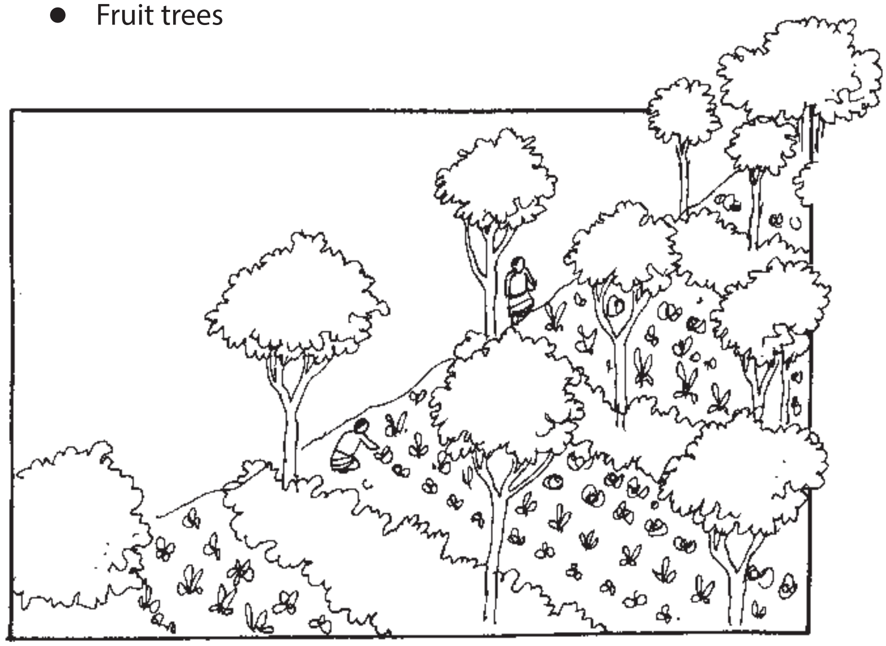
Advantages

- Conserves soil moisture and improves soil fertility
- Increases productivity by maximizing site utilization

3. Introduction of agricultural crops/vegetables under different spacing of tree species including fruit trees on the Jhum land or degraded Jhum lands

Tree species to be tried:

- Important and socially accepted tree species
- Fruit trees



Inter Crops:

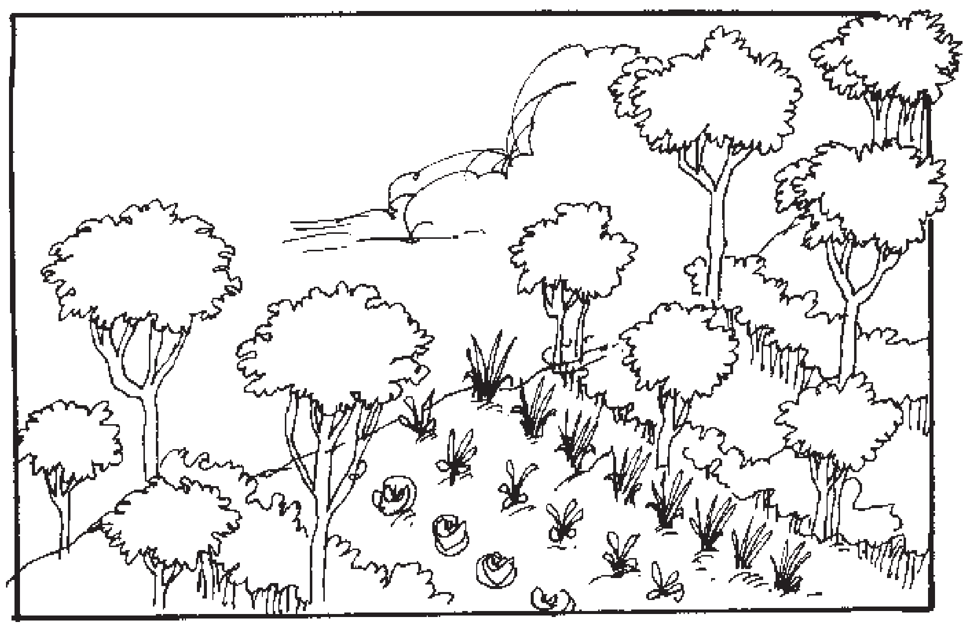
- Two or more agricultural crops, vegetables (Rabis/Kharif season), spices
- Fruits (e.g. Pineapple), sweet potato, etc. (selection of species depends upon farmers choice and agro climatic zone)

4. Horti-silvi-agriculture system (wide alley cropping) in Jhum Lands

  - Silvi and horticultural crops are grown in interspace for five to six years or until the canopy of fruit trees becomes fully closed.
  - Agricultural crops can be continued simultaneously in wider spacing.

Advantages

- Meets the production requirement of fruits, wood, crop and fodder
- Conserve more moisture and minimize soil erosion
- Maximize site utility to increase productivity



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Chapter
FOUR

research & development approaches & management

Chapter
Five

future directions

An R&D Approach for Evaluating and Disseminating Promising Shifting Cultivation Practices

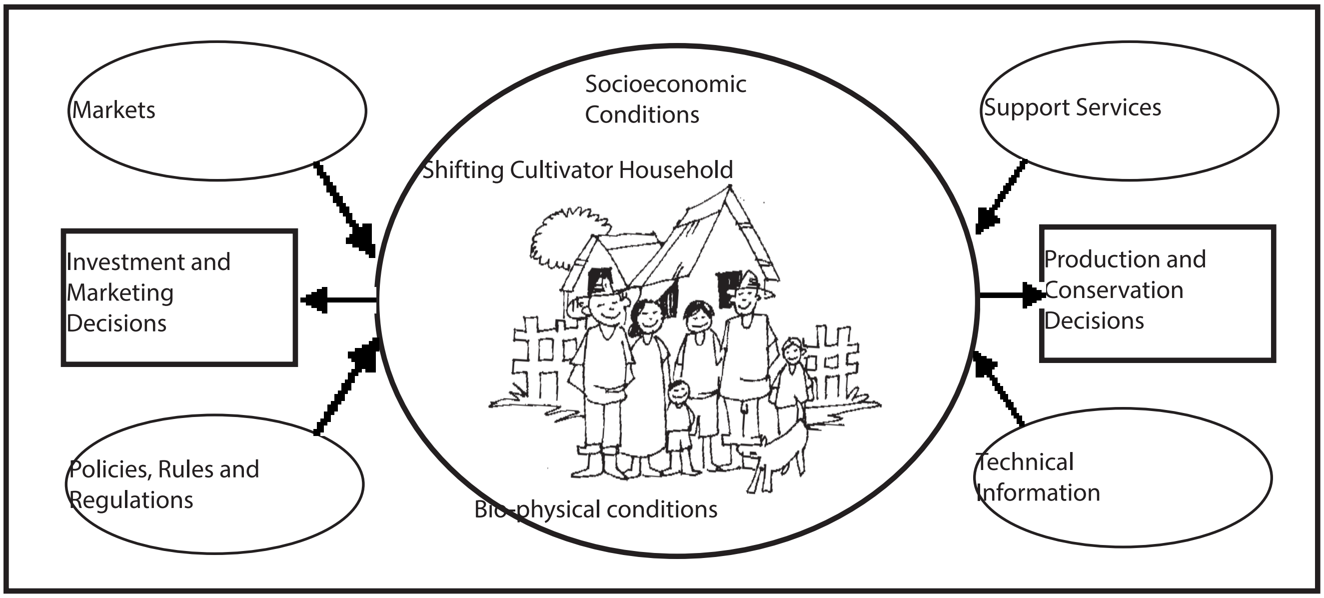
The development of a process for bio-physical research and development for shifting cultivation (SC) involves several steps:

- characterization of promising SC systems;
- definition of their extrapolation domain and generation of preliminary extension materials;
- design and establishment of on-farm trials to validate farmer perceptions of the superiority of these systems and test technological refinements;
- extrapolation through adaptive trials in other locations; and
- generation and dissemination of advanced extension materials.

Within all steps, it is crucial to observe and document how farmers respond to, adapt and modify the SC system or practice being tested, as well as to attempt to understand why farmers respond the way they do. Therefore, a simple household-based framework for analyzing the key factors influencing shifting cultivators' decision-making may be useful.

When conducting research on indigenous fallow innovations, a number of unique challenges must be addressed. Special attention must be given to methods targeted to the specific conditions of shifting cultivation.

Key factors influencing shifting cultivator household decision-making



The research and development process for SC systems is a continuum of tasks.
The process begins with the identification of a promising system or practice for which limited observation suggests elements of real value to other smallholders elsewhere and positive practical returns to investing in a research effort. This leads to a characterization of the system. It also provides a thorough description and analysis based on rapid or participatory appraisal methods and perhaps in-depth surveys. An analysis of the pros and cons of the system is conducted to assess the contribution of the system to a sustainable outcome.

If at this point the system appears to have potential for further development and extrapolation, there is a need sample the soils, fallow vegetation, and crop performance to validate the observed changes and modifications and by farmers.

There is also a need to consider economic factors (such as markets and roads) that may influence farmer adoption. The analysis should identify the critical function of the improved fallow for subsequent crops under local circumstances, for example in improving soil fertility, reducing weed problems, or suppressing soil-borne diseases. This may may be done by comparing fields where the practice is employed with fields where it is not employed.

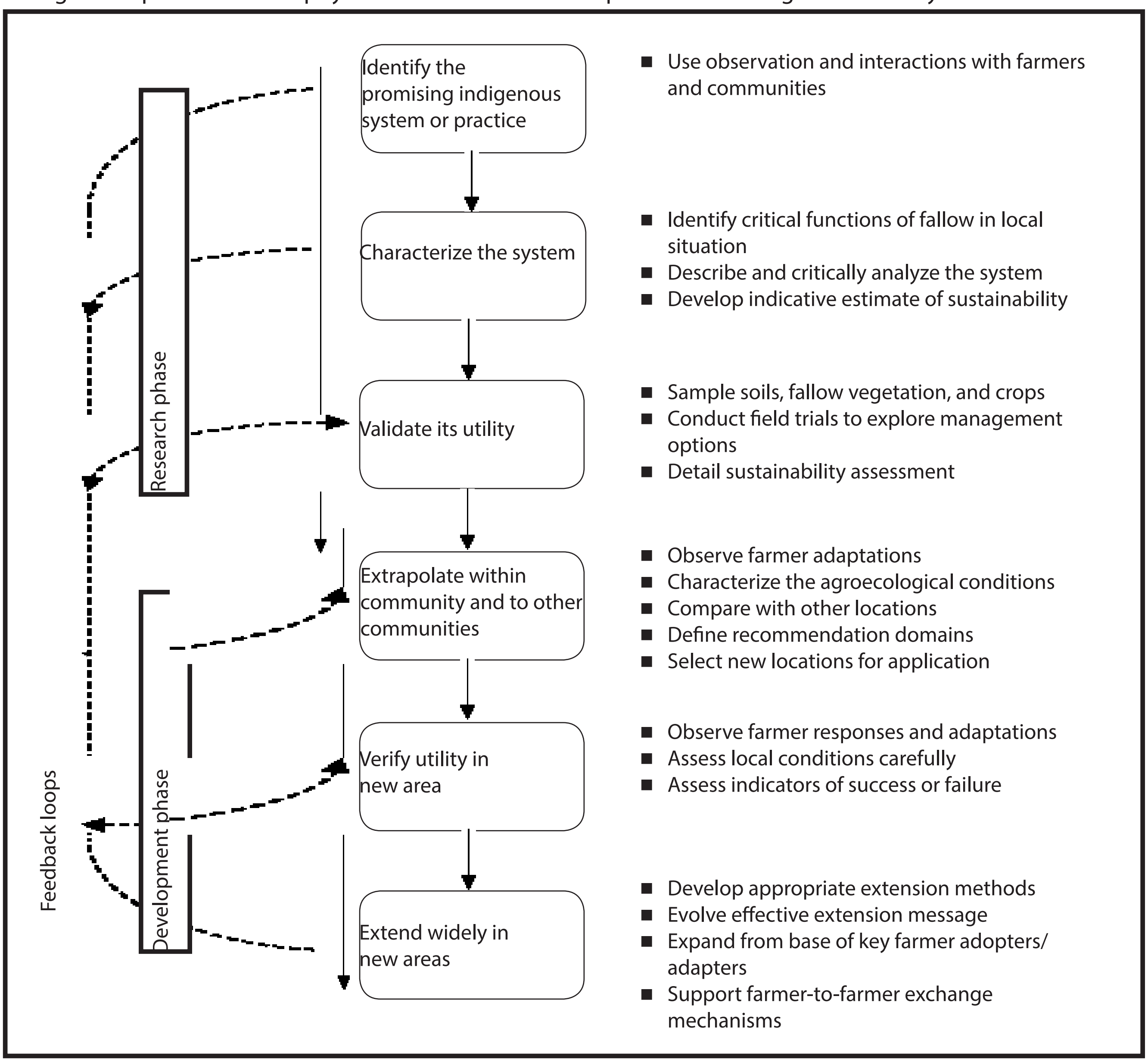
Valid comparisons using this approach, however, may be confounded by site factors. Therefore, it will often be necessary to conduct field trials. If the innovation still demonstrates wider promise after careful evaluation, they may then move on to a dissemination process.

To extrapolate the innovation to other communities, it will be necessary to study the local conditions where it was developed and select new areas where the agroecological and social conditions are comparable. The effects of specific biophysical conditions (such as soils, rainfall, and elevation), culture, and land tenure on the innovation's success should be kept in mind (also refer to Catalyzing

Innovation in Shifting Cultivation Communities: Experiences from Palawan, Philippines, pages 326-334). After selecting new locations, it is tempting to move ahead with an extension program. However, it is best to first verify the innovation with several key farmers before embarking on wholesale dissemination. This provides the chance to adapt the innovation to the realities of the new environment and avoid the possibility of a major failure.

As the promising experience of these key farmers becomes evident, then an effective extension program can expand the adoption more widely. The key farmers become the foundation for diffusion of the innovation. Household decision-making is further discussed in The Role of Fallow in Household Livelihood Strategies (pages 218-224) and How Household Development Cycle Stages Influence Field Expansion among Swidden Cultivators in Negros Oriental, Philippines (pages 169-174). The process of

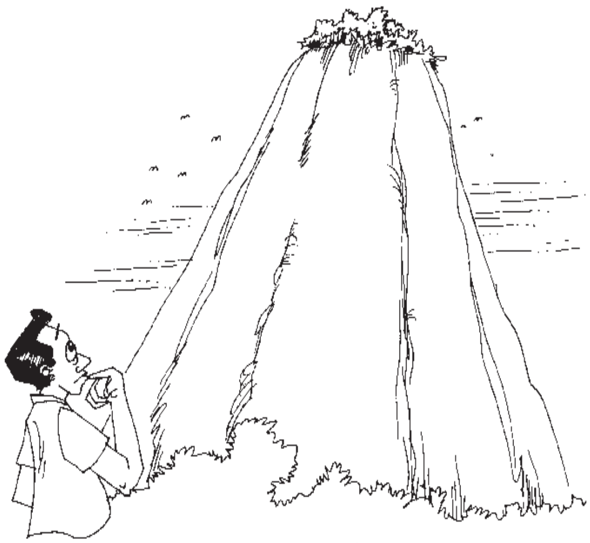
A diagram of process for bio-physical research and development on shifting cultivation systems



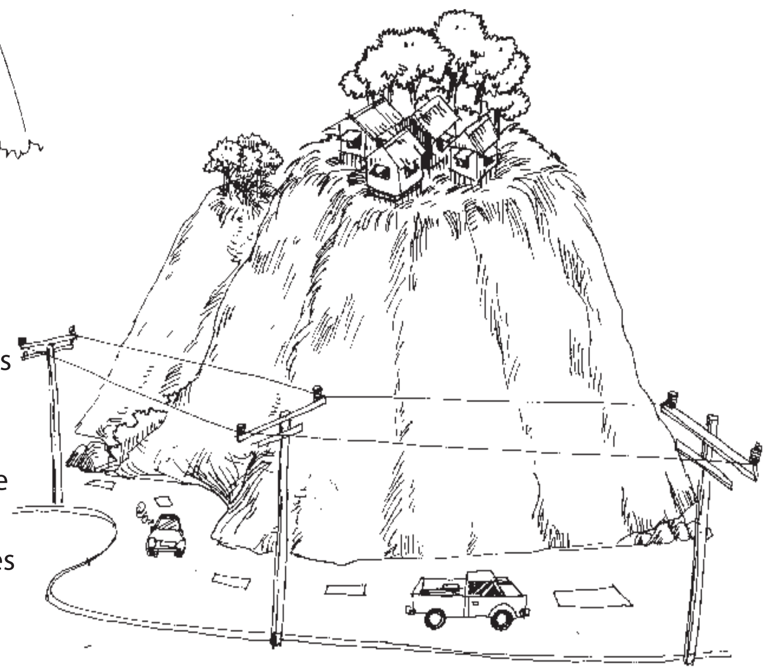
catalyzing innovation at the comunity level is described in Catalyzing Innovation in Shifting Cultivation Communities: Experiences from Palawan, Philippines (pages 329-334).

Facing the constraints to extension

There are perhaps four major constraints that arise in conducting extension among shifting cultivation communities (see also Principles of Extension for Sustainability: People-Centered Agricultural Development,pages 341-346).



1. The communities are often remote from roads and market infrastructure. This means these communities are constrained in participating in the market economy and are limited in their livelihood options. It also means that extension agencies usually have little presence in these areas.



2. There may be problems with extension agency jurisdiction. Shifting cultivation communities often live on land classified as state forestland. Agricultural extension systems may not have the authority to operate there. And if forestry extension services exist and are available to assist smallholders, they are usually very understaffed.

3. Land tenure uncertainty plays an important role in household land-use decisions. Clear land rights are necessary for successful intensification, and adoption of fallow management systems. Yet there is often conflict between the claims of the state and local land-tenure systems. And these may be exacerbated by land conflicts within the community.

4. Land use in shifting cultivation communities is often transitional. Land-use intensification is a process that spans a continuum from long cycle fallows to continuous annual farming. Any particular improved fallow management system may be relevant to a farm or community at one point in time along this continuum, but not at other points. As intensification continually evolves, the successful introduction of innovations in fallow management is quite literally shooting at a moving target.

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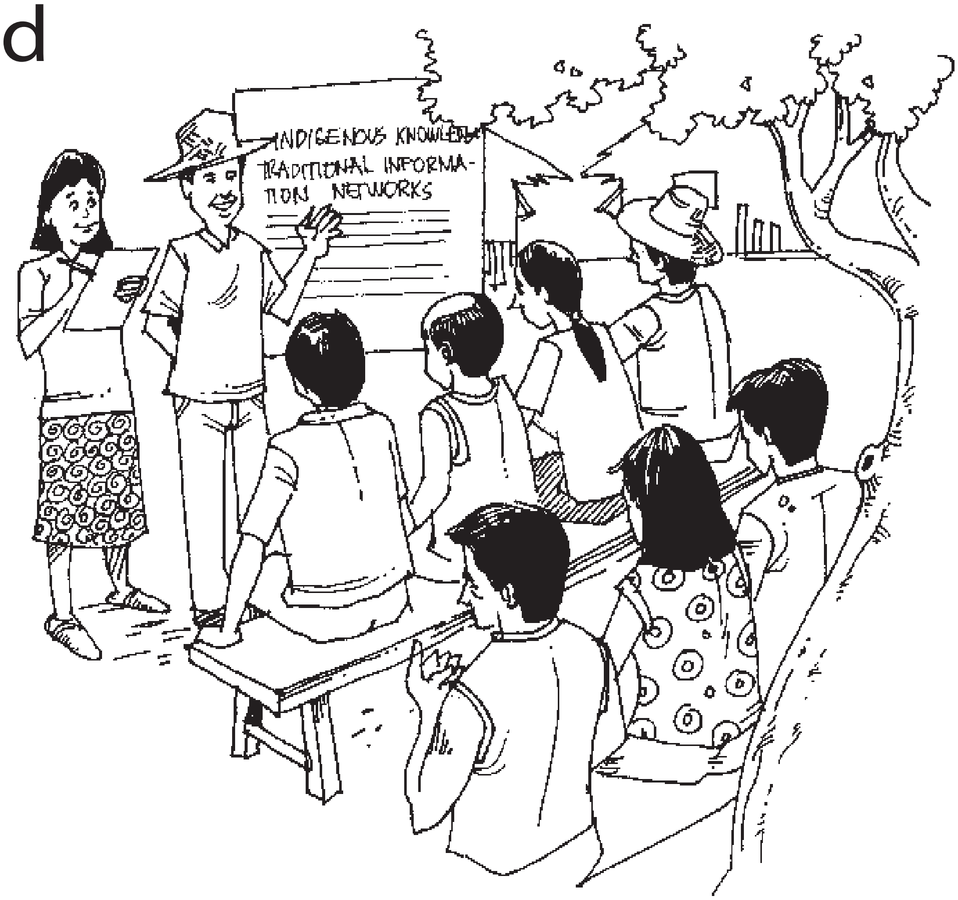
Resource book produced through a participatory writeshop organized by IFAD, IDRC, CIIFAD, ICRAF and IIRR.

Farmer-led R&D



Farmer-led R&D (also called "participatory technology development" or PTD) combines the knowledge and research capacities of local communities and research and development organizations in an interactive learning process. It involves identifying, generating, testing and adapting new techniques and practices to help solve local problems. The ultimate aim is to strengthen the experimental and technology management capacities of local people and communities, thus farmers play a key role in the entire process. The "P" in PTD can also refer to "people-centered strategies and processes. Sometimes, the process is initiated by external partners.

By empoying a farmer-led approach, shifting cultivators can become key actors in the R&D process. Also refer to Participatory On-Farm Experimentation and Evaluation, pages 322-325

Why do conventional research and extension approaches not work well in the uplands?

Conventional agricultural research and extension systems work relatively well in the lowlands, where access to inputs and services is easy and technological "packages" fit well into homogenous, resource-rich conditions. But in the diverse, complex, resource-constrained uplands, conventional research and development are less effective. Reasons for this include:

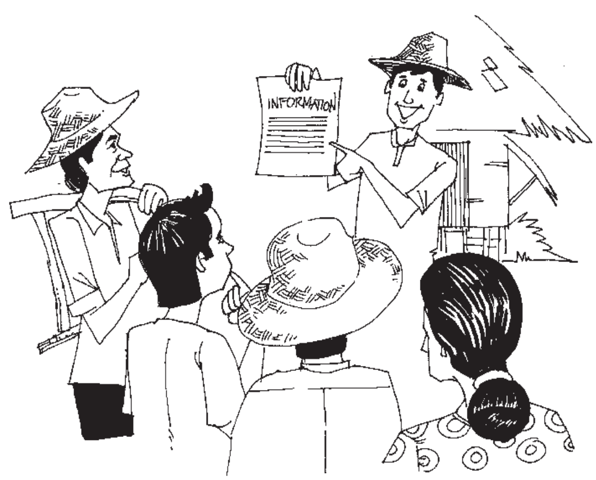
- Neglect of local knowledge and resources
- Over-emphasis on station-based research under "ideal" conditions
- Research typically focuses on a single commodity, as opposed to system interactions
- Neglect of rainfed areas
- Neglect of environmental effects (especially across ecosystems)
- Gender bias
- Primary focus on market-oriented production
- Extension of inappropriate technologies
- Poor extension methods (e.g., formal training, poorly timed, outsiders unfamiliar with local conditions and language)

regarding on-farm experimentation and evaluation.

Principles

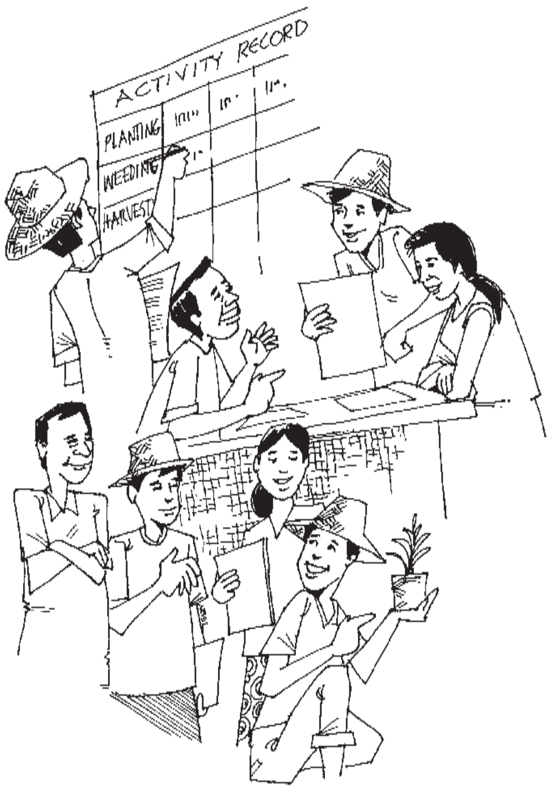
- Consider farmer's needs, indigenous knowledge, existing resources and local networks. Foster the development of these resources.
- Gain joint understanding of the main characteristics of and changes in agroecological conditions.
- Support farmers and their organizations to increase their awareness, self-respect, self-confidence, knowledge and skills. This also encourages local people to continue the research and extension process after outside facilitation ceases.
- Ensure that farmers and outside facilitators jointly define priority problems.
- Provide practical experience to selected farmers so they can develop new technological options and transfer their knowledge to others.
- Use low-cost, locally produced research and extension inputs and materials. Let farmers and their organizations circulate them. This ensures that farmers are self-reliant and inputs are appropriate.

- Encourage demonstrations by a farmer or farmer group on their farm(s). The demonstrations can be replicated by other farmers.



- Promote research and extension roles for farmers themselves. Farmers traditionally fill these functions which should not be taken up by outsiders who often know less about local physical and sociocultural conditions.
- Provide information on the changing situation to create awareness.

- Experiment locally with a variety of options derived from farmers (indigenous knowledge or other farmer experiences) and from formal science. Suggest optional practices for farmers to decide on and test in their own fields, and encourage farmers also suggest practices to test.
- Hold fora for farmers to evaluate and extend the research results to others.



Process

1. Participatory appraisal

Researchers and extension workers lead a participatory appraisal of physical, socioeconomic and cultural circumstances of the community and external factors influencing it. (See Participatory appraisal methods) Topics to identify:

- Indigenous knowledge
- Traditional information networks
- Potential and limitations of local farming systems and natural resources management, within changing external conditions.
- Technical options on how to overcome limitations.

2. Research design

Conduct meeting(s) with farmers to design the research. Topics to discuss:

- The changing external situation
- Technical options suggested by researchers and extension workers in relation to farmers' experiences and knowledge
- Options to test in their fields
- Design of the experiment
- Management of the research (e.g., to be implemented by individuals or groups?)

Key actors

- Farmers and local community members
- Official research and development institutions (usually government or academic)
- Non-government organizations
- Farmer organizations
- Artisans and traders
- Private enterprise (inputs, markets, etc.)

- Plans to conduct the research

3. Technology testing and demonstration

Researchers and extensionists assist individual farmers or a group to implement experiments and monitor progress.

- Farmers record activities, e.g., date of planting, weedings and harvesting, date and amount of input applications, crop yield.
- Regular meetings, field days and exchange visits allow the farmers to show their tests and interim results to others.

4. Joint evaluation

Researchers, extension workers and farmers jointly evaluate the experiment and plan for the new research. Questions to discuss:

- What are the results of the experiment? Positive or negative?
- What do we learn from the experiment?
- What should be the design for the next experiment?
- What should be the management for the next experiment?

5. Experienced farmers extend findings

- Training, meetings study trips and field visits.
- Local production, supply and marketing of inputs.

Limitations of farmer-led R&D

- Farmer experiments are often undirected and unfocused. This is a result of (or leads to) poor experiment design.
- The relevance and application of research can be limited.
- Political friction language problems, remoteness ad inaccessibility can limit the ability of researchers and extension workers to follow up experiments and of local farmers or communities to share their experiences.

Farmers as trainers

Advantages

- Improves farmer-specialists' ability to disseminate know-how.
- Avoids language barriers.
- Training takes place at a convenient time and place – usually in the trainer's own village.
- Topics are adjusted to fit the farmer's context, ideas and local resources.
- Relaxed atmosphere allows a free exchange of ideas.

- Strengthens local information network.

Considerations

- Farmer-trainers must have others' trust: They must be experienced and have good intentions and ethics. Training activities should not burden them.
- Junior specialists who are not experiences in giving presentations should practice as assistant trainers first.
- Selection of farmer-trainers can be a delicate issue, for conflicts may exist among villages or clans.
- Training should be conducted in small groups with field practice. Each group has an assistant trainer to respond to questions and guide the practice.
- Farmers are often willing to pay an honorarium to farmer-trainers.

Meetings

Village and intervillage meetings, study trips and field visits are ways for farmers to exchange experiences, ideas and know-how. Study trips and fields visits allow farmers to see real experiences in specific conditions. This stimulates discussions on what they can apply in their own conditions. Such visits also strengthen information networks and technical assistance.

Considerations

- In many places, village or intervillage meetings are held either by regulation or tradition. These can be used for farmers to exchange ideas with other farmers.
- Study trips conducted to villages of the same ethnic group allow easy access communication.
- Farmers are always interested to see (not only to hear) what happens in the fields. Field visits are effective means of exchanging knowledge and ideas.

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Adapted from an article in
FAO and IIRR. 1994. Resource Management for Upland Areas in Southeast Asia: An Information Kit

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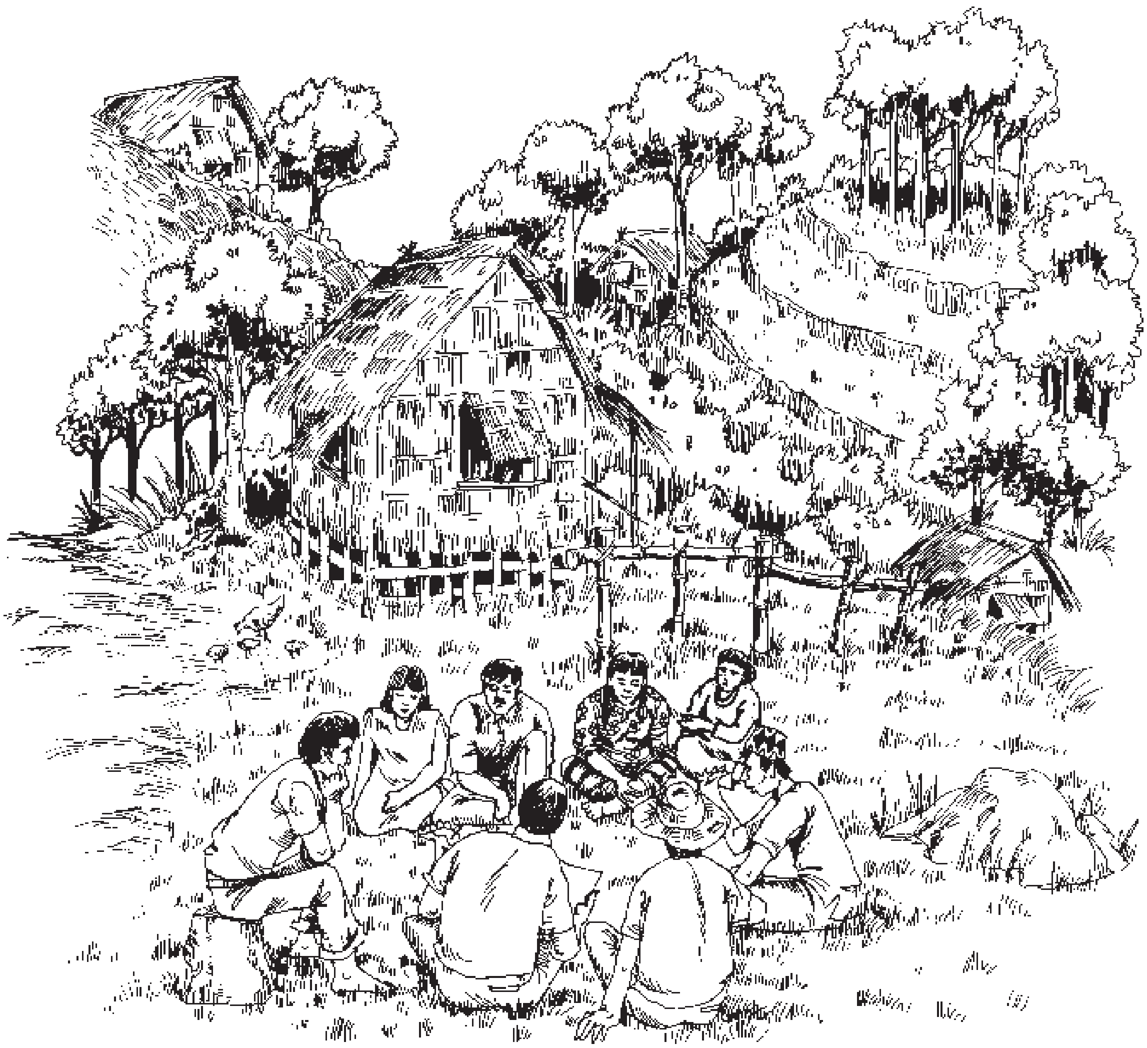
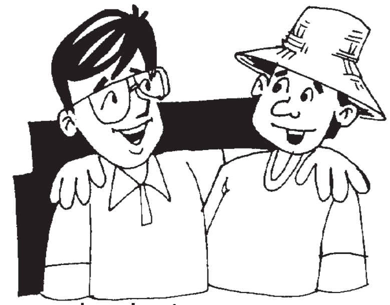
Participatory On-Farm Experimentation and Evaluation

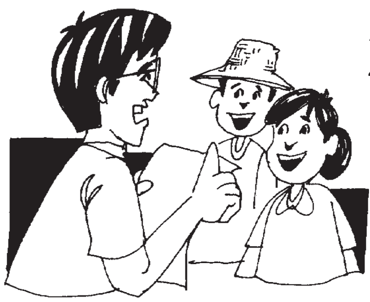


Agricultural researchers have now recognized the need to involve client farmers in all stages of research. A typical research cycle starts with diagnosis and goes through to adoption of new technologies by farmers. Farmers must be part of both of these activities. In between them will often be a series of experiments, which have been traditionally carried out by researchers on research stations. Today, the need for at least some of the experimental research is to be done in farmers fields, by both farmers and researchers, is widely acknowledged. It is also understood that designing and carrying out experiments outside the well controlled environment of a research station can be difficult and failures are common (see also Farmer-Led R&D, pages 317-321).

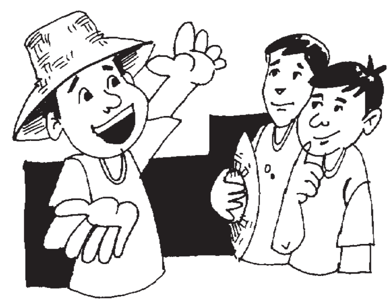
Reasons for conducting on-farm trials



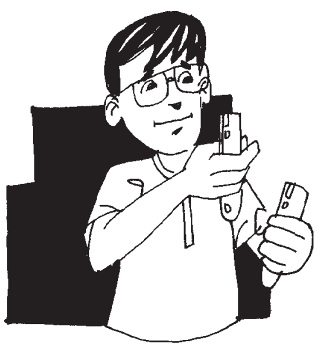
1 Involve the farmer—the primary client. The more involved he/she is in the testing process, the greater the possibility new technologies will be adopted.
2 Get a realistic initial assessment based on farmers' own biophysical, social and management conditions.



3 Get feedback for modifying/improving the technologies.
4 Test technologies developed on station under farmer circumstances with farmers' participation. The intention is to evaluate performance of the technology under a wider range of conditions than is available on-station.



5 Obtain realistic input-output data for socioeconomic analysis.



6 Diagnose: Identify new researchable problems.
7 Assess what farmers think of a technology and how they modify it
8 Analyze the data for presentation to the farmers for feedback and consider further research .

Research-extension inkages in on-farm trials

Both researchers and extensionists can benefit from jointly managing on-farm trials.

Researchers' benefit

- Gain from extensionists greater experience with farmers and with previous development efforts in the zone.

	Type 1 Researcher designed and managed	Type 2 Researcher designed and farmer managed	Type 3 Farmer-designed and managed; researcher-monitored
Rationale	We have excellent results from research station that we wish to evaluate under a wider range of biophysical conditions. We do not have representative conditions on station (e.g. soil fertility, weed flora)	We have evidence that a technology "works" in the area, at least in terms of biophysical response. We now wish to test it in farmers' fields with their involvement. We are interested in information on both biophysical performance and farmer assessment.	Farmers are aware of the potential of a given technology, they like what they see, and would like to experiment with it themselves.
Objectives	Test hypotheses that require biophysical and socioeconomic data, such as profitability for farmers.	Test hypotheses using biophysical and socioeconomic data.	Obtain farmer assessment. Document farmer uptake and how they modify the technology. Farmer empowerment.
Characteristics	Requires same set up as on-station research. Situated in villages; on farms, at farmer training centers, or schools. Serves as focal point for farmers' field days.	Large, unreplicated plots, with farmers being used as replicates. Design, inputs, and instructions provided by researchers, non-experimental variables managed by farmers.	Researchers provide clear advice on the technology. Farmers implement and make own management decision. No control plot unless farmer decides to have one.
Outputs	Solid information on biophysical environment and technology management interactions. Documented feedback on farmers' initial reactions to technology.	Reliable biophysical and economic data (e.g. labor) over a broad range of farm types and circumstances. Reliable information on farmer reaction to technology, its management requirements, its suitability. Feedback for technology design.	Researchers document farmers' decisions, preferences and management strategies. Some limited information may be collected on tree/crop performance. Often, it is not necessary to collect yield data. It is better to obtain yield data from type 1 and type 2 trials, as these are more controlled by the researcher and therefore provide more optimal results. Information is collected on the use of technology after the trial and uptake by neighbors. Feedback to technology design.

Types of on-farm research

Depending on the objectives of the research, we can distinguish between a number of different trials. It is useful to describe three sorts of trials, to understand the key differences in the continuum of concepts.

1 Researcher designed and managed – to test hypotheses using biophysical data)
2 Researcher designed and farmer managed – to test hypotheses using biophysical and socioeconomic data
3 Farmer designed and managed; researcher monitored – to test hypotheses using socioeconomic data

- Impact of work is more directly and is usually more satissatsifying.
- Focus is on actual needs - gives a stronger sense of purpose.

Extensionists' benefits

- Gain from researchers greater technical knowledge.
- The greater the involvement of the extensionists in the experiments, the more enthusiastic and knowledgeable they will be in extending the technology.
- Trials may be called joint research-extension trials.
- High-level extension staff participate in the design, implementation, and evaluation and are co-authors of publications.
- Field agents involvement in establishment and monitoring can save scarce research resources: time, fuel, etc.

Very often a research study generates more questions than answers. The conclusion which contains . . . "thus more research is needed!" is classical. At the end, the experiments might not solve any farmer problems, although research outcomes itself might be interesting. Involving more partners, requires more planning, so it is good to develop a strategy. Each activity is directly linked to others and all necessary steps lead to the overall aim of the research program.

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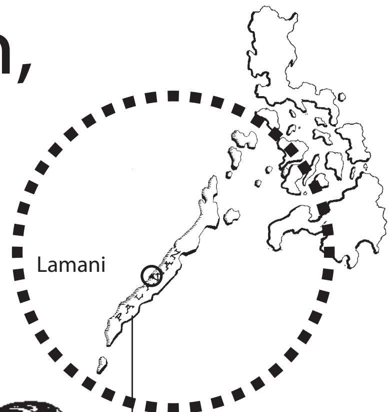
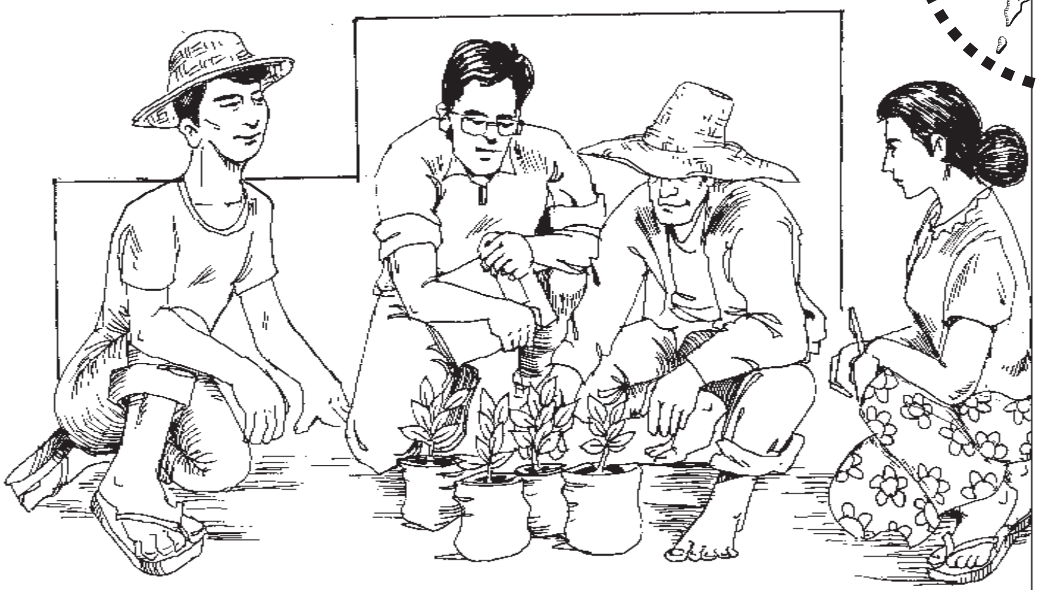
Resource book produced through a participatory writeshop organized by IFAD, IDRC, CIIFAD, ICRAF and IIRR.

Catalyzing Innovation in Shifting Cultivation Communities Experiences from Palawan, Philippines





In 1973, the Tagbanwa of Lamani were in the midst of an acute ecological and cultural crisis. This community of about 500 shifting cultivators on the isolated west coast of Palawan island in the Philippines had been recently forced out of their ancestral lands by a large mining company and had migrated to Lamani in the hope of resuming their traditional way of life. Until then, the community's culture had been deeply interwoven with the ecological and spiritual dimensions of a classically well balanced and sustainable system of integral long fallow shifting cultivation.

There had been no deforestation in the Tagbanwa areas of Palawan as long as they had been able to practice their carefully regulated form of swidden. But now, hemmed in between the mining company to the north and a logging company moving up from the south, and under severe cultural pressure from encroaching settlers from some of the densely populated islands of the central Philippines, their once beautifully tuned integral swidden agroecosystem was on the brink of being driven into a nightmare of drastically reduced fallow and progressive environmental degradation unless something were done to put the community back on a sustainable development path.

In response to a request from the community for help in meeting this challenge, an anthropologist (the author) working in the community decided to mount a small community-based, personally funded, development effort along the lines of what would later come to be called participatory action research (PAR). He returned to the community in 1975 equipped with a library of appropriate technology resource materials, determined to help the community that had welcomed him so warmly. (This was before agroforestry and community forestry. Even farming systems research was just beginning to make its debut in another part of the world, unbeknownst to the author at this time.)

Basic approach and assumptions

The basic idea behind the approach he used was that he could best help the community by facilitating access to relevant technical information – both outside and within the local community – and by assisting the community to process this information through the steps of the adoption-decision process (see box later in this topic) to the point where individuals cold make a well-informed decision about adoption of the innovations. The trial of experimental technologies would be carried out by a community-based research and development (R&D) team and would be grounded in the community's own centuries old tradition of experimentation.

Main assumptions behind this approach

Innovation	Selected members of the community would work together in a community-based research team, each member contributing their respective knowledge and skills. The products of this "technology blending" exercise would be applied in a number of concrete "demonstration experiments," and would eventually be perfected through trial and error.
Diffusion	Information about the innovations would spread from the small R&D team by word of mouth to the community-at-large. The anthropologist's role would be limited to monitoring its spread.
Adoption	News about such interesting activities would spread rapidly and people would readily adopt those innovations that demonstrated good efficiencies in the use of available resources.

In practice things did not work out as expected. Numerous and repeated deviations from the assumed course of events provided the basis for an improved understanding of constraints on technological change and a strategy for catalyzing innovation in traditional communities.

Outcome of the experiments

A diagnosis of the agroecological crisis based on discussions during the previous fieldwork led to a provisional plan of work on experimental technologies in support of four innovations:

1. Adoption of wet rice cultivation to supplement shifting cultivation
2. Development of a locally appropriate windmill irrigation technology to extend the benefits of paddy rice to families lacking surface water resources for irrigation (the water table was only 1 m deep in most places)
3. Organic kitchen gardens
4. Exploration of the possibilities for what later came to be called agroforestry

After about 18 months of activity by the community-based R&D team with the

Technology	Adoption outcome
Wet rice	Adopted. After an initial period of resistance on the grounds that it was something other ethnic groups did, it was adopted by some community members close to the demonstration sites and was under serious consideration by many others.
Windmill irrigation	Not adopted. It was too labor and management intensive for the present generation of wet rice adopters. However, the innovation process within the community-based R&D group did lead to the development of a locally appropriate windmill technology (after four unsuccessful prototypes!). In another 20 years, after all the surface water resources for paddy development were exhausted, it might be time to reconsider this or some other low-cost ground water irrigation technology.
Organic kitchen gardens	Not adopted. The techniques experimented with were totally incompatible with the rest of the traditional farming system. Free-ranging pigs and flighted chickens played havoc with all attempts at fencing. Composting practices ran afoul of deep-seated psychological aversions to the concentration and handling of manure. There was a good reason why most of the plants in the traditional home gardens were trees.
Agroforestry	Adopted. This was the technology that received the strongest endorsement by the community, even though 18 months was not long enough to demonstrate practical results from limited tree introductions. Nevertheless, it was obvious to the community that planting of tree crops was highly compatible with well-established land use traditions. Numerous planting niches existed in and around the intensifying swidden system and the high value placed on diversity of cultigens created a very welcoming attitude to new introductions. On the strength of the community's verdict that it was better to plant trees than windmills, the anthropologist decided to start a new career in agroforestry.

anthropologist acting as resident catalyst, the outcome was as follows:

Lessons learned about constraints on innovation

All cultures have both a conservative and an innovative side. The conservative side of Tagbanwa culture was strongly expressed by the young man who voiced the community's initial reaction to the idea that rice paddies might also be an interesting way to grow the traditional staple food:

> The livelihood of the Tagbanwa is swidden, no other. For a Tagbanwa there is no way to get food except swidden. This is the 'office' of the Tagbanwa. Every year you make swidden until you die. Passed down from generation to generation since the time of our ancestors — swidden, no other.

This resounding rejection of the very idea of any other livelihood than the traditional one is all the more interesting because it was this same young man who, a little over a year later after participating in an experimental trial of wet rice farming, would become one of Lamani's first adopters of paddy rice! A community's first judgment is not always its best judgment.

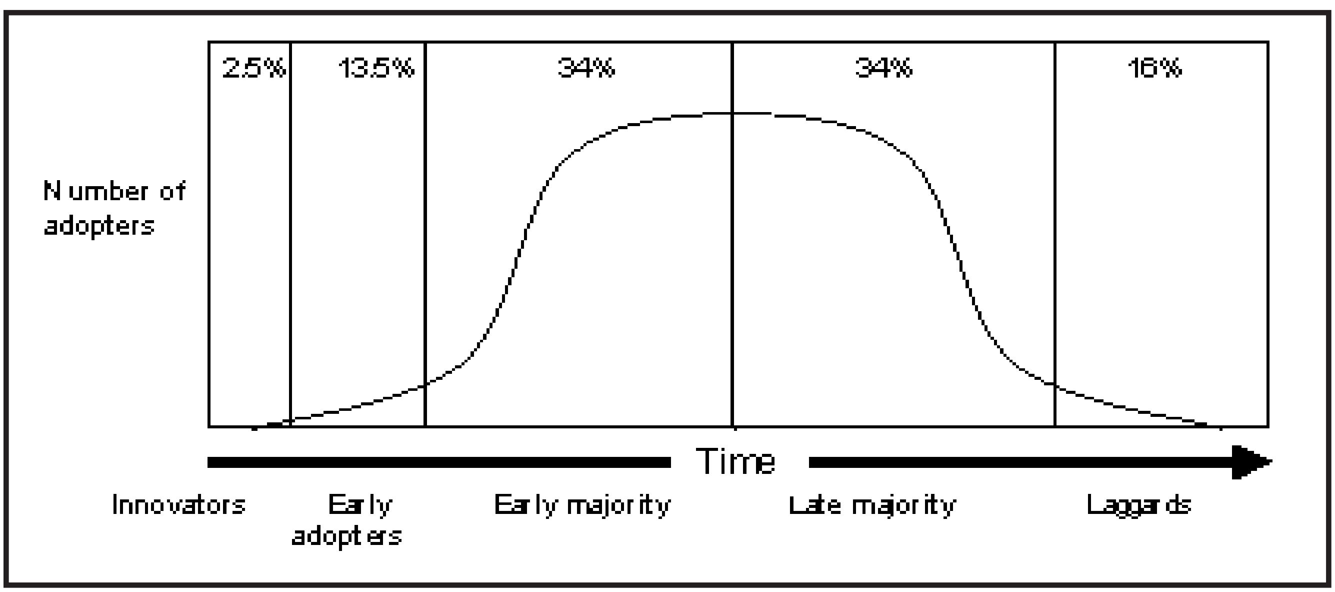
The opposing tendencies toward resistance to change and innovation exist within a single individual and within the population as a whole. At the population level some individuals are more innovative and quicker to adapt

Basic Principles of Cultural Innovation

All viable cultural communities maintain ways of defending themselves against disruptive change.

All viable cultures maintain ways of overcoming their own conservatism through appropriate innovation.

The challenge for development catalysts is to assist the community to strike a favorable balance between these opposing tendencies and achieve some form of continuity-in-change.



Generalized bell curve of adoption of an innovation within a population (the figures shown are indicative)

to change than others, as suggested by the generalized bell shaped curve known to sociologists and other students of the adoption process.
In addition to external constraints on innovation such as uncertainties about rights to use resources and pressures from external groups and government policies, all cultural communities also have their own internal defense mechanisms to protect them from unwanted change.

Cultural self-defense against change can be quite conscious, but there is also a whole range of nearly automatic defense mechanisms that may operate unconsciously. Among those observed during the fieldwork in Lamani were:

- Low cultural value of and lack of incentives for innovation
- Low self-estimation of ability of individuals to innovate
- Social constraints on the flow of information within the community
- Traditional technology deeply interwoven with spiritual values and rituals
- Strong ethnic identification with traditional technology ("The livelihood of the Tagbanwa is swidden, no other.")
- New technology (e.g. wet rice) was strongly identified with other ethnic groups (We don't do that, they do that.")

Additional barriers to innovation associated with automatic constraints on the flow of information within the community were also observed:

- Local knowledge may be difficult for community members to access because it is not verbally mediated and it is embedded in concrete activity contexts (people don't normally talk about how to do things; they learn new skills by watching others; and they may not remember how to do it until they are doing it)
- Aversion to didactic communication in egalitarian societies (among peers no one wants to appear more knowledgeable than another)
- Politeness (people don't normally volunteer unsolicited information; if you don't know what they know you can't ask for it)
- Functional fixedness (new functions might be inconceivable until demonstrated)
- Specialized technical knowledge may only be possessed by a few individuals and there may be incentives to keep such knowledge secret (prestige, economic value)
- Most perceived strains in swidden life are minor, immediate and social, rather than major, imminent and ecological, and attempts to focus attention on ecological problems may be met with incomprehension or resistance.

Under normal conditions these constraints might not pose problems for cultural survival, but if the whole agroecosystem is in crisis and under pressure to change in order to avoid further degradation of the environment on which it depends, then these automatic defense mechanisms could easily block the very innovations that would make it possible for the culture to survive.

The role of the catalytic activist

Contrary to his initial expectations, what the anthropologist discovered in Lamani was that for innovation and diffusion of information to occur in the presence of these constraints, it was necessary for him to play an active role as catalyst of the requisite processes. Working to facilitate local access to potentially useful information (both outside and inside the local community) and to stimulate the processing of this information through a number of barriers thrown up by the automatic defense mechanisms of the culture, to the point where a fair and well-informed assessment of the usefulness of the information can be made by the local community.

> **Catalyst**
>
> The term originates in chemistry where a "catalyst" is defined as something that increases the rate of a chemical reaction without actually entering into the reaction itself. The presence of a catalyst lowers the threshold of a reaction so that it occurs earlier and faster than it would without the catalyst.

Facilitating the indigenous research tradition

Farmers have been conducting their own informal agricultural experiments since the dawn of the Neolithic. Without this indigenous tradition we would have no agricultural technology at all.

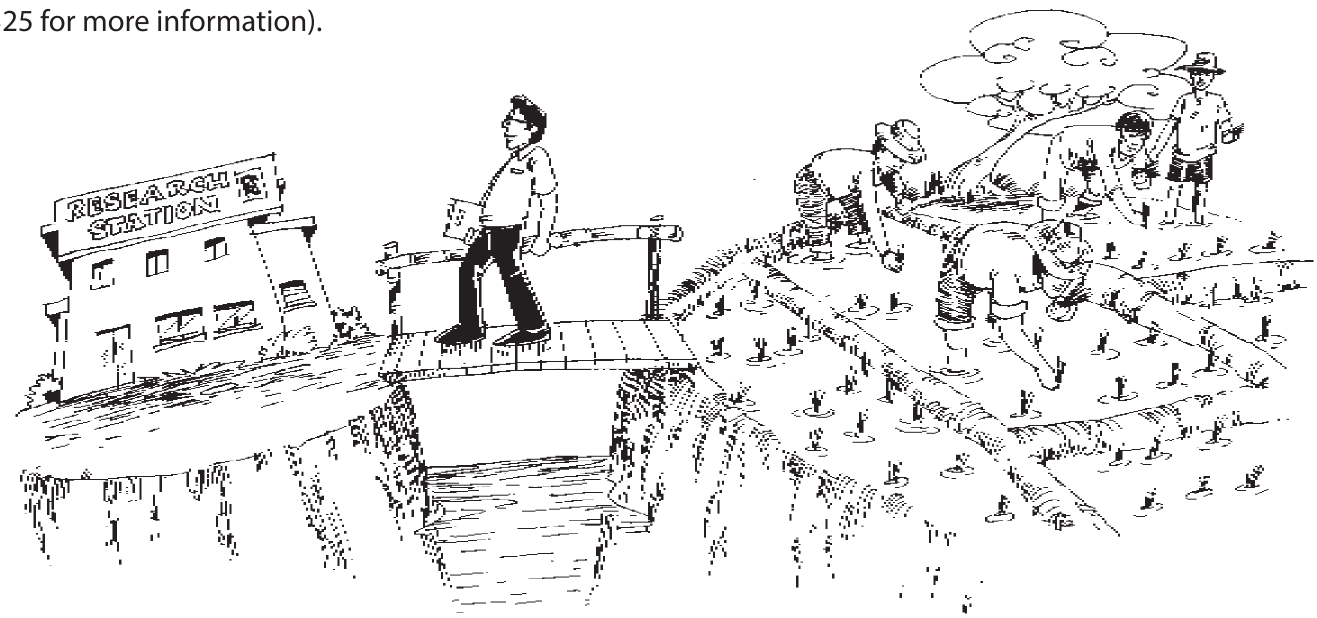
Formal scientific research may have a role to play in reaching new levels of productivity, but it is really the frosting on the cake. What the external catalyst in a community-based R&D team like the one in Lamani is facilitating is the community's own centuries old tradition of experimentation.

If you have any doubt about whose tradition the "participatory research" methods you are using are supporting, take a look at the record keeping and the analytical methods. Do the local people keep such records? Is this the kind of analysis the local people perform in order to make their land management decisions? If you have introduced new data keeping and analytical methods is there any evidence that these methods have been adopted beyond the project context? How do the local people conduct experiments and how can you support it?

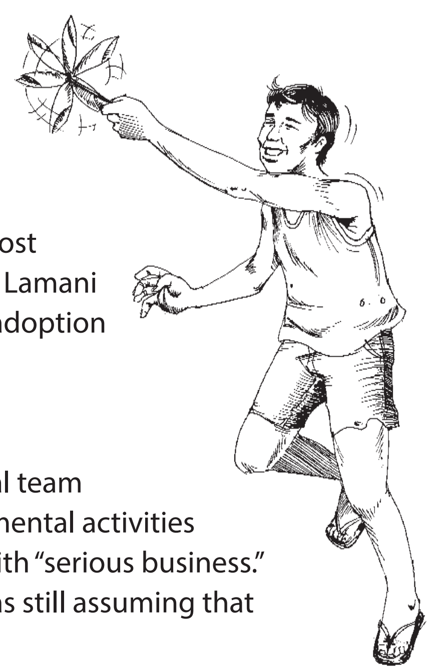
> **Whose information?**
>
> Even if some of the ideas for what is done in these experiments originates outside the community, the information that is generated is primarily for the use of the community itself, not for some distant research station. As such, it is not important that the catalytic agent understand every nuance of the local experimenter's thinking, as long as that thinking is facilitated.
>
> Indigenous cultures have their own "rules of evidence." It is vitally important in this kind of work to recognize that it is these rules and criteria, not those of formal science, that determine whether or not a community adopts or rejects an experimental technology. And that is as it should be, for only they have the inside view of the total set of constraints and opportunities within which they must operate.

Bridging the two centers of research and innovation

Both the local community and the formal research centers have legitimate claims to being centers of research and innovation. While it may sometimes be necessary to make an effort to decontruct the false view of the research center as the only source of information, it would be a mistake not to recognize the important contributions that research centers can make. If the experience in Lamani is at all indicative of the attitude of other communities, local people expect their outside helpers to bring something new and tangible into the community. It can be very disappointing if all they bring is an opportunity to get "participated" (also refer to An R&D Approach for Evaluating and Disseminating Promising Shifting Cultivation Practices, pages 313-316, Farmer-Led R&D, pages 317-321, and Participatory On-Farm Experimentation and Evaluation, pages 3222-325 for more information).



How to engage the innovative side of the culture

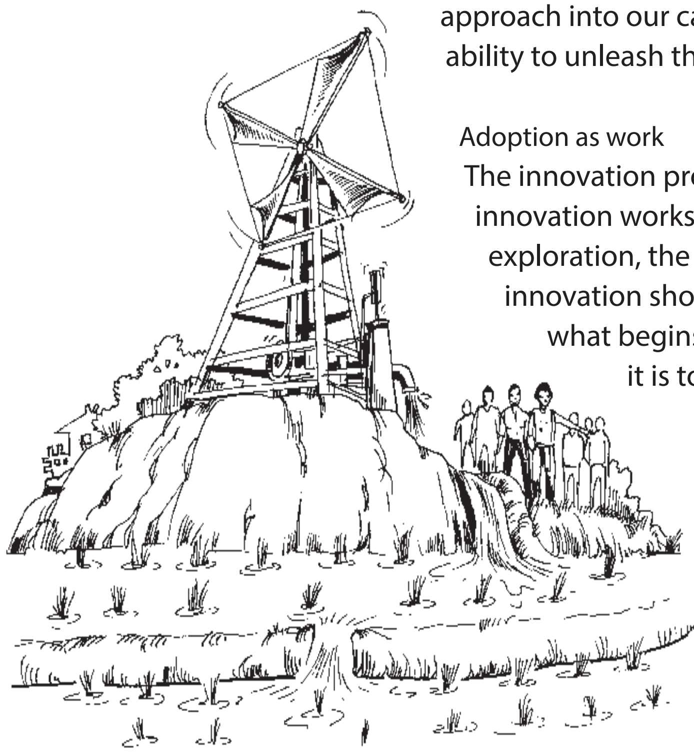


Much of the resistance to adaptive change in conservative communities is semantic in nature, but it is also the existing semantic forms that hold the key to unlocking the creative potential of the community. One of the most effective ways of changing rigid attitudes about a technical problem is to create opportunities for experimenting with alternative solutions. The most important event in learning how to enable the creative process in Lamani was the discovery of the cultural semantic of "innovation as play, adoption as work."

Innovation as play

The spirit of play was the key to the active involvement of the local team members in the R&D work in Lamani. Only by labeling the experimental activities as "play" could they avoid the risk of embarrassment associated with "serious business." This was not understood by the anthropologist at first since he was still assuming that the activities had to be taken seriously to succeed. As he eventually discovered, however, exactly the opposite was the case.

A playful attitude is fundamental to the innovation process everywhere. We speak of "playing with a new idea" whenever we want to just explore and be creative without having to worry about whether it will work or not. When we deliberately incorporate this approach into our catalytic work with communities we have the ability to unleash their creative potential.



Adoption as work

The innovation process is one thing, adoption is another. While innovation works best when it is done in a spirit of playful exploration, the decision of whether or not to adopt an innovation should be based on how well it works. Eventually what begins as play must mature into meaningful work if it is to be adopted by the larger community beyond the R&D team. It must also compare favorably with alternative modes of work in terms of returns to labor input. If there is an easier way of accomplishing the necessary work, the innovation is unlikely to be adopted.

The Cultural Meaning of Work and Play in Lamani

The Tagbanwa word for work is "buat." The word for play is "buabua" – a diminutive form meaning "little work." This illustrates an important fact of life in Tagbanwa communities: most children's play is a kind of "little work" or practice of adult tasks (e.g. cutting wood, catching birds, cooking, etc.) In fact, most of the toys that a child possesses are small makeshift versions of adult tools (short unsharpened machettes for clearing imaginary swidden fields, little baskets or old worn out pots for cooking imaginary meals). Like children everywhere, child's play in a Tagbanwa village is a kind of rehearsal for adult life. The key distinction between play and work is that the latter has "kapolus" or efficacy. Thus, when a little boy's play with bird traps matures to the point that it is able to put meat on the table it is said to have "kapolus" and can now be described as "work."

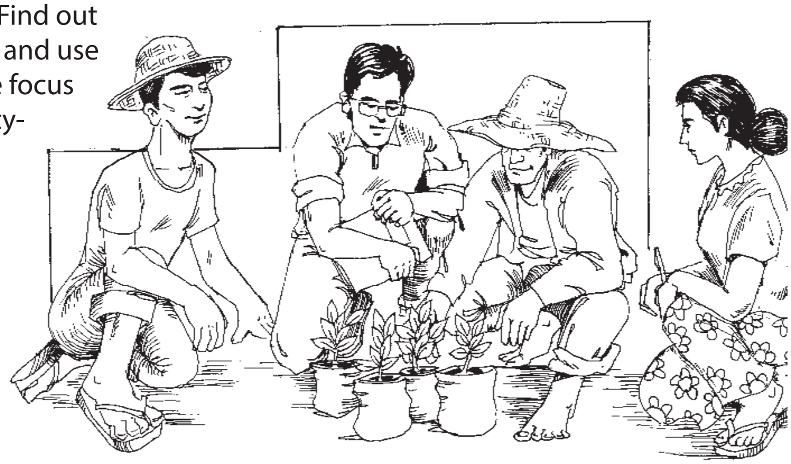
The general expectation embedded in these linguistic forms is that what begins as play will eventually mature into meaningful work. As such, these forms provide an excellent cultural rationale for the innovation process within a local R&D team. Does the community in which you work have similar linguistic forms?

Another useful way to sharpen the focus of your efforts is to . . .

Orient your catalytic inputs to the stages of the adoption decision process

Concept	Application
The adoption-decision process is well understood in social science (Rogers 1995), but very few development workers seem to be aware of it. It offers an unusually effective source of guidance for one's efforts as a catalytic activist. Here is a simplified version of the basic steps in the process by which people come to a decision about whether to adopt or reject an innovation.	The method is simple: create contexts for public participation in activities at each step of the adoption-decision process and facilitate information processing at each step. Do this in a way that assists the community to make its own well-informed decisions without bias to the final outcome. The catalytic role has an "active phase" (steps 1-4) and a "passive phase" (step 5).
Steps	Catalytic activities
1. Knowledge of the innovation	■ Disseminate knowledge by word of mouth or other means.
2. Observation of the innovation	■ Provide opportunities to observe the innovation and learn about it.
3. Decision to try it	■ Facilitate discussion of the innovation with demonstrators, opinion leaders and peers.
4. Experimental trial (a.k.a. trial adoption)	■ Provide support for individual trials (pay attention to modifications that enhance "adoptability").
5. Adoption decision	■ Create opportunities for discussion with peers, then get out of the way and let them decide on their own whether to adopt or reject the innovation.

Every culture has a word for "experiment." Find out the local word and use it to define the focus of a community-based R&D team



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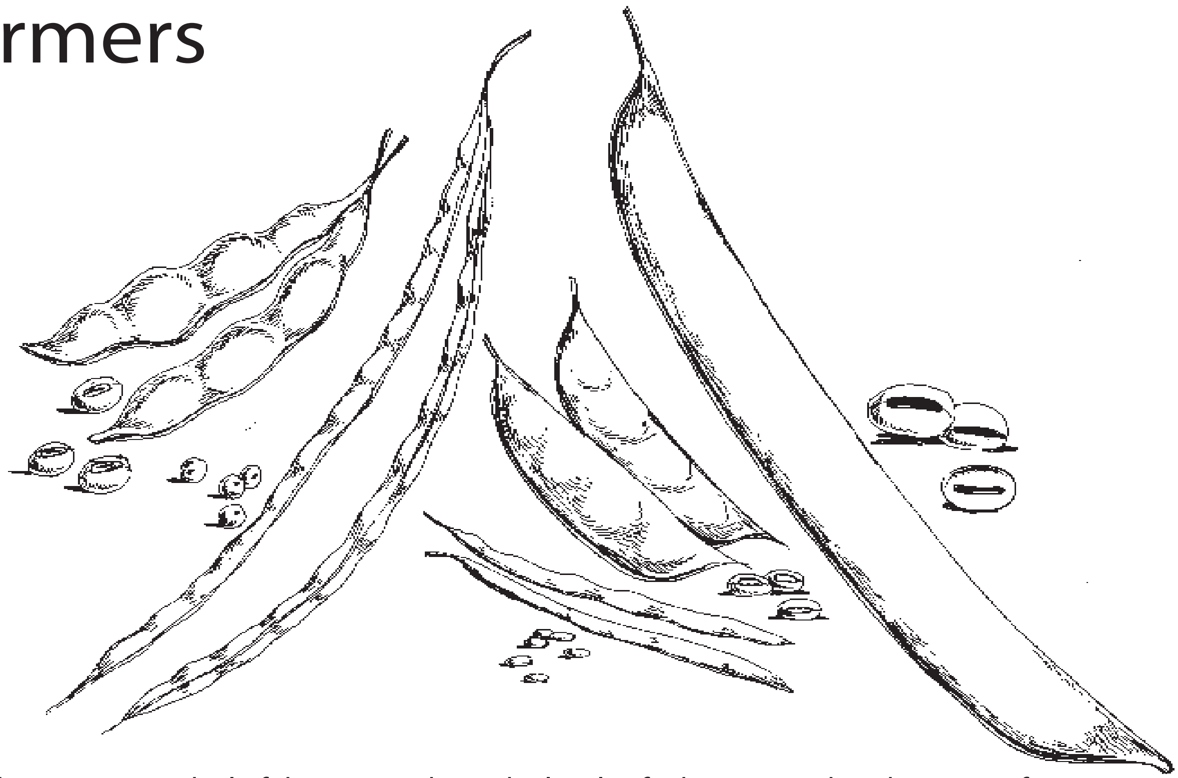
Prepared by
John Raintree

Resource book produced through a participatory workshop organized by IFAD, ICRAF, IDRC, CIIFAD and IIRR.

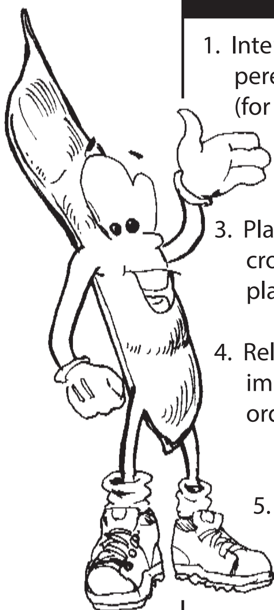
Achieving the Adoption of Green Manure/Cover Crops Systems that are Attractive to Farmers



There is a great deal of discussion about the levels of adoption or abandonment of green manure/cover crop (gm/cc) systems (see also Changing Our Understanding of the Fertility of Tropical Soils: Nutrient Banks or Nutrient Access?, pages 65-71, and Putting the Nutrient Access Idea Into Practice, pages 259-264). In general, there is some evidence that many traditional systems are gradually being abandoned as high-input technology and incentives have spread, as traditional foods have become unfashionable, as chemical fertilizer has become inexpensive and more widely available, and as professional extensionists have criticized farmers for doing things that are not recommended in university textbooks. This gradual process of abandonment has apparently affected several Vigna systems in Viet Nam that once associated rice beans (V. umbellata) and mungbeans (V. radiata) with everything from rice and maize to tea.

Nevertheless, some other systems, such as the velvetbean (Mucuna spp.) system that has spread spontaneously through Mexico, Guatemala, Belize and Honduras over the last 50 years, or the velvetbean system that has been promoted and gained more than 30,000 adherents in Benin in the last ten years, have spread widely and quickly right up to the present day.

Table 1. Most important niches for short-stature green manure/cover crops in shifting agriculture, and possible best species to use



How it fits into the system	Possible best species
1. Intercropped with the annual and semi-perennial crops being cultivated in the system (for instance, maize or cassava).	Mungbean, pigeon pea, jackbean. In highlands, runner bean
2. Planted under tree crops.	Forage peanut, jackbean
3. Planted after the soil is too poor for annual crops to grow, to recuperate the land and plant crops again.	Tephrosia, jackbean
4. Relay cropped into annuals or planted immediately after the harvest of annuals in order to grow during a dry season.	Rice bean, pigeon pea, jackbean. If soil is fertile, lablab bean. If dry-season fodder is desirable, lablab or pigeon pea. For fodder in highlands: sweet clover.
5. Seeds are broadcast or dibble-sticked into the first-year fallow to improve the fallow (often shortening it from five to ten years down to one or two years).	Tephrosia, velvetbean

What is the difference? What makes some systems so much more popular than others?

Factors that contribute to adoption

Most of the programs and organizations that have had success at introducing sustainable gm/cc systems have taken into account the following factors.

- The land occupied by non-food-producing gm/ccs must not be land the farmer would normally use for any other purpose at that time.

This means that, if the gm/cc does not produce food, it must occupy land that cannot be used for any other known purpose (i.e. cash or subsistence crop) during the time the gm/cc is using it. Although this sounds like a very difficult, if not impossible, rule to follow, in fact we are finding more and more times and places that can be used:

- If the gm/cc does produce a valued food, it can be grown in any way that fits into the system like any other equally valued crop.
- The gm/cc can be grown intercropped with another food (e.g. jackbean (Canavalia ensiformis) with maize or cassava). Intercropping is presently the most popular niche for gm/cc's.
- The gm/cc can be grown the first year or two of a fallow in order to "improve" the fallow. This was done, for instance, by shifting cultivation farmers in Son La Province in Viet Nam, who broadcast Tephrosia candida seeds into their first year fallow, thereby reducing the normal five-year fallow to just one or two years. In this case, and the following one, since the soil is very poor, farmers usually use gm/ccs that withstand very poor soils, such as jackbeans, Tephrosia, or particularly hardy trees.

- The gm/cc can be grown on wasteland to bring it back into production. For instance, farmers in Yen Bai Province, Viet Nam, recuperated hundreds of hectares around a lake by growing jackbeans and Indigofera spp. trees on the land. Now, all this land, once useless wasteland, is producing beautiful harvests of rice, maize, coffee, etc.
- The gm/cc can be grown during the dry season, either relayed into normal rainy season crops (such as the cowpea (Vigna unguiculata)/maize and lablab bean (Lablab purpureus)/maize systems in Thailand), planted after the normal crops (such as the ricebean/rice system in Viet Nam), or intercropped with the normal crop and then allowed to grow through the dry season (e.g. the sweet clover (Melilotus albus)/maize system in highland Oaxaca State, Mexico).
- The gm/cc can be grown under fruit or forest trees or almost any perennial crops (such as the perennial peanut (Arachis pintoi) under citrus trees). In this case, we choose particularly shade-resistant gm/ccs, like jackbeans, the perennial peanut, or Centrosema pubescens.
- Other small, occasional niches can be found, such as in extremely acidic soils (velvetbean or buckwheat), or during very short periods of time (Sesbania rostrata).

- Green manure/ cover crops must not cause any repeated cash costs.

This rule means that farmers must be able to produce their own seed year after year, and the the gm/cc's must have no disease or insect problems capable of slowing down very much their vigorous growth. It also means we need to avoid using innoculants. In the event that an insect or disease problem does significantly slow down a gm/ccs growth, we must usually discard it and look for (or hopefully already have available) another species. The Brazilians, for instance, quit using the lablab beans some ten years ago because they were heavily attacked by insects.

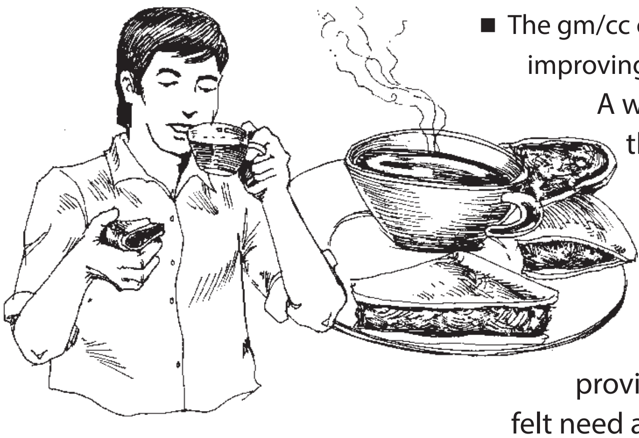
- Green manure/ cover crops must not increase labor costs very much.

This rule means that, except where animal traction or tractors are available, gm/cc's will have to be applied to the soil surface. It also means that the intercropping of gm/ccs is particularly advantageous, because the weed control the gm/cc is providing the main crop can sometimes eliminate more work than what it takes to plant and cut down the gm/cc. That is, in quite a few cases, the introduction of the gm/cc can actually reduce over-all labor expenses.

The labor factor is also one of the reasons why farmers are often very happy to use gm/ccs to move to a zero till system. Farmers are often motivated to plant gm/ccs by the possibility of never having to plough or hoe their fields again.

■ Green manure/ cover crops must fit into the existing farming systems.

Farmers will see gm/ccs, at least during the first few years, as much less important than food or cash crops. Thus the gm/ccs will have to be adjusted to fit into the already-existing farming system, and not the other way around.



Green manure/ Cover crops are used to make a coffee substitute, sweetcakes, sprouts and other foods

■ The gm/cc chosen should provide at least one major benefit other than improving the soil.

A worldwide study of introduced gm/cc systems found that those systems that farmers continued to use long after the extension program had left the area were almost always systems that produced definite benefits other than those of just soil improvement. Thus, whenever it is at all possible, we should choose gm/cc species that can be eaten, fed to animals, or provide some other benefit for which there exists a strong felt need among the farmers.

■ The one or more gm/cc species used should fit the available niche(s) as well as possible.

In general, good gm/cc species should establish themselves easily, grow vigorously under local conditions, be able to cover weeds quickly and be able to either fix plenty of nitrogen or concentrate plenty of phosphorus. They should be resistant to insects, diseases, grazing animals, bushfires, droughts, or any other problem they may have to face within the farming system. They should also have multiple uses, and should produce viable seeds in sufficient quantities for future plantings. If the gm/ccs are to be used for intercropping, they should grow well in moderate shade and fit into the cycle of the main crop(s).

We have learned, while trying to apply these rules in many different situations around the world, that finding acceptable, widely adopted systems for (or preferably, with) farmers requires a great deal of flexibility and creativity. No textbook is going to tell us exactly what technology should be used in each circumstance. Extensionists have to be open, learn from the farmers, listen to them, and then work together with them to find out which species and which systems will best fit their particular needs and situation.

Great care should be used not to introduce into new areas gm/cc's that might themselves become pests. The most dangerous species in this respect seem to be creeping perennials. Common kudzu (Pueraria lobata), tropical kudzu (Pueraria phaseoloides), and even the perennial soybean have aroused complaints from farmers because they are invasive and are quite difficult to kill. Many programs have decided not to use these species rather than risk their becoming pests.

Gm/ccs have become very useful for large-scale farmers having as much as 100,000 ha in Brazil. But among poorer, shifting cultivation farmers, gm/ccs tend to be most useful for those who have between 0.5 ha and 10 ha. Farmers who have more than 10 ha/household can still use shifting agriculture in ways that do not destroy their soils; it will be difficult for any other technology to compete with that system. For farmers under 0.5 ha/household, the use of the land is often (although not always) so intensive that there are no times or places in which the gm/cc can fit without taking the place of another crop. In these cases, the farmers are usually better off to make compost or buy fertilizers, organic or otherwise. Farmers who dedicate all or virtually all their land to year-round paddy rice are also among those for whom gm/cc's may have no feasible niche.

Nevertheless, among the remaining farmers–those with 0.5 to 10 ha–niches for gm/ccs can very frequently be found. Generally, the most successful method for doing so is to first observe the local farming systems, looking for the above-mentioned niche: traditional crops among which gm/cc's could be intercropped, times during the growing season when lands are left idle, or perennial crops around which gm/ccs can be grown. In the absence of these possiblities, one can try growing the gm/ccs during the drier seasons or as "fallow improvers" so that farmers can begin planting again within a year or two instead of waiting four or five years or more. Another important niche for the use of gm/ccs in Southeast Asia is in the recuperation of lands taken over by imperata grass.

Characteristics of the most important green manure/cover crop species

Common name	Resistance to shade	Resistance to poor soil	Resistance to drought	N-fixation kg/ha	Erect or climbing	Annual or perennial	Eaten by humans	Controls weeds	Other uses
Velvetbean (Mucuna spp.)	3	3	3	140	Climbing	Both	Only with processing	4	Medicine, animal feed
Jackbean (Canavalia ensiformis)	4	4	4	240	Both	Perennial	Only tender pods	3	None
Lablab bean (Lablab purpureum or Dolichos lablab)	3	1	4	130	Both	Perennial	Yes, pod, green or dry seeds	3	Animal feed, especially dry season
Cowpea (Vigna unguiculata)	3	3	Some vars. 4	80	Both	Annual	Yes, pod and fruit	3	None
Rice bean (Vigna umbellata)	3	3	3	80?	Both	Annual	Yes, very good taste	2	None
Mungbean (Vigna radiata)	3	2	2?	80?	Both	Annual	Yes	2	Bean sprouts, poultry feed
Pigeon pea (Cajanus cajan)	3	3	4	70+	Erect	Perennial	Yes	2	Animal feed
Tephrosia (Tephrosia vogelii or T. Candida)	2	4	4	?	Erect	Perennial	No!	2	Insecticide
Sunnhemp (Crotalaria chroleuca)	3	3	3	?	Erect	Annual	No	2	Insecticide for stored grains

Key: 4 – Excellent; 3 – good; 2 – fair; 1 – poor

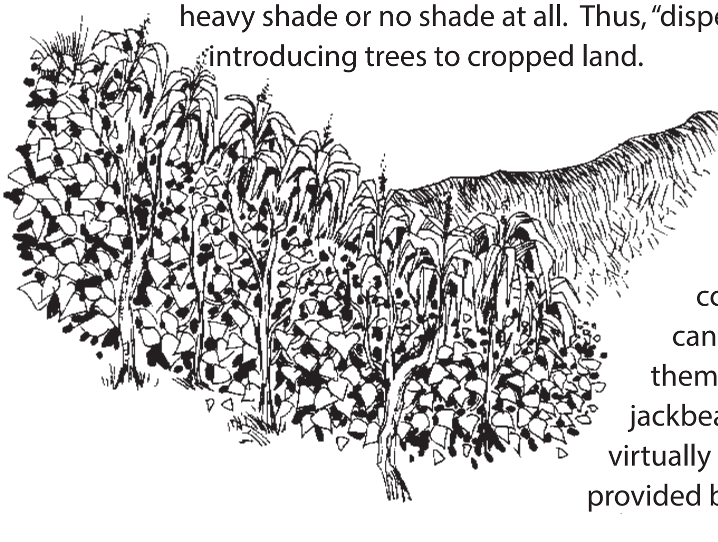
Other lessons learned

The following is a list of additional lessons learned:

1. Many programs will have to decide whether, in their efforts to intensify shifting agriculture systems, they will work with "improved fallows" or "gm/ccs". First of all, we should remember that these categories are not mutually exclusive. In fact, all gm/cc systems could, in a way, be seen as improved fallows. Even gm/ccs intercropped with annual crops can be seen as "simultaneous fallows," whereby the fallowing (soil recuperation) function goes on simultaneously with the growing of crops. Furthermore, many agroforestry systems, such as alley cropping and dispersed trees, could definitely be benefited by adding viny gm/ccs.

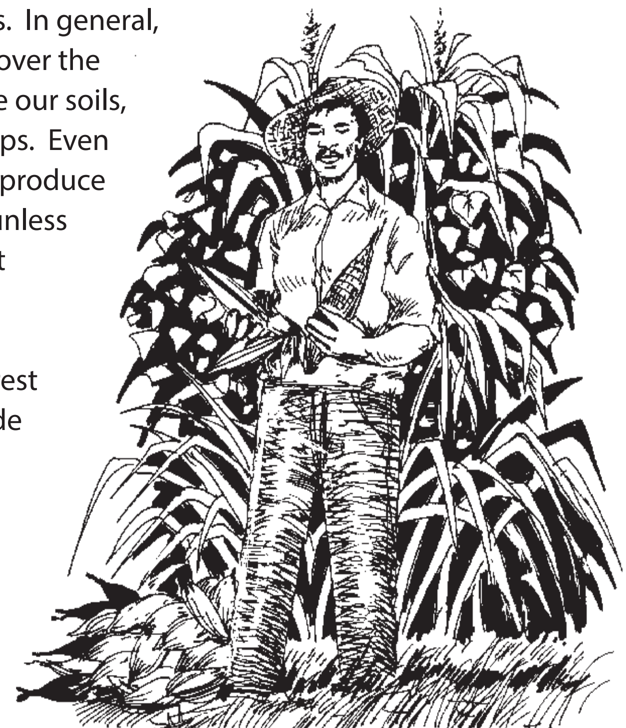
   Nevertheless, there is a need to decide to what extent long-term tree species will be used as such, and to what extent farmers would probably prefer shorter-term, less woody and shorter stature plants in their fields. Several issues should be taken into account when making this decision:

   - Do farmers have natural forests, or at least well-developed fallow forests? If so, the possibilities of using an improved fallow system are greatly enhanced. Without fallows, it is often quite expensive (in terms of the land's opportunity cost, if nothing else), to "improve" them.
   - Is there any national demand for the products of gm/cc systems? If neither beans nor sprouts nor sweetcakes are popular, and if there are very few animals (or the animals are easily and amply fed with local resources), gm/ccs will be less attractive.
   - In isolated areas, are there forest products that can be easily transported to market? Southeast Asia's spices are ideal for improved fallow products, because they often have a very high value per unit of weight, so they can be transported relatively cheaply out of the often isolated areas where natural forests still exist.
   - If local laws or customs give usufruct rights to farmers who plant trees on the land, this factor will represent a major motivation for farmers to prefer tree-based improved fallow technologies. If, on the other hand, farmers can only own or use unforested or cultivated land, farmers will have a major incentive to use viny or bushy species.
   - Many tropical crops do better with a light shade (say 20 to 30%) than with either a heavy shade or no shade at all. Thus, "dispersed tree" systems can very often be ideal for introducing trees to cropped land.



   We should always remember that many times both kinds of plants can be used. For instance, in the last case, dispersed tree systems provide an ideal environment for gm/ccs. Some gm/ccs, such as tephrosia or velvetbean can make fallows much more efficient (reduce them to one or two years), while others, such as the jackbean, can make trees grow more vigorously, and virtually any gm/ccs can supplement the organic matter provided by alley cropping.

- The desire to grow annual or semi-perennial crops. In general, with such crops, if we wish to have a dense cover over the soil and/or enough leaf fall to maintain or improve our soils, we must grow most of those leaves <u>below</u> our crops. Even contour hedgerows and alley cropping will never produce enough vegetation to maintain yields over time, unless they shade out more of a farmers' crops than most farmers are willing to sacrifice.



  Gm/ccs do virtually everything for the soil that forest trees can do, but they produce the inevitable shade <u>below</u> our crops rather than above them, thereby permitting the crops to grow well, also. Shorter-stature species do virtually everything for the soil that forest trees can do, but they produce the shade <u>below</u> the crops rather than above them, thereby allowing the crops to grow well, also. Therefore, farmers growing unflooded field crops of any kind (again, between 0.5 and 10 ha) will very frequently find that shorter-stature species are what they need.

2. The more deteriorated the situation is (especially in terms of soil quality and rainfall regularity), the more limited will be the selection of gm/cc species that will grow vigorously. Nevertheless, in a year or two, when these gm/ccs have improved the soil somewhat, farmers can often graduate to less hardy gm/cc's that produce more subsidiary benefits.

3. Gm/cc's are usually not a total substitute for chemical fertilizers, but are rather a complement for them. In fact, gm/ccs will often dramatically improve the impact of chemical fertilizers—by supplying micronutrients, making fertilizer nutrients more soluble, maintaining soil structure and moisture, etc.— thereby making the fertilizers more economically attractive. Nevertheless, as farmers gradually develop more efficient ways to grow gm/ccs, they will often find ways of maintaining their soils' fertility with negative over-all costs (the side-benefits become more valuable than the labor and resource costs), thereby making chemical fertilizers singularly unattractive except as a long-term supply of phosphorus and an occasional short-term supplement to enhance synchronization.

4. When farmers are first approached with the idea of gm/ccs (if they haven't developed them on their own already), they will often fear that the gm/ccs will increase the population of rats and snakes. Nevertheless, we have never had farmers complain about the snakes or rats after they have adopted the practice, even in areas where very poisonous snakes are common. In part, this may well be because the gm/cc makes a mat of organic matter considerably easier to see through than those of most weedy fields, so snakes are easier to avoid. Furthermore, the very presence of more snakes means the rat problem is more often kept under control.

Another occasional problem is fire. In this case, the farmers should choose gm/cc species that stay green during the dry season, such as jackbeans, lablab beans, or sweet clover (Melilotus albus).

5. A tremendous amount of research about gm/ccs needs to be done. We need research into already-existing gm/cc systems to document them and find out in what additional environments they might be useful. A very high priority right now is research to find ways for various species of animals to be fed using common gm/ccs. Innovative associations of gm/ccs and common crops, especially low-lying crops (such as upland rice or vegetables, for instance) need to be investigated, as well as associations of gm/ccs (e.g. velvetbean and jackbean/maize systems, or Vigna and jackbean/cassava systems). We also need to know a good deal more about what the minimum requirements are to move to zero tillage, and how most easily to achieve these requirements under varying conditions.

   Virtually all of this research can and should be done in the field and through collegial participatory processes.

Conclusion

The potential of gm/ccs, as well as the need for them, is tremendous. Deteriorating shifting agriculture systems are destroying our soils, eating into our forests, and even contaminating the air we breathe. At the same time, hundreds of millions of people now depend on chemical fertilizers, the price of which depends on that of petroleum. Even the petroleum price rises of the last two years will very likely push chemical fertilizer prices beyond what millions of resource-poor farmers can afford. If working alternatives are not in place so these farmers can continue to produce food at their present levels or better with less use of chemical fertilizers, hunger and malnutrition could well increase in the future.

Prepared by
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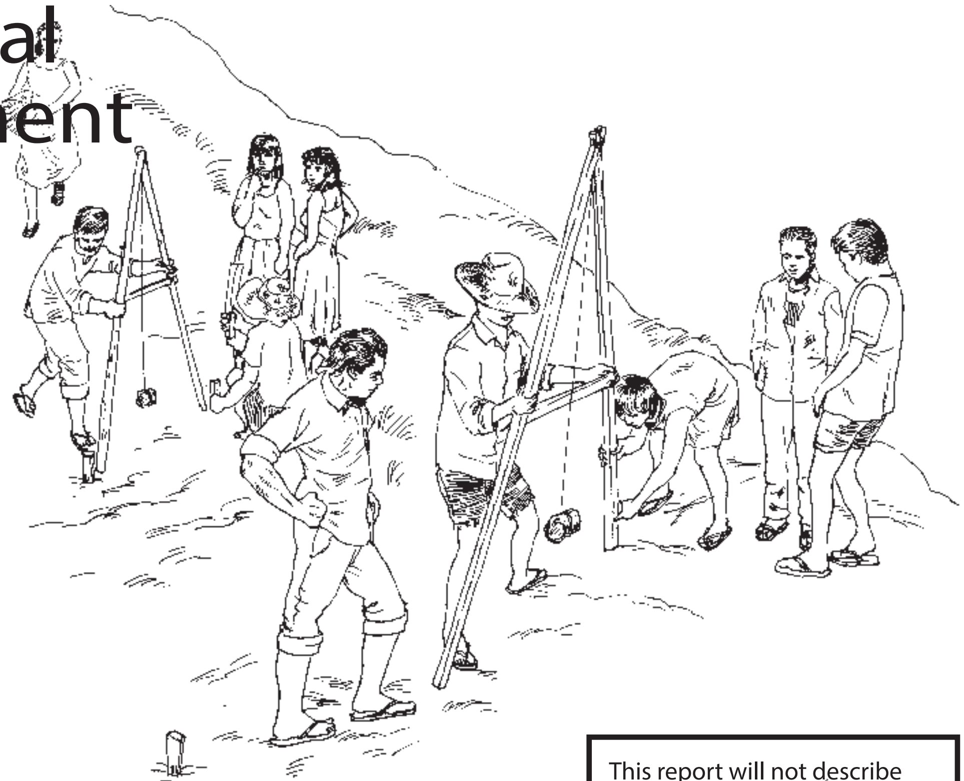
Resource book produced through a participatory writeshop organized by IFAD, IDRC, CIIFAD, ICRAF and IIRR.

Principles of Extension for Sustainability People-Centered Agricultural Development



We generally speak of people-centered agricultural development (PCAD) as a series of principles. As long as these basic principles are employed, there is room for a tremendous amount of adaptation to local circumstances, farmer needs, and institutional imperatives, without causing any major decrease in the effectiveness of the over-all approach (Farmer-Led R&D, pages 317-321, and An R&D Approach for Evaluating and Disseminating Promising Shifting Cultivation Practices, pages 313-316).

This report will not describe the people-centered agricultural development (PCAD) principles or ways of applying them. Rather, it will describe the inner synergism of PCAD as well as its relationship to:

- the situation of resource-poor farmers in developing nations
- the sustainability of agricultural development
- the empowerment of resource-poor people

Discussion on the principles of PCAD and the ways of applying them can be found in the book "Two Ears of Corn: A Guide to People-Centered Agricultural Improvement", by this author.

Basic principles

1. Motivate and improve the methodology with which they try out new technologies, thereby reducing risks inherent in adoption and provide a means for them to continue to develop, adopt, and adapt new technologies in a permanent scientific process. This principle is often referred to as "participatory technology development."
2. Use rapid, recognizable success in these experiments as a "detonator" to motivate farmers to innovate rather than use external incentives or subsidies.

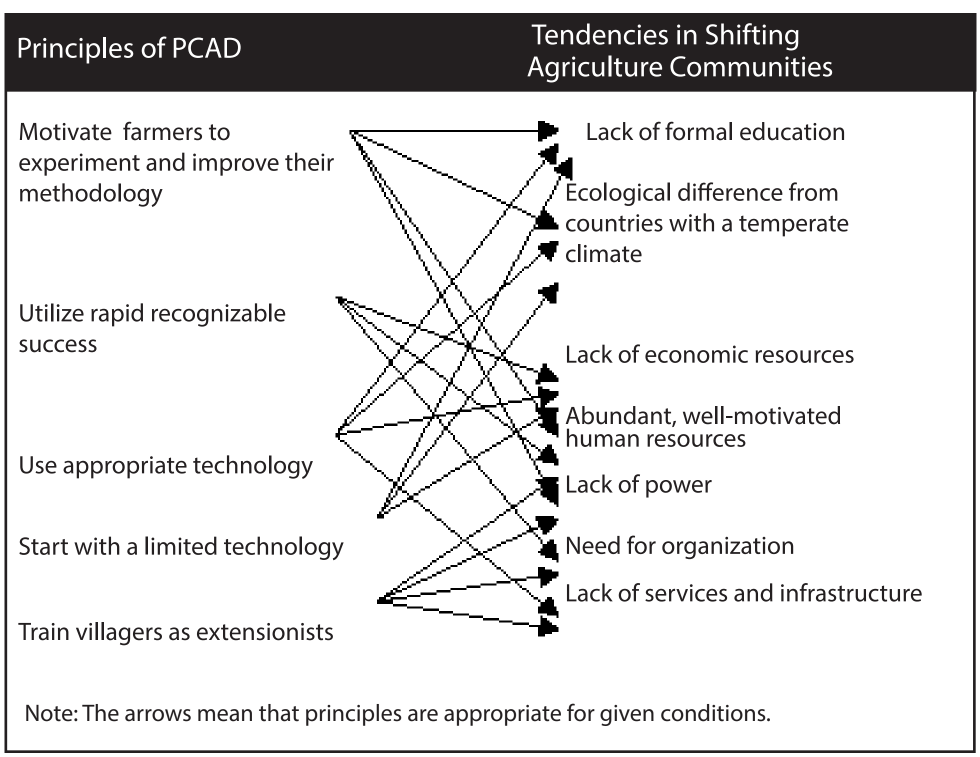
3. Use technologies that rely primarily on inexpensive and locally available resources.
4. Begin the process with a limited number of technologies, so that the program is focused. Hence, it can achieve the maximum possible percentage of successes right from the start, and allow even the poorest farmers to become involved in the process.
5. Train village leaders as extensionists and support them as they teach additional farmers. This process will create and nurture a community-based multiplier effect. This principle is referred to as "farmer-to-farmer extension".

Synergy between different PCAD principles

Numerous farmer-to-farmer extension programs in Southeast Asia train villagers as extensionists. On the other hand, a growing movement in South America uses participatory technology development, which emphasizes the development of technology by village farmers through small-scale experimentation. Nevertheless, long experience in a diversity of cultures has shown that these five principles, when used together, reinforce each other, making the other principles more effective. That is, there exists a synergy between the various principles.

> Though PCAD is sometimes called a methodology, it is more flexible than most methodologies. Different organizations in different countries have modified considerably the specifics of the approach, without reducing substantially the effectiveness of the basic ingredients.

Diagram 1. Relationship of PCAD and shifting agriculture farmers.



There is a relationship between the PCAD principles and the situation of resource-poor farmers (Diagram 1). This diagram presents the obstacles and problems that a system of agricultural development must overcome, like the lack of formal education and economic infrastructure. Also, it shows the important resources that a system of agricultural development must take advantage of, if it is to be as effective and efficient as possible. These resources include an abundance of well-motivated human resources and an ecology that, in many cases, is highly favorable to very high rates of agricultural productivity.

> These principles, none of which is a part of any of the presently dominant systems of agricultural extension in developing nations, are quite well adapted to the conditions that reign in the villages of the developing world.

The sustainability of agricultural productivity

The need for sustainability of increasing yields

Most governments in developing countries can rarely afford to have professional extensionists working with all their farmers. Few of them have extensionists working with more than one out of every four farmers, and the frequency of farm visits is so low as to be largely ineffective. The result of this lack of resources is that governments often target those areas which they consider to be of high agricultural potential, that make the problems of poverty and inequality more severe.

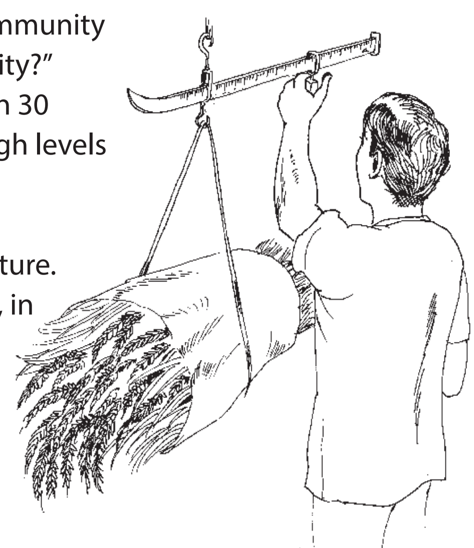
The only conceivable way of meeting this challenge successfully is that governments should enlist the farmers' own efforts in solving their problems of low productivity.

The PCAD process teaches villagers how to experiment and teach each other through the most efficient teaching process, learning by doing. Each year, farmers continue to manage experiments. Some of them also work as extensionists, teaching farmers in other villages what they have learned. The success of the innovations they learned through the PCAD process motivates them to continue to experiment and share what they know.

Factors needed to achieve sustainability

We must ask ourselves, "What are the factors that must exist in a community for the farmers to, maintain , if not improve, high levels of productivity?" This question has been asked to groups of agronomists in more than 30 different nations. Results show that the factors needed to sustain high levels of productivity are the same in all these nations. These include:

1. The motivation to continue the development process.
2. Self—confidence and a respect for their own knowledge and culture. People who are convinced they are ignorant or incompetent will, in fact, become incompetent.
3. The ability to organize and manage experiments. The only way farmers can maintain both productivity and profitability in a modern, rapidly changing environment is to constantly try new technologies.

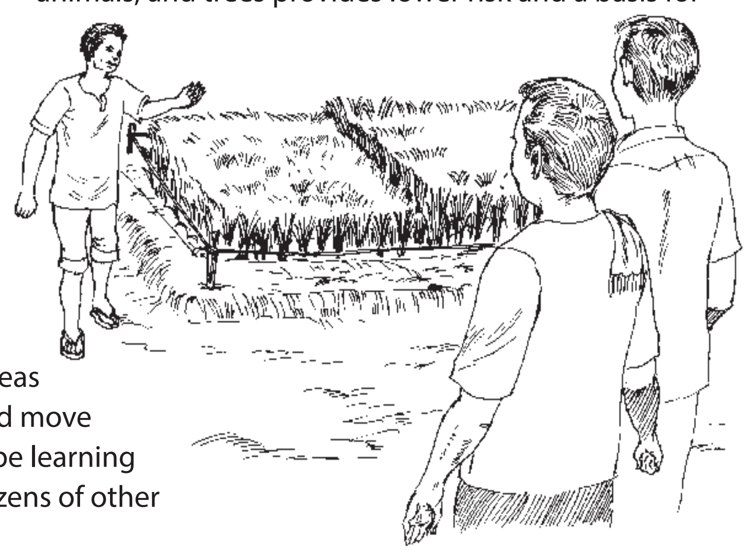


Widespread experience on three continents shows that farmers can fulfill three major roles (and many minor ones) in improving their own agricultural development:

1. Establish and manage experiments in order to modify those technologies already known and develop new ones.
2. Spread knowledge of useful technologies from one farmer to another.
3. Carry on (by themselves, if necessary) the processes of agricultural investigation and extension once they have learned them, thereby continuing to increase their yields.

If governments are to sustainably meet the future challenge of feeding their growing populations, at a cost within reason, they must involve farmers in these three activities.

4. Medium- to long-term use rights over a certain minimum of natural resources that are in a satisfactory condition. Without a minimum of certain resources—land, water, etc.—no one can produce enough food to live well.
5. Access to or ownership of adequate financial resources. This does not require big amount of money. Most present loan programs handle more money than small farmers really need. Farmers need at least some extra capital to risk in their experimentation and invest in improvements. Most of this usually comes from their own increased productivity.
6. A certain basic knowledge of biological and agronomic processes. This knowledge is necessary in order to understand experimental results and decide what possibilities of improvement will be most promising for future experimentation.
7. Diversified farming. Knowledge of a series of crops, animals, and trees provides lower risk and a basis for future innovations.



8. The ability and motivation to share information about agricultural technologies with other farmers. No one farmer can ever do enough experimentation to continue improving his/her productivity. The only way the whole villages or areas can solve their problems and move ahead is for each farmer to be learning from the experiments of dozens of other farmers.
9. Organizational capacity-building. With constant innovation, new needs and new opportunities will be encountered. These needs and opportunities will often best be seized or solved not through some preexisting structure, but by new organizations, permanent or temporary, that people will create if and when they are needed.

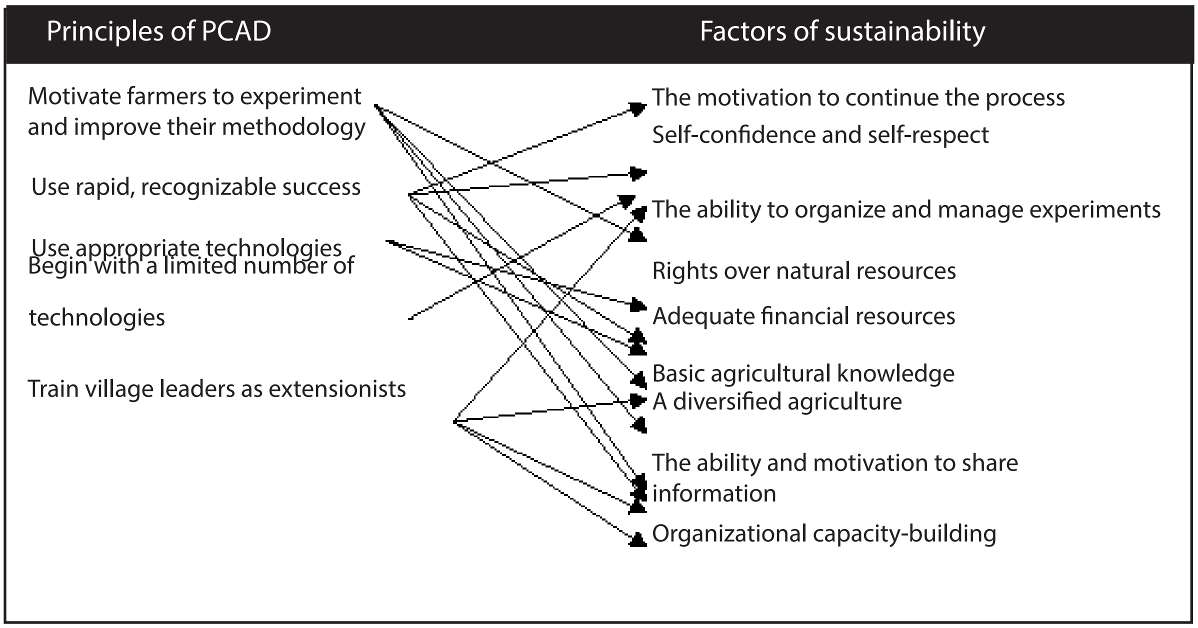
Catalysts in this process would be:

- Networks with outside sources of information and support.
- Administrative capabilities. The ability to plan strategically, to handle money and

accounting procedures, and to manage group dynamics can make the process still more efficient.

- Minimal rural infrastructure and access to markets.
- A high literacy rate among the farmers. Although the process has worked in areas

Diagram 2. Principles of PCAD and the factors of sustainability.



where functional adult literacy was as low as 20%, higher literacy rates make the process more efficient.

This diagram compares a list of PCAD principles vis-a-vis the list of factors of sustainability. Each arrow indicates a causal relationship between the competent use of the principle and the strengthening of one of the factors needed for sustainability.

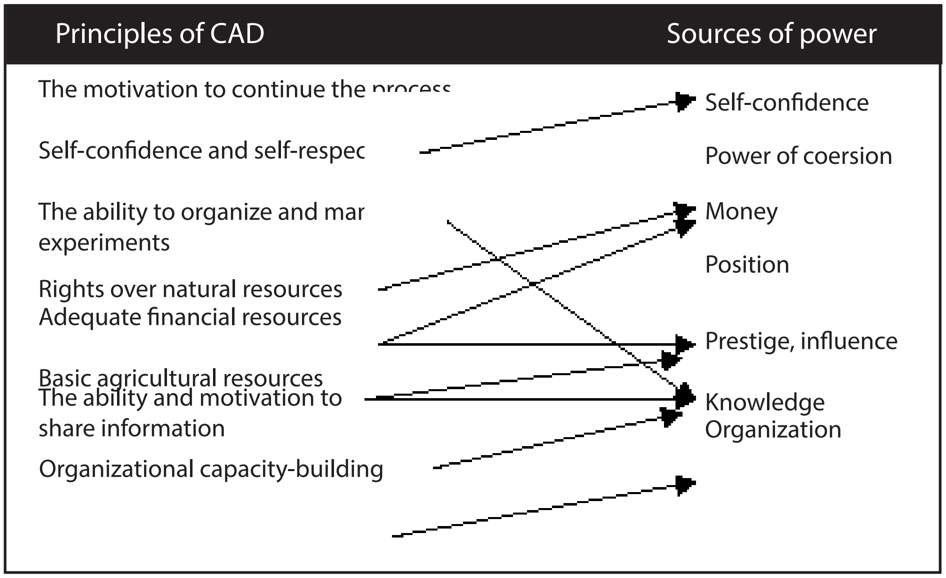
Taking the first principle as an example, through experimentation farmers gain the ability to manage experiments through the time-honored methodology of learning by doing. When farmers experiment, they gain a good deal of basic agricultural knowledge through their experiments. When farmers know how to experiment, and are motivated to do so, they gain the ability to continue to diversify their agriculture. And when they are capable of constantly acquiring information in this manner, they will, on a sustainable basis, have something valuable to share with each other.

The PCAD principles go a long way toward strengthening precisely those factors that can make the development process self-sustaining at the village level.

PCAD, sustainability and empowerment

It is also worthwhile to compare the above list of factors needed for sustainability with a list of those factors identified by social scientists as sources of power in any society:

Diagram 3. Factors of sustainability and sources of power.



One can see immediately that virtually all the sources of power are inherent in one or several of the factors of sustainability. That is, empowerment is inherent in any process that permits villagers to sustain the process of agricultural development. If we wish agricultural development to be an on-going process—to be sustainable—it inevitably must include empowerment. Unempowered farmers are simply incapable of carrying on the process.

Effectiveness of the PCAD Principles

1. We have learned that the principle of limiting the initial number of innovations taught is easily the most important of the principles. Limiting the initial number of technological innovations to one or two simple technologies—a "detonator"— that will provide a dramatic impact to get the social process moving, is probably the most important of the PCAD principles.
2. The PCAD process is very difficult, or even impossible, in an institutional framework that discourages decision-making at a level close to the village extensionist. Both the principles and the technologies used must be adapted according to differences in farming systems, cultures, land tenure, environmental factors, accessibility of the villages, accessibility of markets, etc. Institutions that fail to provide the space for such adaptations will rarely be successful in using the PCAD approach.
3. The methodology is also made much more difficult where previous development programs have been highly paternalistic, giving away all sorts of inputs, food, and other artificial incentives. Nevertheless, even in these sorts of situations, significant successes have been achieved.
4. The PCAD approach has not only proven itself capable of achieving high rates of farmer adoption and increased productivity but also, even more important, has done so at much less cost than other extension systems.
5. Sustainability of the process of agricultural improvement is not to be found in the technologies introduced, but in the social process of active, farmer-run innovation and dissemination of ideas.
6. The achievement of this sustainable social process requires a series of conditions that include villager empowerment as a necessary ingredient.

Prepared by
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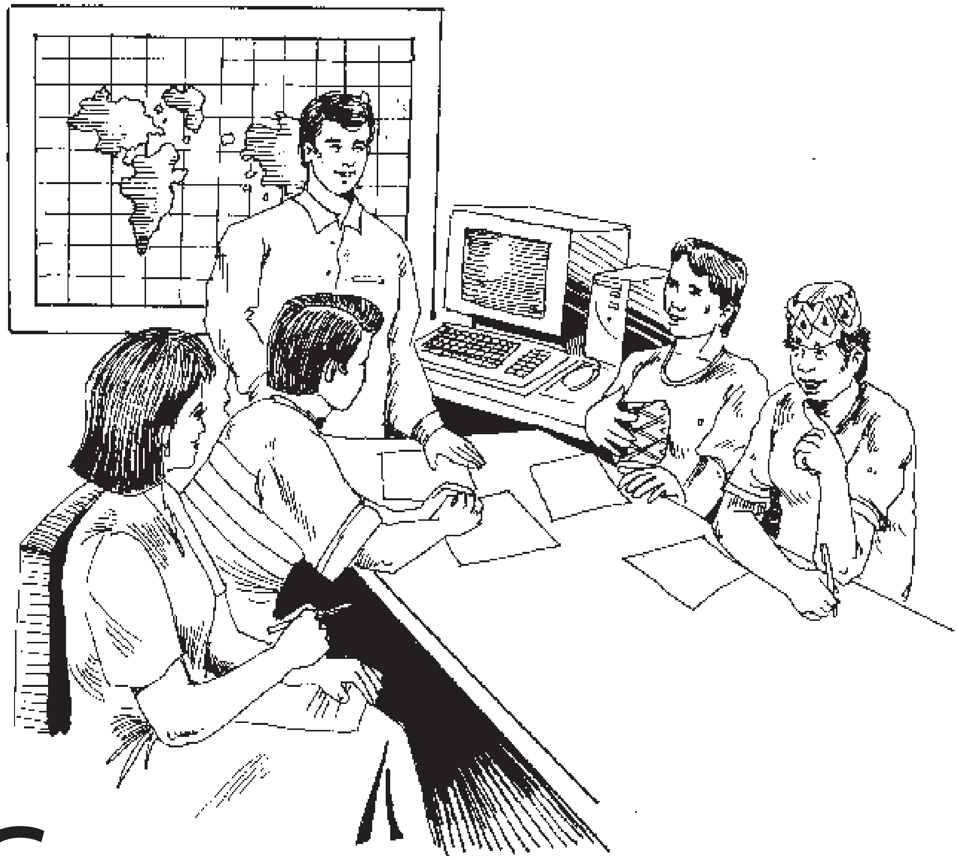
Resource book produced through a participatory writeshop organized by IFAD, IDRC, CIIFAD, ICRAF and IIRR.

GIS for Planning and Monitoring Land Use Practices in Shifting Cultivation Areas

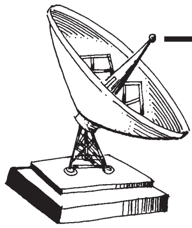


Geographic Information System (GIS) is a computer-based software that stores, retrieves, manipulates, analyzes, and produces geographically referenced data. It integrates spatial and non-spatial or attribute data (elevation, erosion, rate, identity, e.g. maize, lake ranking class 1 or class 2) data within a single system. This offers the flexibility to combine data from a variety of sources. It is becoming a standard tool for natural resources planning such as land use planning, natural hazard mapping, monitoring of land degradation, and managing of water resources.

Through GIS, land use data of a community such as area devoted to agriculture, forest, shrub, and shifting cultivation can be assessed. In areas where shifting cultivation is practiced, GIS is used to determine the characteristics of land occupied by shifting cultivators, land use practices,

GIS and shifting cultivation

- GIS can employ satellite or other remote sensed data to provide much information on shifting cultivation, e.g. area coverage, the extent and status over the season and over time.
- Remote sensing images are cheaper compared to aerial photographs. The information received from the satellites is processed at the earth stations and converted into pictures called satellites images.
- Information from remote and inaccessible areas can be obtained, although sone governments restrict access to data covering "sensitive" areas.



Advantages of GIS

1. Improves our understanding of the resources that are available.
2. Facilitates more effective development and comparison of alternative strategies and answering "what if" type questions relating to policy, analysis and planning option and evaluation.
3. Reduces time taken to prepare reports, graphs, and maps, which will improve the efficacy of geographic information used in policy analysis, planning evaluation.
4. Improves planning of future resource surveys by providing information on existing survey data and guidelines for effective data storage, transmission and manipulation.
5. Improves turn-around time to requests for information by managers and planners by making data and information more accessible.
6. Facilitates manipulation of geographic data to produce new information via the analytical and manipulative capabilities of computer programs.
7. Facilitates the development of dynamic models to assist in planning.

N. Rollings. (Undated) An Introduction to Geographic Information Systems. Department of Ecosystem Management, University of New England, Armidale NSW.

and status of natural resources. Based on these information, decision makers can form alternatives in development and conservation planning.

Limitations of GIS

- The digitizing phase (if required) is very much time consuming and requires an expert technician.
- Initial establishment cost (equipment) can be high, although prices are generall falling.
- GIS requires institutional commitment and resources.

Requirements for GIS

Hardware:

A computer and other peripheral devices are essential equipment in handling spatial data in a GIS. These devices are collectively known as the hardware.

- Computer PC/mainframe,
- High resolution color monitor (for displaying maps and images),
- Digitizer (for inputting analog map data information),
- Printer (for outputting maps, images and textual information), and
- Plotter

Software:

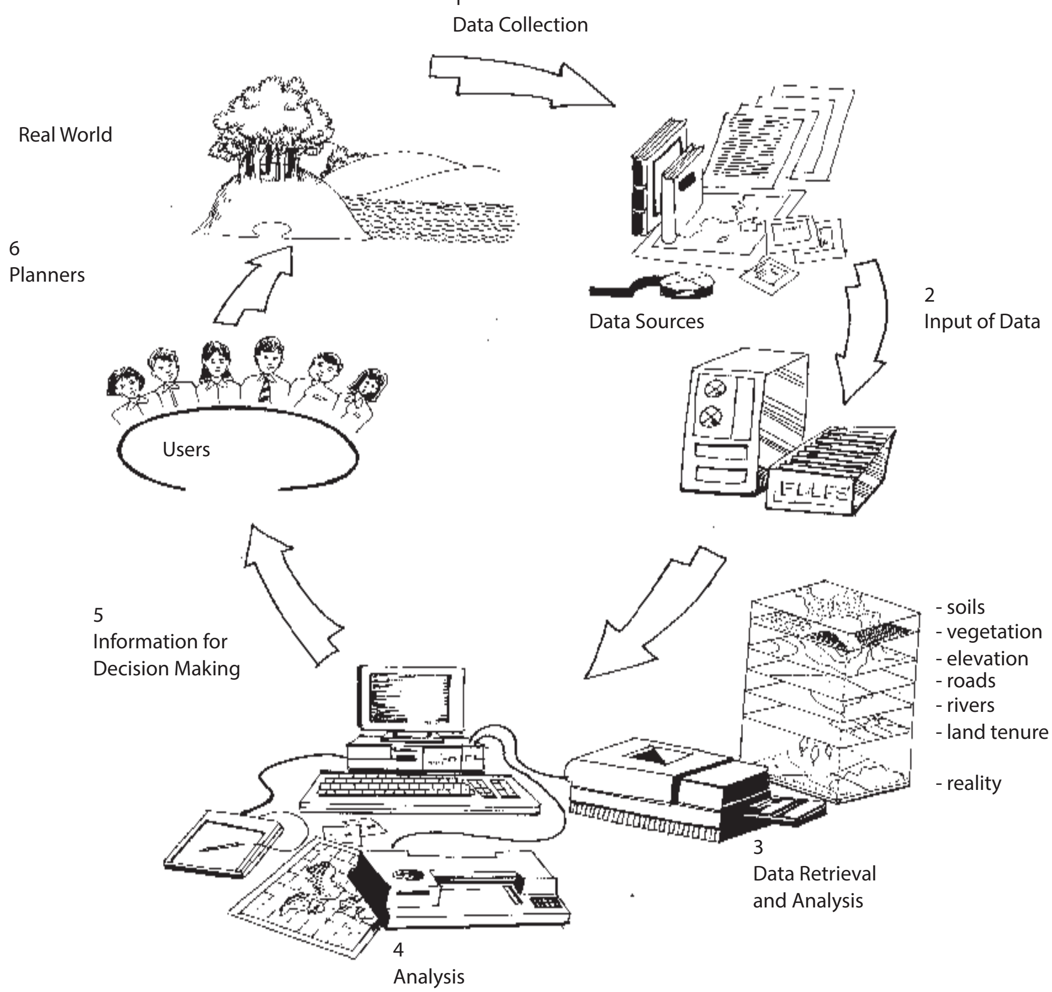
The software controls the various operating systems and some of the popular software are:

- ARC/INFO
- IDRISI
- ILWIS

Peopleware:

- Skilled technicians are required to manage the equipment and software, particularly if modelling and detailed analysis are planned.

(Based on Brouwer, de H. 1994. Introduction to Geographic Information Systems. ITC. Netherlands.)



How GIS is constructed

1. Data collection

   Data are collected from the real world. At this point, data can be spatial (georeference) and non-spatial attribute data. It is important to have a general objective for contructing the GIS.

   Data sources: These can be reports, topographic maps, satellites images, information on a computer discs, tapes and maps.

2. Input of data

   This is the process of entering data in the digital database of a GIS. Spatial data are entered through:

   - Manual digitizing
   - Scanning
   - Keyboard entry
   - Downloading existing data files, e.g. purchased satellite data from the Internet.
   - Downloading from data-collecting devices, e.g. Global Positioning System (GPS)

For attribute data

- Keyboard entry
- Downloading existing data files

3. Data analysis

Spatial Data is generally stored in layers, e.g. a land-use map may have separate layers for topography, roads, boundaries, soil capabilities, urban areas and, of course, land-use categories. The most important component of the GIS is the analytical capability of the system. The analysis and procedures include:

- Retrieval, classification and measurement operations. (e.g. the total area of a particular land-use or vegetation type can be quickly calculated).
- Overlay operations - new spatial elements are created by overlaying maps, e.g. layers can be readily combined to give the area of a particular land-use on a given soil type.
- Neighborhood operation, and interpolation functions estimates values based on the values of known sites. This is extremely useful for developing digital terrain models.
- Some GIS have powerful capabilities to create dynamic models, e.g. to evaluate possible scenarios of land-use for various urban growth rates provided by the user.

Examples of landuse maps generated through GIS

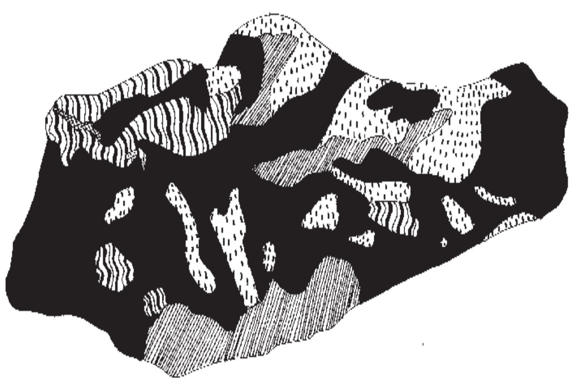


Fig 1. Landuse in Kali Khola Watershed in 1978.

- Agriculture (194.90 ha)
- Forest (573.36 ha)
- Boulder (2.06 ha)
- Shrub (146.99 ha)
- Shifting Cultivator (111.19 ha)

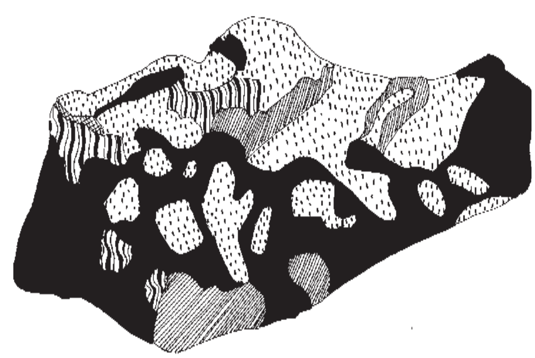


Fig 2. Landuse in Kali Khola Watershed in 1999.

- Agriculture (366.45 ha)
- Forest (436.96 ha)
- Boulder (3.15 ha)
- Shrub (119.09 ha)
- Shifting Cultivator (66.85 ha)

4. Data output

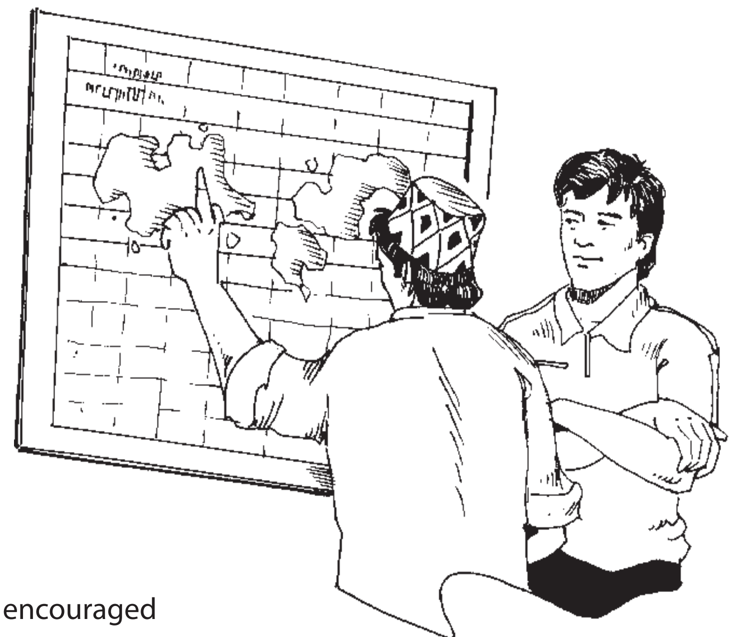
This is the procedure by which information from the GIS is presented in a form suitable for the user. Data output are in one of three formats such as softcopy, hardcopy and electronic.

A case study on using GIS to monitor shifting cultivation areas in Central Nepal

Shifting cultivation (khoria) is practiced mainly between the southern part of the Middle Mountain and the northern part of the Siwalik region of Nepal and in some parts of the

High Mountain areas. Chepang (Praja), a minority ethnic group and other disadvantaged groups of people depend on shifting cultivation for their livelihood.

In Nepal, however, there is a lack of systematic study concerning the area used for shifting cultivation. Thus, a case study using GIS was conducted to monitor land use changes and develop an alternative plan for sustainable use of land resources for the cultivators. The case study was conducted in the middle mountain region of Central Nepal (Balla et al. 2000).



As a result of the study, a land use change map was generated from GIS showed that a large part of the survey area where shifting cultivation is practiced, was not suitable for general cereal production due to steep terrain, inadequate soil depth, and proneness to erosion. The research suggests that shifting cultivation should be stabilized by some of the suitable techniques like Sloping Agriculture Land Technology (SALT), agroforestry or horticulture. It was also felt that planting suitable multi-purpose tree species should be encouraged in the private land for supplementing fodder, fuelwood, and timber demand. Suitable areas for this were readily identified.

Since income-generating activities are the shifting cultivators' priority, vegetable and seed production will be a cash earning enterprise. Production of non-timber forest products is another source of income for the farmers. It is thus recommended that a forest inventory be carried out to estimate the total existing biomass and the production potential on an annual basis of the existing forests using both the GIS information and the household survey.

The result of this case study was submitted to the International Development Research Centre (IDRC), New Delhi by the Local Initiatives for Biodiversity, Research and Development (LIBIRD), Nepal.

References:

Balla, M.K., K. W. Awasthi, P.K. Shrestha, D.P. Sherchan and D. Poudel. 2000. Degraded Lands in Mid-hills of Central Nepal: A GIS Appraisal in Quantifying and Planning for Sustainable Rehabilitation. Local Initiatives for Biodiversity, Research and Development (LI-BIRD), Pokhara, Kaski, April 2000.

Prepared by
Dil P. Sherchan

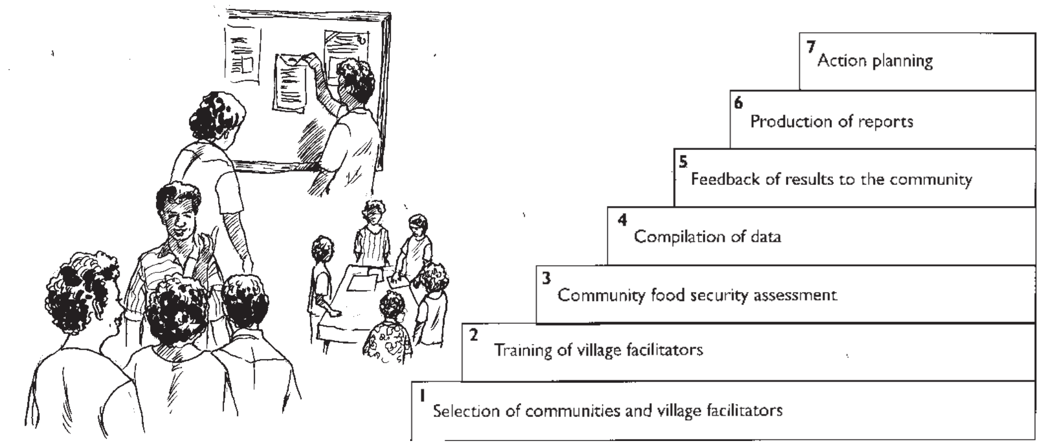
Resource book produced through a participatory writeshop organized by IFAD, IDRC, CIIFAD, ICRAF and IIRR.

Participatory Assessment Strategies for Extension and Training in Melanesian Communities

The collection of baseline data is often difficult for community based NGO's. Participatory approaches can be used for problem identification and the collection of baseline data. This process can also be used to facilitate the sharing and understanding of the complex resource management issues involved in shifting cultivation and village food security (also discussed in *Farmer-Led R&D*, pages 317-321). The process of problem identification and collection of baseline information is turned into a useful learning process for all the stakeholders.

Melanesian communities are composed of different groups from Fiji, Vannatu, Papua New Guinea, New Calenopin and Solomons. Majority of the communities are engaged in shifting cultivation. The communities are very supportive of participatory research/ undertakings.

In Lauru, Choiseul province an APACE(Appropriate Technology for Community and Environment) pilot participatory food security assessment had the following steps.



Step 1

- Selection of communities

  The local management committee together with the representatives from each of the participating communities developed the criteria in selecting the pilot site/community.

- Selection of village facilitators by the community

  Village facilitators, both men and women, from each of the two pilot communities were selected based on their skills, interest and the respect they command in the community. Likewise, a number of leaders were involved to ensure that the village leaders would own the results of the participatory assessment.

Step 2

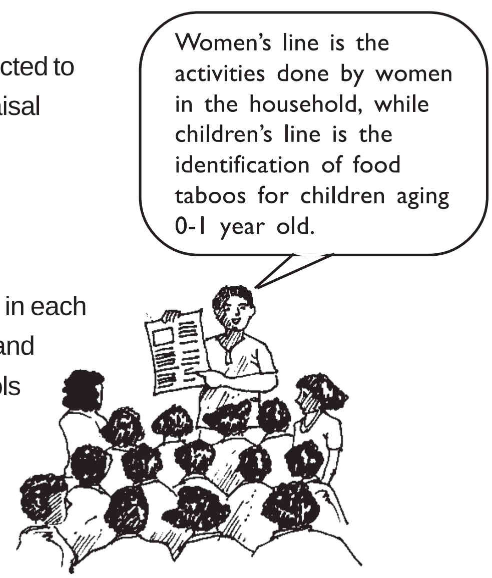
- Training of village facilitators

  A three-day workshop for village facilitators was conducted to train them on how to use the Participatory Rural Appraisal (PRA) tools in collecting relevant data.

Step 3

- Community food security assessment

  Community food security assessment was conducted in each village. The assessment was conducted in four days and involves different groups from the village using PRA tools such as cropping calendar, women's and children's line, transects and surveys.



Step 4

- Compilation of data

  The NGO staff together with a couple of village experts compiled and analyzed the gathered data as well as summarized the resources and threats on food security in the locality.

Step 5

- Feedback of results to the community

  The community facilitators planned a series of dramas to portray the main issues identified in the assessment of the community. After the presentation, a discussion in local language was facilitated. Copies of the report in local and English language were left to the community leaders and other groups/ organizations that had been involved in the assessment.

Step 6

- Production of reports

  Initially, NGO staff planned to produce the reports. Later, however, the community facilitators requested the NGO staff to teach them how to prepare the said reports. Such reports were better received by the community.

Step 7

- Action planning

  Results of the assessment can be summarizedas follows:

  – Key areas where the community and other actors need to address threats to food security were identified.

  – Increased awareness of the community on the different issues and the complex resource management involved in sustaining community food security.

  – Baseline data is available for the community to monitor changes and progress in the improvement of food security.

  – Production of reports in local language and in local terms makes the findings accessible to and useful to local people.

Application of Participatory Assessment to Shifting Cultivation

Most of the resources needed by the community came from the shifting agriculture system – forest, garden, bush fallow, river, sea, reef, mangrove, swamp, nut forest, etc. Each of these sources of food has a role to play in food security of the village. The process involved in participatory assessment allows the community to identify and discuss, among themselves, the problems and available resources the community possesses and how they would manage these resources in a sustainable way.

In the case of Sasamuqa, the food security assessment highlighted the community's problem on nut groves, which in the past were overlooked. Through the adoption of the participatory assessment process, the Sasamuqa community realized that their trees need pruning because it can remove the parasitic plant that destroys the nut trees. As a result, they climb and prune their trees, which resulted to an improved and healthy nut trees.

Disadvantages of the process

- Difficulty in training people with the skills on PRA specifically good data recording.
- Long and delayed process in producing reports in two languages due to unskilled facilitators.
- Data may not be acceptable for formal bodies.
- Possible inaccuracies in the result of the assessment due to rapid qualitative methods.

Prepared by

Tony Jansen and **Rosalyn Kabu**

Resource book produced through a participatory writeshop organized by IFAD, IDRC, CIIFAD, ICRAF and IIRR.

Community Level Planning for Resource Management

Many communities engaged in shifting cultivation are finding it increasingly important to be able to demonstrate the sustainability of their resource management systems. Concern is focused particularly on land and forest resources although other biophysical and socio-economic resources may also be involved. One aspect of this lies in the ability of such communities to plan and manage natural resources in a rational and systematic fashion.

In shifting cultivation, natural resources have many alternative and competing uses that include forest production (for wood and other forest products), food production, human settlement and spiritual renewal. "Outsiders" also provide competing demands in the form of timber extraction, biodiversity conservation, mineral extraction, energy production and industrial development. Outsiders often perceive shifting cultivation as primitive and wasteful, while shifting cultivators may be mistrustful of outsiders and constrained to participate freely in planning exercises.

Planning process

A generic planning process might include the following steps:

1. Setting of objectives and "planning for the planning" – there is usually some objective in conducting the planning exercise. Communities regularly plan their resource use but this is not always systematic or focused on reaching broader concensus. Objective setting may need to be preceded by goal setting and visioning for some communities in order to level expectations. This step is largely to obtain focus and commitment which may in itself be a substantial challenge for many shifting cultivation communities.

2. Unit of analysis – it is important to define the limits of the resources being included in the planning exercise. In the case of land this will be boundaries; in the case of labor for example, this limit may be less tangible, e.g. female labor. Case 1 below discusses the watershed approach to natural resource planning and presents an

CASE 1: Watershed and Village Planning in Northeast India

Watershed planning approaches identify those discrete geographical areas where the water drains toward a single outlet point. Farmers in the upper watershed are made aware of the impacts of their activities on farmers and other resident of the lower watershed. A natural resource, water, is thus the common thread among these stakeholders.

In India, development planners advocate watershed/sub-watershed approaches to planning for regional development. However, the experience in northeast India shows that planning and program implementation may not yield the desired results due to a lack of understanding of the ground realities, particularly in tribal areas. Natural resources such as water are not always the common factor among northeast tribes.

In the northeast, overlapping tribal and village boundaries are common within one watershed area: there may be two to three different tribes in one watershed; or two to three villages in a watershed may belong to the same tribe. Although cooperation persists among these neighboring villages, rivalry and competition can also be serious.

Recently, village planning was introduced for the treatment of degraded lands (mostly swidden fallow areas) in the development of the Catchment Area Treatment (CAT) Plan of the River Valley Project (e.g., Doyang Hydroelectric Project in Nagaland) and the Community Biodiversity Conservation Project of the North Eastern Council. The process had these advantages:

- The geographical boundary at the village level is well defined and understood.
- The concept of "community" is much better understood than that of "watershed." Community members more easily relate project benefits to their own situation.
- Though there is no existing institution in place for watershed or natural resource management, it is possible to work through the Traditional Village Institution (TVI).

Contributed by Vincent Darlong
Nagaland, India

alternative for shifting cultivation communities.

3. Situational analysis – this is the primary data collection stage typically involving a resource inventory and assessment. The inventory is like a stocktake of the various community resources and the subsequent assessment involves some analysis of the uses, conflicts, and opportunities presented by each.

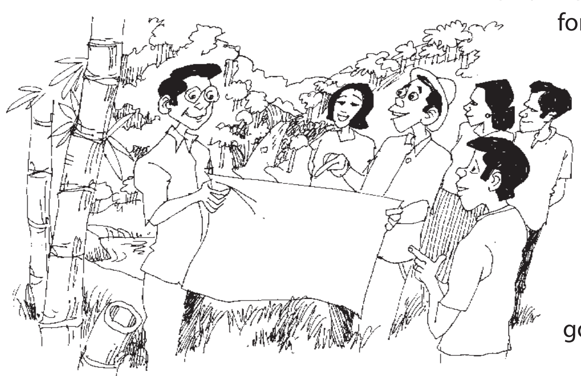
4. Optimizing resource use – balancing the various resource demands is often difficult and time consuming. It is critical to have all the main stakeholders involved and while concensus is not always achievable, participants must be open to considering other opinions.

5. Documentation and recording – depending upon the planning objectives, documentation and recording may proceed to a defined format. Case Study 2 below describes a successful documentation of community level planning in the Philippines.

CASE 2 – Community Land Use Planning in the Philippines

Two communities in an island on the western Philippines learned that a mayor and other officials were intending to make land use plans for their island but they had not been consulted. The people organized themselves and used wrapping paper to make their own plans, not only for their land but also for the surrounding waters.

They decided that the nearby caves, where the swallows made their nests, were to be protected very carefully and only a limited number of local people were allowed to harvest bird nests for sale. Two small bays were to be kept as fish sanctuaries and no fishing would be permitted. Other ocean areas would be for fishing but only by local people using small nets, spears or hooks. Some areas in the island could be utilized for shifting cultivation, other areas for residences and backyard gardens and one small area was opened to limited eco-tourism. The remaining portions of their islands were to be kept as sanctuaries for wildlife although a small amount of timber harvesting would be allowed.



The communities gave their plans to a local organization which converted it into a prototype for the benefit of government officials. The community plans were more thorough and protective than those proposed by the government officials.

Contributed by: Delbert Rice
Kalahan Educational Foundation, Philippines

6. Implementation, management and monitoring – resource planning provides an opportunity for communities to coordinate the implementation of community development activities. It also permits the monitoring and evaluation of the implementation as baseline information has been collected during the situational analysis.

Some planning tools and methods

A planning process requires management and skilled facilitation. Some institutions have specialized in this and many tools have been developed for the purpose, including:

1. Various participatory processes e.g. Participatory Rural Appraisal (PRA); Community Problem Analysis (CPA) and so on.

2. Community mapping and modeling – community mapping is described more clearly in Case Study 3.

3. Geographic Information System - GIS is a computer software developed for the collation, storage, analysis and outputting of spatial data. Such data is often contained within maps but more importantly the GIS software allows the data to be analyzed and manipulated in a fashion not always possible or convenient with a printed map.

CASE 3 – Community Mapping

Community mapping is a participatory exercise to map the various resources of the community. The perspectives, scale and symbols used are selected by the communities themselves and these often reflect the relative importance of certain resources from their viewpoint. Such maps are extremely useful during all planning stages including data collection, analysis and plan preparation. But more than this, community mapping entails a participatory process that has many advantages in building community confidence, awareness, concensus and the ability to present their plans to outsiders.

The useful publication "Community Mapping Manual for Resource Management" (DENR & ESSC, 1998) describes a process whereby plastic sheets and pens are issued to the community members to produce a map. The sheets are subsequently scanned and digitized allowing its integration with the formal technical maps used by outsiders. The specific stages are as follows:

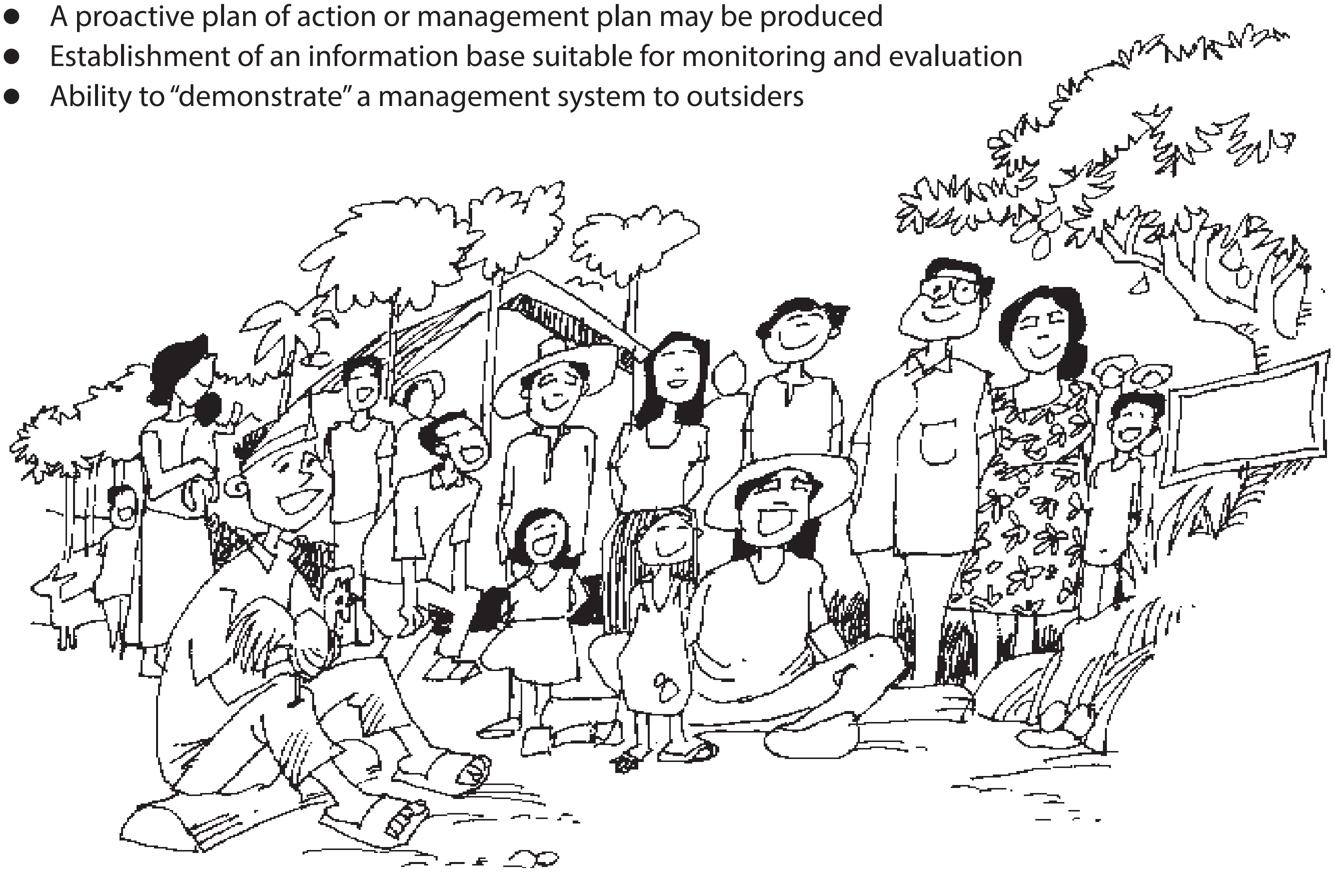
- Networking/initial consultations
- Data preparation: profiling the community and collating secondary information
- Site analysis and community interaction: orientation and establishing working relations
- Community mapping: map production, dialogue and verification
- Technical integration: GIS overlay with technical maps, data updating and technical analysis (see GIS for Planning and Monitoring Land Use Practices in Shifting Cultivation Areas, pages 338-342)
- Validation/feedback

All planning outputs are returned to the community at each stage of the process.

Advantages of community-level planning

Resource use planning has advantages inherent in the process of bringing stakeholders together to discuss and reach some concensus on the optimal use of their resources. Recent developments in devoluton have supported local initiatives in legislation and resource use planning. Community level resource planning has been undertaken in many countries throughout Asia and some of the advantages include:

- Empowerment of individuals, groups and communities
- Better understanding and awareness of local resources
- More rational and optimal resource use
- Conflict resolution and avoidance
- A proactive plan of action or management plan may be produced
- Establishment of an information base suitable for monitoring and evaluation
- Ability to "demonstrate" a management system to outsiders



Reference:

DENR and ESSC. 1998. Community Mapping Manual for Resource Management. Environmental Science for Social Change, Loyola Heights Subd., Quezon City, Philippines. GEBA.

Prepared by
John Freeman

Resource book produced through a participatory writeshop organized by IFAD, IDRC, CIIFAD, ICRAF and IIRR.

Documentation and Revitalization of Community Ethnobotany from Shifting Cultivation Forest Fallows

In areas where shifting cultivation is practiced, a wide variety of products is harvested from the forests. These include foods, medicinal plants, building materials, fibers, fuel and fodder. In the Solomon Islands, it is estimated that most communities utilize more than 400 species of plants from the forest. The forest food plants harvested provide an important source of food especially in times of crop failure or shortage in certain seasons.

The management of shifting cultivation fallows has a direct effect on what types of plant and animal products can be harvested from the fallow vegetation. Changes in fallow periods and management would affect these wild food resources.

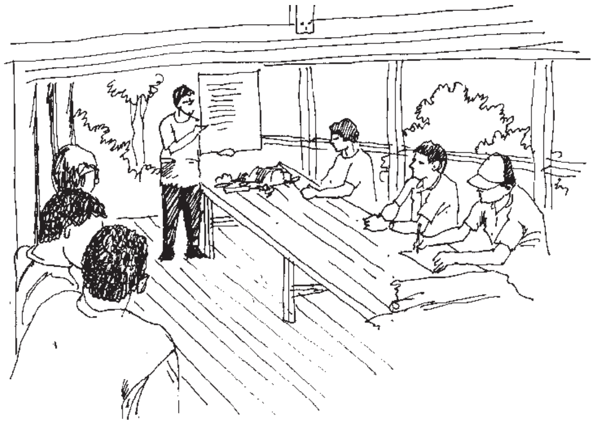
In Babatana, a community-based ethnobotanical project was initiated to investigate community knowledge of forest food plants and revive their use in order to promote sustainable forest management.

Reserve area

The reserve areas are places where gardens are not allowed to be made. This may be the "tabu" or grave sites. But some things can be gathered from these places such as leaves, lawyer cane and other ropes. Tabu sites are often very useful as they preserve patches of primary forest in areas where the rest of the forest may be far away.

The area may be too steep to make a garden and is also reserved. In some tabu places, whether things can be harvested or not will depend on the type of spirits that belongs to that place.

The project



Four community workshops were facilitated over a period of two years to collect ethno botanical data on the forest food plants known in the Babatana communities. In the first workshop, the model and guidelines that were designed by the participants themselves, were established. A large group of local men and women of mixed ages from nearby communities collected the plants, recorded the information, compiled the manual and planned community education initiatives.

This group was adequately trained so that later on, they could be the village's 'ethno botanists', to lead initiatives in other communities even without the assistance of people outside their locality.

The first workshop participants should return for the follow-up workshops to provide continuity and consistency in the training process. This activity would also allow them to have broader training in ethno botanical methods as they progress throughout the succeeding workshops.

Lauru residents were requested to attend the workshop and if possible, the training may be extended to other language areas of Lauru. Another year was spent with small working groups, editing and compiling the data into a suitable manual format for community use.

Collection of plants

Plant specimens of all the forest food plants in the book were collected during the workshop. The plants were found in the wilds and collection forms were filled up on the same site where the specimen was located. The information gathered included descriptions of the stem, both sides of the mature leaves, fruit and flower if possible. Actual specimens of the collected plant species were used during the discussions. This helped the participants in familiarizing themselves with the plant. After the discussions, the specimens were turned over to the National Herbarium for scientific identification and reference.

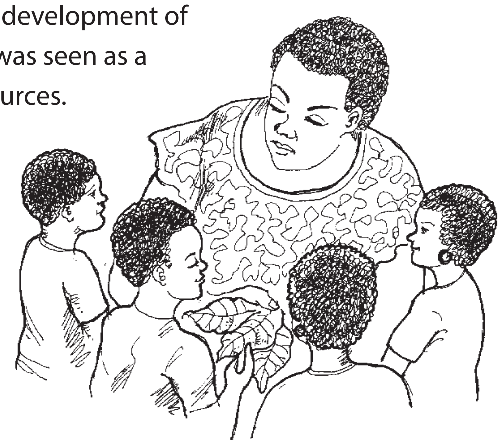
After each workshop, the groups reported back to their communities in an informal gathering after church services where the importance of the forest food plants, traditional knowledge and forest conservation were shared and explored. Some of the participants also talked in primary schools where there was a lot of interest from the students and the teachers. It was decided to try and build on these experiences.

Preservation

- Each collected specimen is laid flat on a piece of paper
- If necessary, leaves are folded to reveal both sides of the leaf
- The newspaper is folded on top and the plant press is then tied together tightly
- Each extra leaf specimen can be added on top until the press is full
- The specimen can last for a couple of weeks as long as they are kept flat in the paper
- The press should be stored in a warm and dry place before it is turned over to the National Herbarium for drying

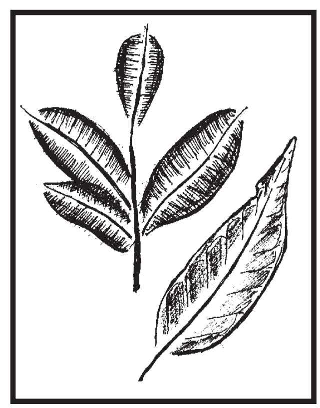
Education in the community

In the early stages of the project, key elders in the group requested the development of some special approaches in working with young children. The project was seen as a suitable venue for the children to learn about the forest food plant resources.

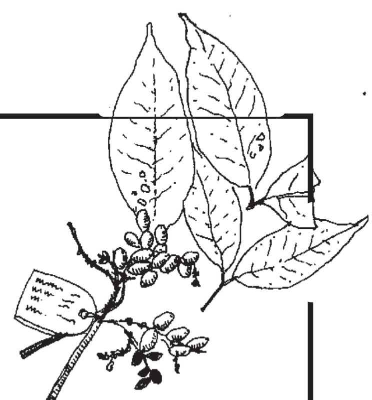


After the workshop in Sepa, it was decided to develop some activities with the local primary schools. Students were asked to collect the bush food plant leaves and print the leaves on a paper, as part of the classroom exercises developed by the teachers. It was envisioned that this would be a valuable education initiative. At the same time, the product of the workshop was used for the final manual.

Teachers developed successful activities which enabled the integration of the education of traditional knowledge of forest food plants into the existing curriculum in innovation ways. The teachers' experience would be replicated on a wider scale.



Sample recording system



Common Name: Gnetum gnemon

Edible part: Leaf and fruit

Plant Type: Nut Tree

Vegetation Types: Recent and old secondary forest

Landform: Hills and flat areas

Height and Size: Two fathoms. It has a red flower. The fruit is yellow or red.

Availability in the Bush: Plenty

Harvesting, processing and cooking:
Collect the young leaves. Boil with water or with coconut milk. Fruits are also cooked in an open fire. Unripe and ripe fruits can also be boiled with water.

Cultivation: Seed

Prepared by
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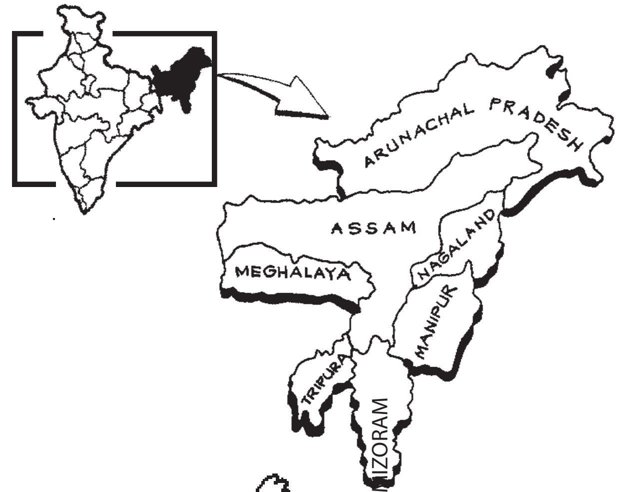
Resource book produced through a participatory writeshop organized by IFAD, IDRC, CIIFAD, ICRAF and IIRR.

Strategies for Developing Areas Practicing Shifting Cultivation in Northeast India

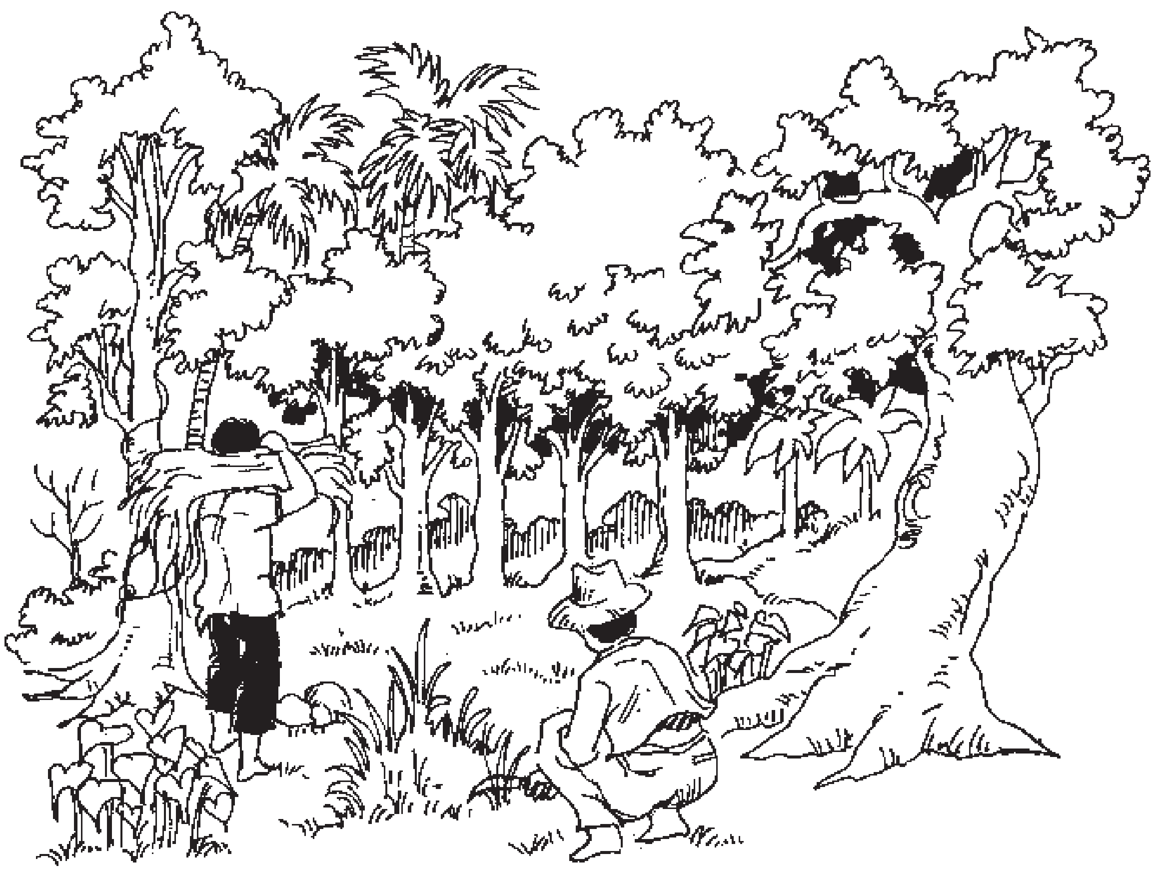


A typical Indian approach and strategy for developing areas practicing jhum (shifting cultivation) has been to contain, if not progressively reduce areas under shifting cultivation; and/or reduce the number of families practicing it. In order to achieve this goal, the government has introduced the Jhum Control Program, wherein the areas under shifting cultivation are transformed into other land use practices. The jhumias (shifting cultivator) are resettled or rehabilitated with permanent land use occupation. The most popular and successful programs are cash crop plantations (rubber and tea), tree farming and horti-silvicultural practices.

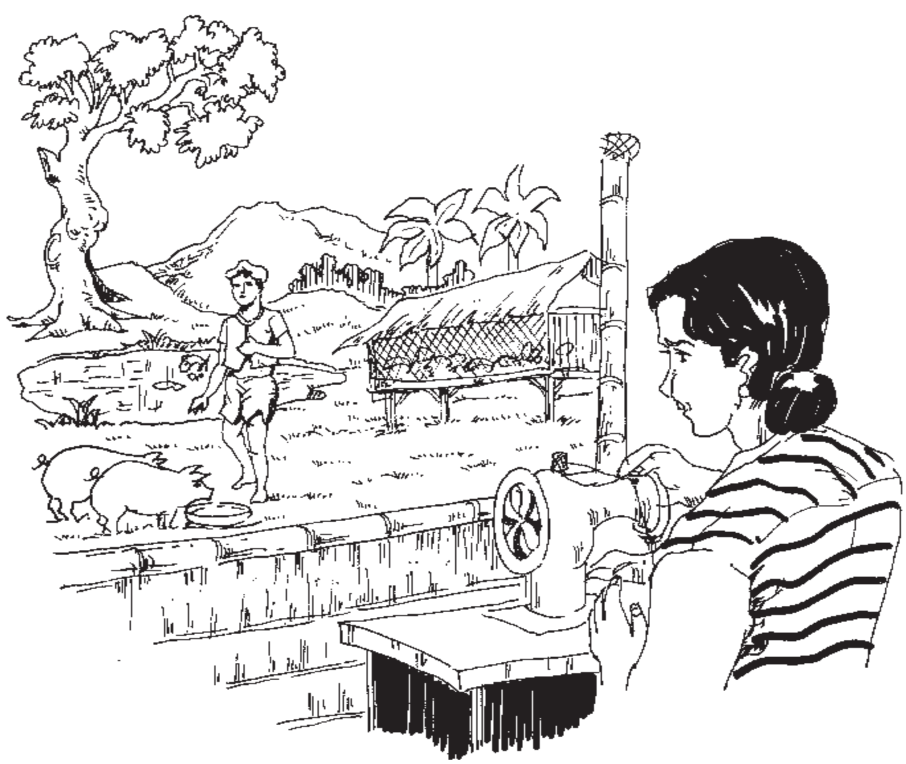
Strategies for development of areas under shifting cultivation in Northeast India

Strategies	Lessons
■ Transform the jhum lands into terraced lands with irrigation facilities to encourage settled cultivation, at the same time assuring other inputs such as agriculture extension services, fair price shops, roads, communications and marketing facilities. Large areas of suitable lands have been converted into terraced fields with minor irrigation facilities (at least during the monsoon months) in Nagaland (Angami areas in Kohima district and Chakhesang areas in Phek district) and Manipur (Tangkhul areas in Ukhrul district), where paddy-cum-fish cultivation is very popular. In Nagaland, terracing is promoted by the Soil and Water Conservation Department.	Some developed lands have brought in settled cultivation and improved productivity and economy for the farmers (by way of selling fish). However terracing without irrigation facilities (depending only on rain) has not brought any benefits to the cultivators. Such farmers (in some parts of Tripura and Garo Hills of Meghalya) tend to return to shifting cultivation.
■ Identify areas suitable for plantation of perennial crops (rubber, tea, coffee, etc.) that would give subsidiary occupation for a family on the basis of one hectare of plantation. Degraded fallow lands and/or forest lands were converted into rubber plantations in Tripura. Such programs are executed by the Tripura Forest Development & Plantation Corporation and Tripura Rehabilitation Plantation Corporation with funding assistance from Rubber Board, Tribal Welfare Department and loans from commercial banks.	This is a good proposition for settlement programs for shifting cultivators. However, being a costly project, it cannot reach a large population needed to be resettled. This program could not be implemented without assistance from the government. Other requirements of the cultivator need to be also internalized in the program.

Strategies	Lessons
■ Develop grass reserves to support a subsidiary program of animal husbandry. This program has only been partially successful in some parts of Arunachal Pradesh and Tripura. In Manipur, the program has succeeded on its own through the local efforts of the traditional people of Nepali origin who are trained in dairy farming by profession.	This has brought a new dimension of economic incentive to the farmers by selling milk, among others. However, one constraint in Tripura is the availability of sufficient land for the project.
■ Develop suitable areas for agri-silvicultural, horti- silvicultural, commercial forest plantations, tree farming that would give full occupation to a large number of village population. Pineapple cultivation in Tripura promoted by the Agriculture Department, Tribal Welfare partment, Tripura Tribal Areas Autonomous District Council; banana/sugarcane plantations in Mizoram promoted by the state Agriculture and Horticulture departments; and tree farming in Nagaland promoted by NEPED).	Both pineapple and sugarcane/banana cultivation in Tripura and Mizoram had brought in a measure of settled occupation to the communities with improved economy. Tree farming is now a 'movement' in Nagaland.



Strategies	Lessons
■ Bring out Enabling Resolution (people participate in the protection, regeneration and management of government forests) to implement Joint Forest Management (JFM) for development of areas under shifting cultivation. The states of Arunachal Pradesh, Assam, Manipur, Mizoram, Nagaland and Tripura have brought out the enabling resolution.So far, the successful examples are only from the state of Tripura.	Wherever people have first hand experiences of the adverse conditions of forest degradation, such as in Tripura, JFM programs tend to be more successful than the other areas. While JFM resolutions are clear in terms of peoples' partici-pation in government forest lands, the mechanisms and benefits of government parti-cipation in people-owned forests are yet to be worked out in detail.
■ Allot 2 ha of land to each family of shifting cultivators for permanent settlement, one ha of which will be developed for wet rice or terrace cultivation, while the other one ha will be developed for forestry and horticulture. This has been implemented in Mizoram under the New Land Use Policy. The Local Self Administration Department of the State Government allots land with input from state departments of forest, horticulture, agriculture, veterinary & animal husbandry, rural development, etc.	Slow progress of the program is due to limited availability of suitable lands for large number of families. Non-availability of sufficient funds for development of wet rice cultivation is another drawback. Poor extension services of the state government departments involved in the program; non-availability of timely loans to the farmers for forestry and/or horticulture development; and non-availability of additional land beyond 2 ha per family even when the family sizes grow or increase also interfere with the successful implementation of this program.



Strategies	Lessons
■ Implement the Integrated Jhumia Rehabilitation Program to help the cultivators. This is a composite program of resettlement of shifting cultivators through allotment/development of land and development of micro-enterprises for economic improvement (i.e. pig rearing, poultry farming, apiculture, fishery, carpentry, tailoring, handlooms and handicrafts). (This has been implemented by the Tribal Welfare Department of Tripura government, both as rehabilitative measures for the shifting cultivators and supportive measures of the generally marginalized tribal communities of the state.)	The program helps in the resettlement of shifting cultivators into productive occupation. It likewise, improves the general economic and social conditions of otherwise impoverished tribal communities of the state. It also reduces the dependency of jhumias on shifting cultivation in some parts of the state.

One important role of the government is to encourage NGOs and the government-sponsored societies to take up activities for sustainable management of shifting cultivation. The two most important organizations in the North-East region of India in the areas of shifting cultivation are the Nagaland Environment Protection and Economic Development (NEPED) and the North Eastern Regional Community Resource Management Society (NERCRMS).

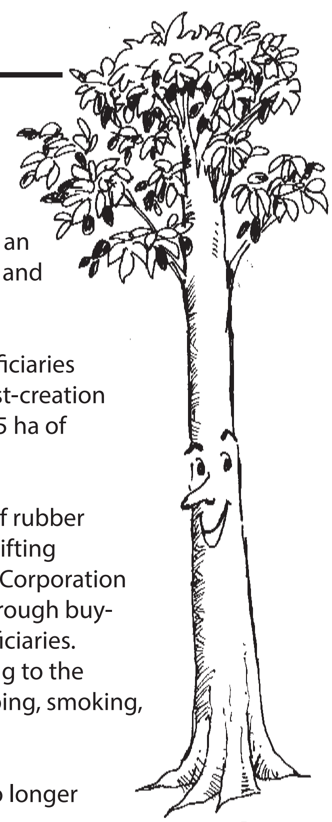
Success Story through Rubber Cultivation from Tripura

Rubber plantation-based rehabilitation projects for shifting cultivators have been undertaken successfully by the Tripura Government. This was done through the Tripura Rehabilitation & Plantation Corporation (TRPC), an agency knowledgable in the technical requirements of rubber plantation and rehabilitation activities.

The TRPC undertakes the creation of rubber plantation wherein the beneficiaries (the shifting cultivators to be settled) are initially engaged in pre- and post-creation activities. Thereafter, the beneficiary-families are allotted an average of 1.5 ha of rubber plantation or approximately 600 rubber trees per family.

Between 1983-2000, the Corporation is reported to have raised 3591 ha of rubber plantations under different schemes, benefiting about 2240 families of shifting cultivators belonging to the Reangs, Tripuris, Debbarmas, Garos, etc.. The Corporation has also set up "Smoke Houses" and continues to back up the program through buy-back schemes of the smoked rubber sheets being produced by the beneficiaries. The Corporation in association with other organizations also offers training to the beneficiaries in various aspects of rubber cultivation & maintenance, tapping, smoking, sheet making, preservation, etc.

It is reported that the jhumias rehabilitated through rubber cultivation no longer return to shifting cultivation.



Prepared by
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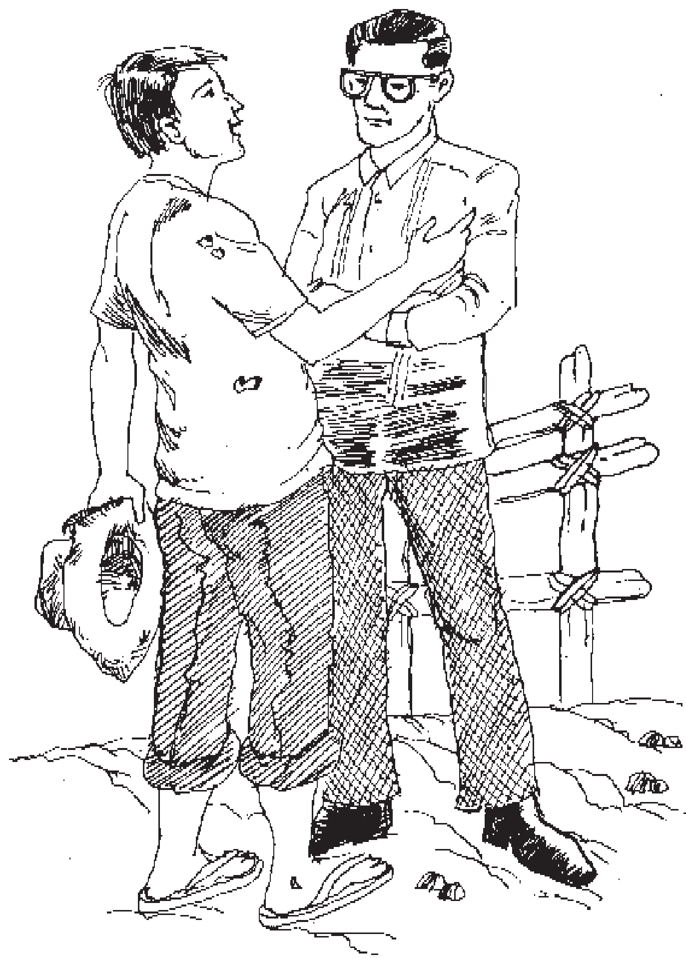
Resource book produced through a participatory writeshop organized by IFAD, IDRC, CIIFAD, ICRAF and IIRR.

Enhancing Sustainability of Shifting Cultivation in the Philippines through Policy and Institutional Support



Shifting Cultivation has been praised as a sustainable and environment-friendly form of land use. On the other hand, it is also condemned as a harmful system that destroys forest resources and damages upland ecosystems. These opposing views have often resulted in confused public perceptions and contradictory government policies. Also refers to Shifting Cultivators: Are They to Blame for Deforestation?, pages 44-48, and Shifting Cultivation: Myths and Realities, pages 41-43 for more discussion on this.

Why do shifting cultivators shift?

Like other tillers of the soil, many SC farmers wish to have permanent farms. However, they are forced to change sites for the following reasons:

- loss of organic matter, soil fertility and productivity through nutrient exportation and accelerated erosion;
- decline in crop yields due to competition with weeds;

- insecure tenure,
- rapid population increase; and
- cultural practices.

Cultural Influences

In Papua New Guinea and Laos, shifting cultivators abandon their farmsites and move to a new location when a family member dies.

Reasons of government for sedentarizing shifting cultivation

Campaigns to stabilize shifting cultivation have been launched for the following reasons:

- perceived destruction of the diminishing forest resources (some have policies to maintain a certain percentage of land under forest cover);
- ecological damage in the uplands and collateral damage in the lowlands;
- apparently wasteful and inefficient use of limited land resources; and
- desire to bring all citizens under the formal scope of the government.

Strategies used for stabilization

Two principal strategies had been employed by the Government in their past attempts to sedentarize shifting cultivation.

1. Legal measures

Laws have been enacted making it unlawful to cut and burn forests, occupy forest lands without permission, and grow non-forest crops in public forest areas. However, these laws have failed to stem the rising tide of SC farmers in public forests.

2. Socio-economic approach

Shifting cultivators in the ecologically fragile uplands were permanently resettled in areas highly suited to intensive sedentary cultivation.

For example hill farmers on densely populated Java Island have been transferred to the sparsely populated Kalimantan provinces under Indonesia's Transmigration Program. However, this approach is no longer a viable option in countries with high population densities and no more unoccupied arable lands, such as the Philippines.

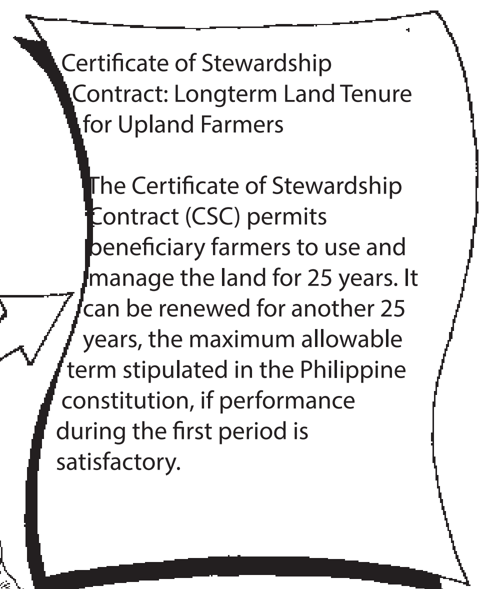
Since the above approaches have had limited success, some countries found it imperative to explore other alternatives. One promising option revolves around the principle of "development in place" which has two basic objectives. First is to maintain the productive capacity of shifting cultivation sites. Second, to neutralize or remove the forces that impel the transfer of SC farmers to other sites.

These objectives cannot be achieved in isolation. They must be accompanied by supporting policies and institutional action;

Policy support

1. Policy on land tenure

To eliminate their constant fear of eviction, reinforce their desire to settle on permanent sites, and motivate them to improve their farms and their outputs, farmers should be granted long term or, if possible, permanent tenures (see also Resource Tenure Systems and Stabilization of Shifting Cultivation, pages 55-60, for more details on this). The Philippine examples of giving Stewardship Certificates to individual farmers, Certificates of Ancestral Domains Claims (CADC) to organized tribal minorities, or Community-based Forest Management Agreements (CBFMA) to organized communities for 25 years, renewable for another 25 years under the provisions of the people-oriented forestry programs, seem to be attractive and effective. While this tenure is not permanent, many farmers have been induced to participate (see Community-Based Forest Management in the Philippines: Evolution, Lessons and Challenges, pages 391-396).



2. Policy on Land Use

Many forestry authorities in the region still adhere to the strict "forest crops for forest lands" policy. Thus, even if farmers are granted secure tenures over forest lands, they may find it difficult to survive if not allowed to raise food crops. Thailand and the Philippines used to have this strict land use policy. They have since tempered it and now allow integration of food crops with tree crops under agroforestry systems. They have established programs that enlist the participation of shifting cultivation farmers in people-oriented projects that permit the planting of non-timber trees like rubber, fruit trees, coconuts and mulberry on public forest lands. The farmers welcomed this change and many have been encouraged to become sedentary farmers.

3. Policy on forest products extraction

In past decades, large corporations had the exclusive privilege to harvest timber from the public forests. The farmers or local communities were only allowed to collect non-timber forest products. But now, in line with the shift towards people-oriented forestry, more harvesting rights are bestowed to farmers and local communities, thereby making available more livelihood opportunities to them.

Technical support

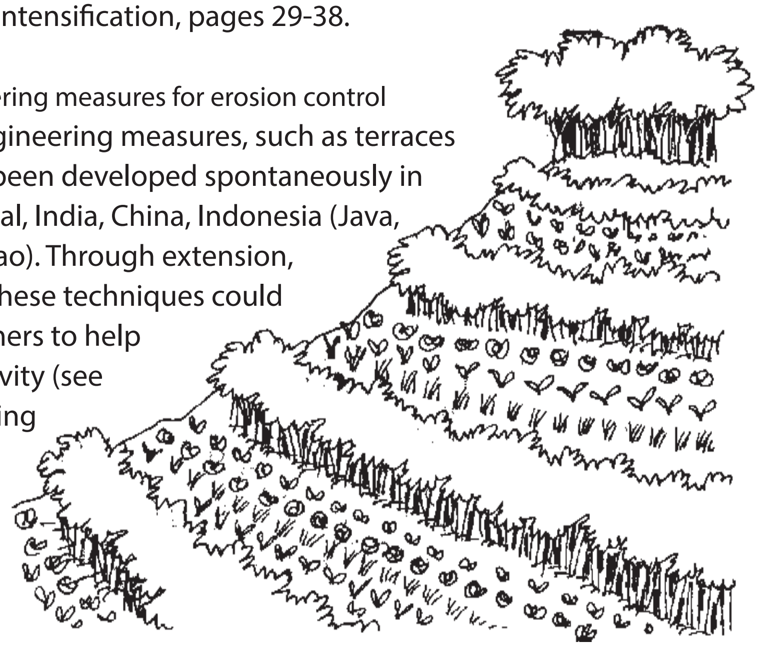
The provision of technical and institutional support is also essential to ensure and improve site productivity.

1. Technology transfer: vegetative measures for maintaining site quality

Upland farmers are aware that forest vegetation minimizes erosion and restores/preserves productivity. Thus, vegetative approaches to erosion control can be easily understood and adopted. These approaches include contour hedging, using leguminous cover crops, laying tree stems along contours to impede run-off and reduce erosion, and applying green manure as mulch and organic fertilizer. The use of vegetation can be doubly beneficial. Aside from minimizing soil and nutrient loss, it also helps in Nitrogen fixation and soil fertility build-up through accumulation of organic matter. Care must be exercised to develop appropriate models - see Economies of Labor and Information on Swidden Intensification, pages 29-38.

2. Technology adoption: engineering measures for erosion control

Soil conservation through engineering measures, such as terraces and contour rock walls, have been developed spontaneously in several countries, such as Nepal, India, China, Indonesia (Java, Bali) and the Philippines (Ifugao). Through extension, training and demonstration, these techniques could be disseminated to other farmers to help maintain their farms' productivity (see Catalyzing Innovation in Shifting Cultivation Communities: Experiences from Palawan, PhilippinesI, pages 326-334).



Institutional support

1. Capacity-building

Capacity building, through training, is an important means to help in sedentarization. When the farmers acquire knowledge, they will understand the reasons for, and the advantages of, converting to stabilized cultivation. This may lead to development of positive attitudes towards settled agriculture and in turn, may motivate them to make their farms sustainable.

2. Creating public awareness through information and education campaigns

Public awareness about the economic and ecological costs and benefits of shifting cultivation could influence SC farmers to adopt more stable farming practices. Government-sponsored media and information networks could be tapped for awareness campaign.

3. Research and development

Government research directed towards achieving productivity and sustainability of upland farms should be accelerated. The results of such research can be used by shifting cultivators for stabilizing their farms (also see Participatory On-Farm Experimentation and Evaluation, pages 322-325).

4. Infrastructure assistance

In most cases, shifting cultivation farms are remote and inaccessible, so farmers can hardly avail of social services (education, health, communication). In addition, transporting their products to market becomes difficult. Government assistance in infrastructure development is necessary to help alleviate these difficulties.

> Indonesia's Transmigration Program in Kalimantan includes the initial building of homes, installation of electrical/water systems and building of access roads. Thailand's Forest Village program established to sedentarize the nomadic northern mountain tribes included similar infrastructure assistance. In the Philippines, the construction and maintenance of access roads and trails in CBFM areas have served as incentives for SC farmers to settle down.

5. Credit assistance

Investment capital is needed to maximize production beyond subsistence needs to generate marketable surpluses. The government needs to formulate policies that encourage credit institutions to lend funds to the farmers under especially liberal terms not normally found in traditional banking transactions.

Institutional reforms to enhance assistance to SC farmers

1. Structural changes in government agencies

Most government line agencies possess regulatory powers that place them in direct confrontation with farmers, giving rise to the "us against them" attitude on both sides. This attitude makes it difficult to promote collaborative activities between them. Some countries have undertaken vital institutional reforms that place more emphasis on "developmental" rather than "regulatory" functions of government agencies. Hence, an interactive information and technology flow between the government, line agencies and the farmers is now feasible.

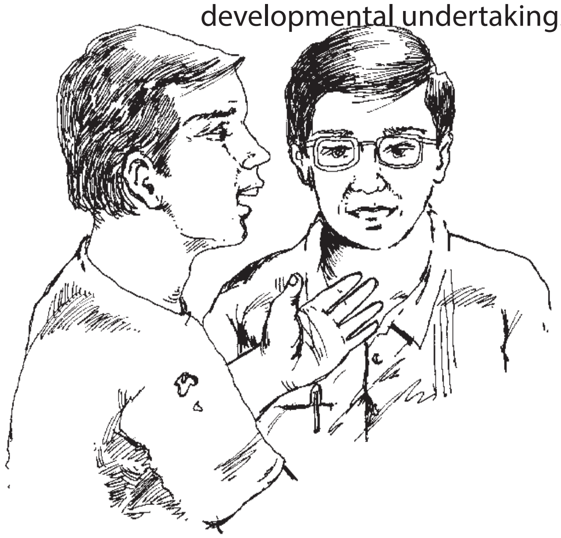
2. Institutionalization of customary laws

Government recognition of customary laws helps to support the stabilization of shifting cultivation. For example, since indigenous communities emphasize communal rather than individual resource management, the Philippines' DENR adopted the approach of granting permits to communities instead of individual farmers for community-based forestry operations. This action encouraged farmers to actively participate in community forestry programs.

- Thailand's Royal Forest Department set up units such as the Divisions of Community Forestry and Private Land Reforestation to assist farmers in forest management and conservation.
- In the Philippines, the Community-based Forest Management (CBFM) Division under the Forest Management Bureau (FMB) of the Department of Environment and Natural Resources (DENR) was set up to guide in the management of people-oriented programs of the national government (see Community-Based Forest Management in the Philippines: Evolution, Lessons and Challenges, pages 391-396).

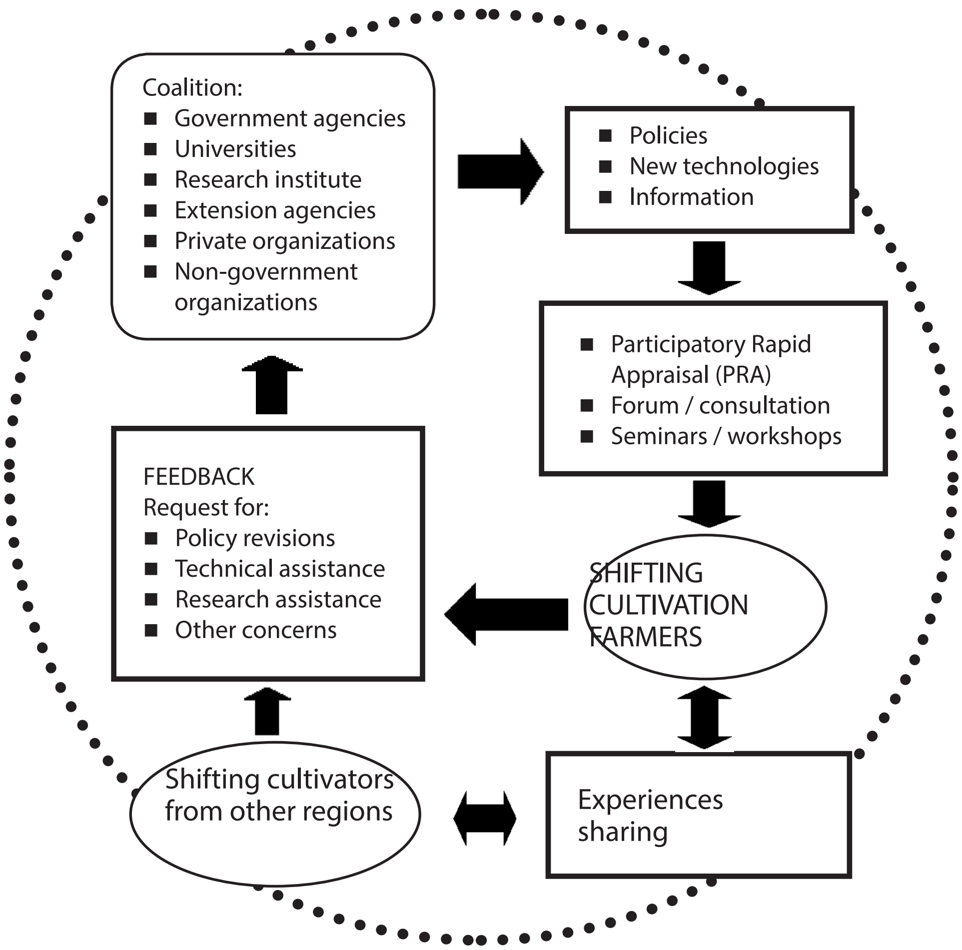
3. Institutional support through NGOs

In the last three decades, governments have sought Non-Government Organizations (NGOs) as partners in developmental work, having observed their effectiveness in dealing with rural communities. Institutional adjustments have had to be carried out to make this partnership possible since, at the country level, regulations normally do not allow such government-private sector collaboration in these types of developmental undertakings.



The government and its line agencies play a vital role in stabilizing shifting cultivation which, in effect, help in advancing the socio-economic development of the shifting cultivation farmers. The capacity and willingness of government agencies to implement controversial but necessary people-oriented programs and projects are extremely necessary. If the government will not genuinely push such programs to realization, then the desire to make shifting cultivation sustainable will remain an unrealized dream.

Interactive Information and Technology Flow



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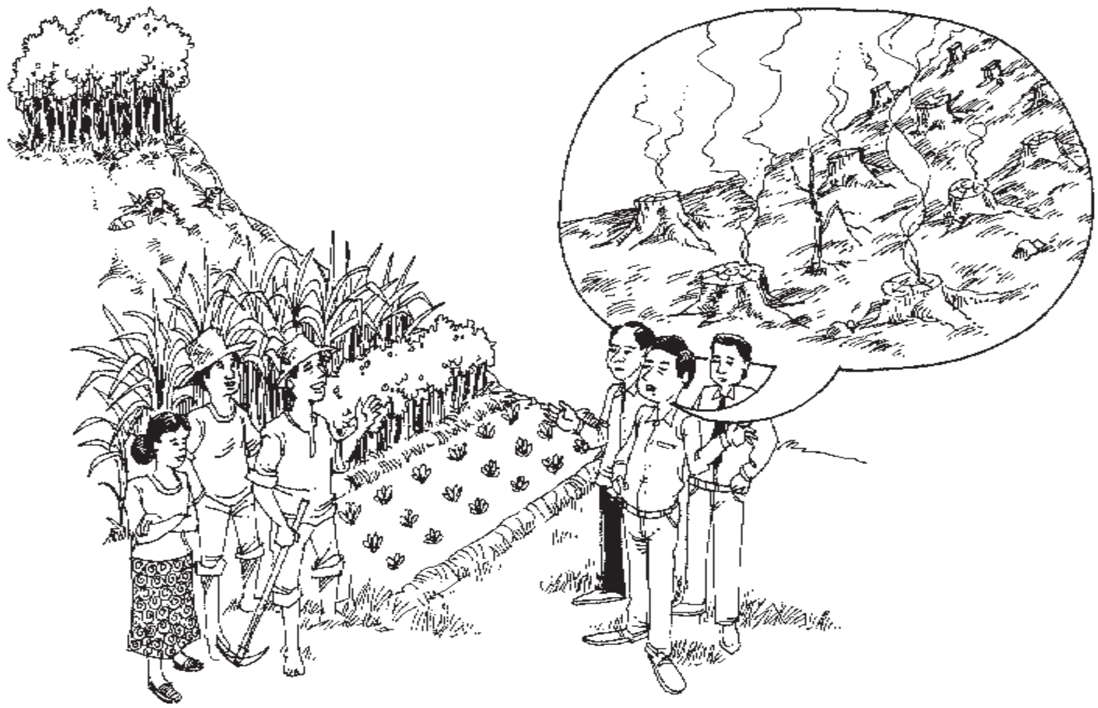
Influencing Forest Policies through Local Realities



Competing demands for resources and difference in viewpoints about the relative merits of various land uses have contributed to difficulties in the management of shifting cultivation (SC). Some of these problems may be resolved through clarification of the issues often highlighted by the policy makers and formulation of appropriate policies. Policy makers also need to be sensitized and reoriented through convincing information and dialogue.

Public perception of SC

Based on scientific evidence, social and biological experts generally believe that SC is socially acceptable, ecologically stable and economically viable. However, a large segment of the general public only see the destruction of forest vegetation and the associated negative impacts, such as erosion of denuded slopes, siltation of streams and flooding of the plains and valleys, and therefore consider SC destructive. Owing to the rapid spread of this negative view among the people, public opinion against SC has grown to such an extent that it has influenced the policy-making process to the detriment of the interest of SC.

Sustainability

Because the majority of policy makers are able to appreciate only the cropping phase of SC and regard the fallow as land that has been damaged and rendered idle and unproductive, they often fail to recognize that the whole system is capable of being sustainable under an intensive fallow management. It is possible, however, that they may alter their views if shown clear evidence of sustainability. This however, needs to be manifested in the form of policy statements.

Land availability

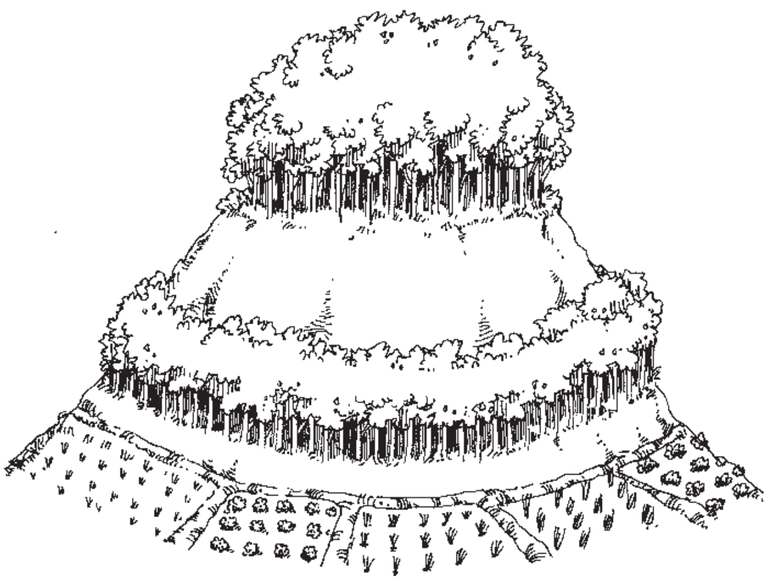
Rapidly expanding populations have led to fast decline in per capita land availability. Since SC requires at least five times more land to support a farm family compared to intensive sedentary agriculture, the diminishing availability of land would make the practice of sustainable SC (as practiced) increasingly difficult. A modified and ecologically managed version of SC is necessary to address this problem.

Compatibility with forest laws

Existing forest laws in Asian countries usually limit the operations and activities that may be allowed within public forestlands. SC, with the associated forest clearing, annual cropping and occupancy for both farm site and home site purposes are, in most cases, not in the list of legally permitted activities. Thus, SC is generally considered an unlawful activity in the guise of traditional system of land management.

Analysis of policy and legal framework

Land use policy



Many countries lack scientifically drawn land use policies that could guide the concerned government agencies in using the land in a sustainable manner. In many countries like Nepal, India and Philippines, agriculture and shifting cultivation continues on steep lands of more than 60% slope. Tree plantation programs have had limited success in many countries because of the allocation of substandard (poor quality) land for afforestation. The land use policy should take into consideration the land use capability classification and land use policies. Some countries have arbitrarily decided to achieve a target of 33% forest cover in the country as a whole and 66% in the hills. However, a more realistic approach is needed to maintain ecological balance as agro-forest and horti-silviculture also meets the definition of forests. This will broaden the scope of the definition of forestland and reduce pressure on the remaining forests.

Land and Tree Tenure

Constitutions of most Asian countries provide that the source of all legal authority in the country is "inherent in the people." But in practice, the community forestry rights rests with the state which hands over the forests, especially use rights, to the community-based user or management groups. However, in many countries the provision is only in the book. In Nepal for example, forestry laws clearly state that user groups do not own the land but only usufruct rights of management over the trees and the derived forest products. It can be argued that tenurial control over trees and management rights of harvest provide only a limited degree of security and incentives for investment in the land. In the Philippines under the community -based forest management program of the government, forestlands are contracted to the local communities for 25 years but the government still retains the right over the marketing and commercial use of the products. Therefore the best tenurial policies should be a package for complete control and use rights over land, trees and NTFPs with elements of social accountability and responsibility enshrined in the devolution agreements.

Policies for forest management

The major issue in forest management in developing countries is the growing resource scarcity leading to a serious imbalance between supply and demand. In many countries, there is a move to increase land under protected areas (PAs) both to protect endangered species and to comply with the international covenants such as Convention on Biological Diversity (CBD). This has further reduced the areas under forest. Therefore, even if the government devolves the management authorities to the communities, there is an urgent need to increase the productivity of the forests handed over to the community. This requires that the communities should also be given rights to change the composition of the forest species. However, in many countries under the conservation laws, selection felling of mature trees is not permitted. This serves as disincentive to improve productivity of the forest. There are also legal hurdles in transporting of forest produce outside the community boundary. An ideal forest management policy should allow all forest operations, including Timber Stand Improvement (TSI), thinning, selection felling, assisted natural regeneration and enrichment planting activities to the community. Since these operations involve technical inputs, the involvement of forest department is necessary.

Marketing policy

Markets play a major role to provide incentives to the community to invest their labour, skills, knowledge and organization skills in sustainable conservation and management of forest resources. Forest policy should make marketing and transportation rights of the community as one of its integral components. The traditional forestry laws have a clear requirement of source certification for movement and marketing of forest products. The authority to issue the certification is generally retained by the Forest Department. However, communities who are recognized to have capacity and culture of following good management practices (GMPs) should also have this authority of certification of origin (or the Marker in forestry lexicon) to provide greater incentives for marketing. Government can retain the authority to monitor the process.

Policies on peoples' participation

Governments across Asia are incorporating clauses in their Forest policy documents to encourage peoples' participation in Forest Management. However, the policy on royalty fixation and granting concessions need serious revisions. Several governments are still practicing the system of royalty fixation based on the system developed during colonial rules. A more scientific way of determining royalty could be based on the products market price and charging 10% of the price as royalty. Also, many governments allow concessionaires to use forest for nationalized forest products, which infringes community rights in their forest and dampens the spirit of community-based forest management. Therefore, there is a need to reform the outdated policies on royalty fixation. Communities should have responsibilities for resource development as well as utilization. The revenues earned could be ploughed back in funding community development projects.

New policy initiatives

Experiments in Nepal, Indonesia, and the Philippines, among others, are attempting to revise forestry policies to support national sustainable management and conservation goals. Recently enacted laws and newly revisited legal interpretations in these countries now support providing resource rights to local forest area communities.

Elsewhere in the region, for example, in Laos and Vietnam, forest policies have also begun to enable local residents to obtain more secure land and resource tenure. In these latter cases, however, tenure or usufruct rights are being extended primarily to households rather than communities. This may lead to further fragmentation of the forest resource base instead of revitalizing traditional community-based arrangements.

Three general categories of policy mechanisms and arrangements for managing state forestlands through community participation are emerging in the Asia-Pacific region: forest protection committees, community agreements, and individual stewardship. Various programs and legal mechanisms are being initiated for vesting rights to individuals and communities in various countries. These examples form a good basis to guide future policy formulation process in Asian countries.

Policy formulation and intervention

Identification of policy makers

Policymaking is historically under the domain of national governments. The processes are basically similar among countries: the Executive Branch proposes policies, the Legislative Branch enacts them into laws, to be implemented by the Executive Branch, and the Judicial Branch settles questions of legal appropriateness of the policy. The executing line agencies formulate enabling rules and regulations to implement the policies. Some time policies are changed or suspended through government orders and circulars whose frequency should be reduced drastically.

How policies develop

Policies on forest resource management are formulated usually in response to felt needs or recognized problems. Thus, policies develop as:

- Direct reactions to burning problems of the country or locality (example: the Thai Parliament imposed a total logging ban because of landslides in a denuded hilly area in Southern Thailand)
- Response to requests of concerned sectors for creation of new policies (example: advocacy by NGOs helped impel the shift in the Philippines from corporate-driven to community-based forest management.)
- Action triggered by recommendations of external expert agencies. (Example: based on recommendations of ICRAF, nitrogen-fixing trees have become the "recommended" tree components of agro forestry projects in several countries.)
- Direct "people-power" action by the local people (example: farmers in Northeast Thailand made a strong stand against monoculture Eucalyptus plantations and favored the use of indigenous species in polyculture.)

Means for influencing policymakers and policies

To help insure that SC-related policies are relevant to extant problems, and their impacts are the desired ones, means must be found to enable target beneficiaries to influence policy makers and the policies that they formulate.

Lobbying by beneficiaries

Intended beneficiaries (or "victims") should avail of direct or indirect access to policy makers to express their views about the appropriate nature, scope and direction of policies.

IEC campaigns for policy-makers

If sufficiency and quality of available background information are questionable, policy-makers may be unable to create policies appropriate to the situation. Information and educational campaigns by NGOs could be a good means for "educating" legislators.

Direct participation in drafting policies

Some line agencies with responsibilities in policy implementation sometimes actually draft legislative proposals and submit them to "sponsoring" legislators for enactment into laws. This is a direct form of participation by implementers in the actual formulation of policy.

Policy implementation guidelines

In shifting cultivation areas, forests should be treated as the source of livelihoods to the local people followed by the repository of biodiversity. Its role as a source of revenue to the government should get the last priority;

Livelihood needs should be met through a system of sustainable use which the local community should implement based on a management plan of the forest designated for the community management;

Subsidies to the urban consumers in fuel wood, timber, water and other products and services sourced from forests should be completely removed;

Forest should be managed for multiple objectives as decided by the local community with technical feedbacks provided by the Forest department;

Government should have no role in the decision-making process related to planting, harvesting, marketing and enterprise developed unless agreed upon rules of management are seriously violated;

In cases where shifting cultivation is ecologically unsustainable and harmful to the greater public goods including the preservation of a unique environment/ecosystem, government should provide a viable alternatives to the community;

Government should provide a package of incentives to encourage sustainable forest management especially NTFP management through financial, regulatory, market and taxation related incentives; and

Government should invest in complementary infrastructure and support services in the shifting cultivation areas to encourage intensive and efficient resource management practices.

Use of local level success stories to influence national policies

Some of the NGOs across Asia are using a series of community-based resource management models as the indicator of their role in policy formulation. For example, in Nepal Annapurna Conservation Programme or APAC managed by a NGO: King Mahendra Trust for Conservation of Nature or KMTCN has been quoted as a replicable model of conservation through peoples' participation. In India, the success in conserving Mangrove biodiversity by MS Swaminathan Scientific Research Foundation or MSSRF has prompted the government to involve NGOs in drafting the country's biodiversity program and policies. In the Philippines, the success of Ikalahan Community in successfully managing their forests through community participation has prompted the government to initiate community-based forest management program in the country.

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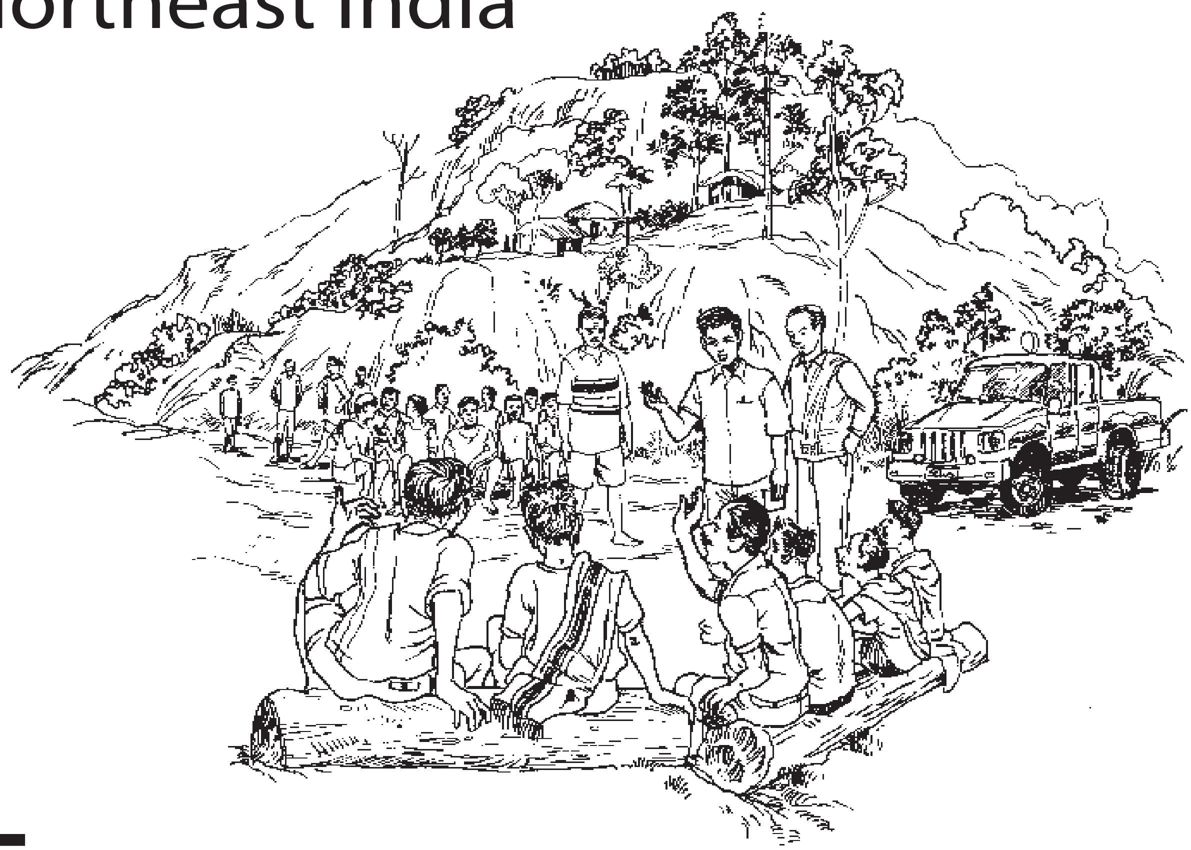
Resource book produced through a participatory writeshop organized by IFAD, IDRC, CIIFAD, ICRAF and IIRR.

Adoption of Joint Forest Management for Areas under Shifting Cultivation in Northeast India



The Joint Forest Management (JFM) program in India that has been implemented since the early 1990s has brought in a new hope and enthusiasm for the sustainable protection and management of government-owned forests by forming a partnership between the people and the government.

In Northeast India, where 52-92% of the forestlands are owned by the people or community, shifting cultivation is the predominant land use system. An adaptation of JFM, with the 'Revolving Fund' concept of the Community Biodiversity Conservation Project, is a possible option for managing the region's land and resources, particularly those lands affected by shifting cultivation. It should be noted that in the northeast, unlike other areas where JFM has been introduced, the land is generally communal tenure, not government.

Traditional Institutions that have authority over the forest lands in Northeast India

- Anchal Samities (in Arunachal Pradesh)
- Syiem/Durbar/Sirdar/Doloi (among the Khasi-Jaintias of Meghalaya)
- Nokma (among the Garos of Meghalaya)
- Village Councils (e.g. Putu Menden among the Ao in Nagaland)
- Traditional Chiefs (among the Kukis of Manipur)
- Village Councils (among the Nagas of Manipur & Mizos of Mizoram)

Stages in the JFM adoption process in shifting cultivation areas

1

Identification of the village for implementing JFM by Forest Department. Site selection is done at the village level as land ownership patterns are defined in the village.

2

Interaction with the traditional village institution/authority. Women and youth with clear supportive or facilitating roles should be involved. Involve other line departments such as agriculture, horticulture, rural development, health, education, etc.

3

Identification of local non-government organizations (NGO) as partners (e,g., Young Mizo Association in Mizoram, Mothers Association in Nagaland, etc.) in motivational activities.

4

Formation of Village Forest Protection Committee (VFPC), represented by a member of every household. Registration of VFPC under Societies Act.

Signing of a memorandum of understanding (MoU) between the VFPC and the Forest Department. (MoU may include benefits sharing mechanism, villagers' resolution to operate the JFM for a minimum of 10 years over the fallow lands, etc.)

5

Preparation of Microplan based on participatory rural appraisal (PRA). The Microplan, among others indicates the harvesting frameworks for the timber, non-timber forest products and other products to be developed and nurtured in the JFM sites. It also identifies the desired micro-enterprises of the communities with brief techno-economic profile for each identified activity. Microplan is prepared by the Forest Department in collaboration with the participating NGO.

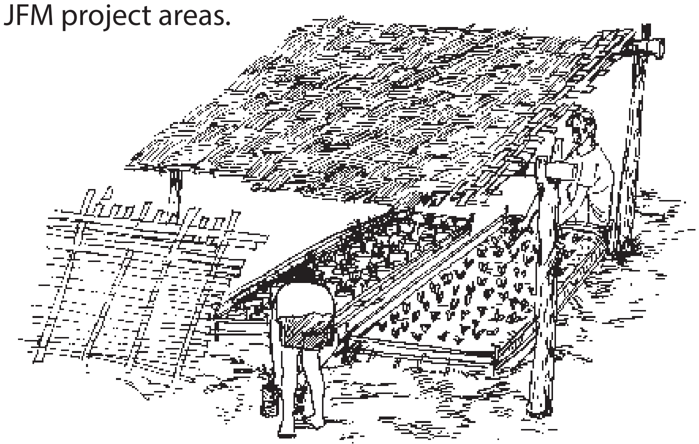
6

Delineation/demarcation of Jhum land along with the VFPCs, individual landowners and village authorities where JFM would be implemented.

Training

Training programs for the members of VFPCs, including women and youth are being funded by the government. These include the following areas:

- JFM project management, including accounting and record keeping.
- Nursery and plantation techniques, including plantation management.
- Management of micro-credits and micro-enterprises.
- Entrepreneurship development for micro-enterprises and skill development for value addition using raw materials such as canes, bamboo, timber, etc.
- Training on marketing and trade opportunities. Training for extension workers, preferably selected from the JFM communities.
- Sensitization training for members of the 'line departments' participating/working in the JFM sites to understand the areas of input and the delivery systems being supplemented by the line departments in the JFM project areas.
- On-site on the job trainings.

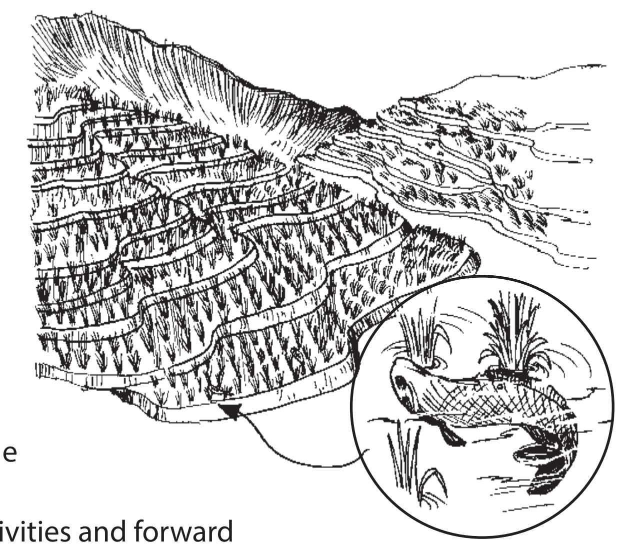


Development of nurseries

Nurseries for JFM areas may be developed at the village level, preferably handled by the women groups under the technical guidance of the local forest officials, the choice of species being carefully worked out for which know-how technology is readily available.

Re-development of Jhum lands

One of the JFM approaches in management of shifting cultivation areas is the re-development of jhum land for improving its fallow values, as also reducing peoples' dependency/pressure on nearby forests/jhum. Two approaches are generally employed:



Indirect approach

By developing alternative livelihood sources to reduce dependence on jhum. The following are the accepted alternatives.

- Development of valley land agro-ecosystem for wet rice cultivation during the rainy season, and cultivation of vegetables and other winter crops during the dry season.
- Development of terrace agro-ecosystem with suitable permanent or rainfed irrigation facilities.
- Development of horticulture with value addition activities and forward

linkages of market facilities.

- r Development of cash crop economy such as rubber, tea, coffee, cashew nuts, spices, etc. with linkages for support prices, credits and markets.
- r Development of NTFPs including medicinal plants, aromatic plants, ornamental plants, orchids, floriculture, bamboo, canes etc. with market facilities.
- r Development of animal husbandry, fishery, apiculture, mushroom cultivation, handloom and handicrafts, other cottage industries and numerous other micro-enterprises that could be location-specific with economic viability; short duration micro-credits for short gestation activities with quick returns may be extended through the revolving fund.

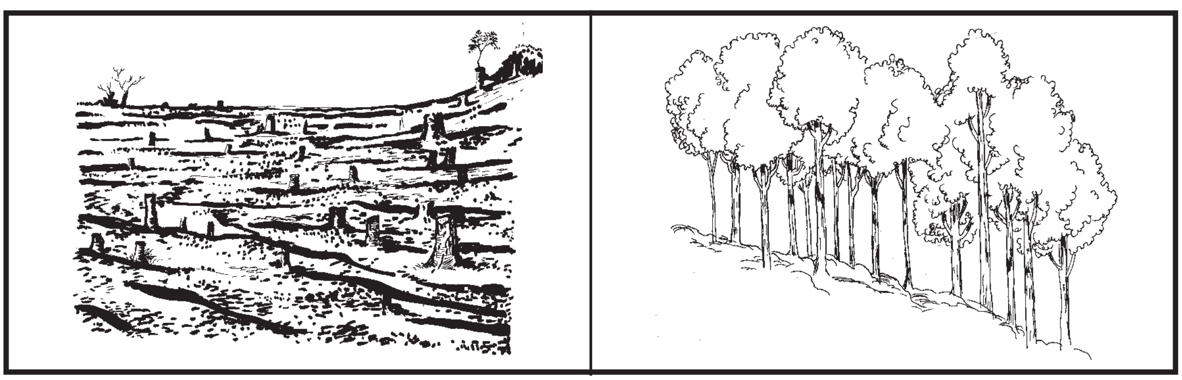
Characteristics of Alnus nepalensis

- Fast growing (fast return of poles and firewood to the farmer).
- Narrow crown allowing sufficient light penetration at ground level for crop growth.
- Ability of bole to slough off lateral branches so that clean bole length of the tree could be increased.
- Ability to rapidly recycle nutrients through rapid turnover of leaf population.
- 'Complementality' traits allowing crops to grow below it.
- Enhances physico-chemical qualities of soil through its nitrogen-fixing properties.
- Facilitates conservation of soil and water.

Direct approach

A direct approach to jhum ecosystem re-development would imply a need for direct interventions for the improvement of the vegetation cover, tree cover, soil fertility, agricultural productivity or output, and overall enhancement of the ecological and economic value of the jhum fallow lands. There are a number of models to this approach.

- Alder (Alnus nepalensis) based shifting cultivation and fallowing is one of the best tested and accepted agro-forestry models in Nagaland (see also Managing Alder for Improved Shifting Cultivation in Nagaland, India, pages 238-243). Nitrogen-fixing alder trees once introduced into the cropping phase of jhum system, can continue through the fallow phase so that the timber can be



harvested on a short rotation basis (e.g. 2 years cropping and 2 years fallowing as in Nagaland with more or less average yield of 1800 kg of paddy per ha).
- Re-development of jhum land by tree farming using native species is well accepted in Nagaland through the efforts of the State Forest Department and the Nagaland Environmental Protection and Economic Development programs (NEPED).

Tree farming allows prolonged fallow period or the jhum cycle, improves the ecology and economic values of the fallow lands, enhances soil fertility and ultimately, agricultural productivity.

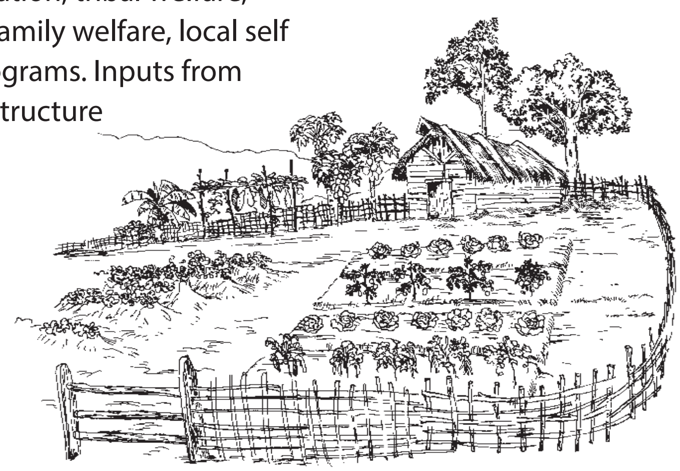
- There are also suggestions to improve the jhum productivity either by mere manipulation of the crop mixture or by introduction of high-yielding varieties.

Revolving funds for micro-credits/micro-enterprises

This is observed to be the most interesting and attractive aspect among the JFM programs in shifting cultivation areas. As much is 50% of the total project cost is suggested to be placed under the direct management and control of the Village Forest Protection Committee (VFPC). The Revolving Fund would be the source of micro-credits for the jhumias (shifting cultivators) for identified micro-enterprises through the PRA-based Microplan. Such micro-enterprises should be economically viable and sustainable, with short gestation or lock-up period of the investment. The members would loan from the Revolving Fund with interest that may be fixed by the VFPCs. The activities to be undertaken and the pattern of loan repayment would also have to be determined by the VFPCs. Measures of penalty to be meted to any defaulter would also have to be determined and implemented by the Committee.

Involvement of line departments

Experiences showed that better successes are achieved when line departments, which are either land-based or non-land-based (e.g., agriculture, horticulture, soil conservation, rural development, public works department, education, tribal welfare, public health engineering, social welfare, health & family welfare, local self administration, etc) are also involved in the JFM programs. Inputs from these line departments would facilitate faster infrastructure development of the area, village economy, as well as implementation of other schemes that would indirectly contribute to the reduction of pressure on jhum lands and the forests.



Development of home gardens

Home gardens play an important role in the tribal subsistence economy. The home gardens traditionally provide the daily requirements of vegetables along with other subsistence needs such as construction materials, fire wood, etc. Home gardens may also provide food and fodder for the domestic animals. In order to reduce pressure on nearby forests and jhum areas re-developed under JFM, it would be prudent to consider the development of home gardens for every household. Such home gardens become areas of conservation, as well as the source of continuous supply of food, fodder, construction materials, medicinal plants, and fruits. Well-developed home gardens could also bring in additional income from the of sale of produces.

Forward linkages for marketing and trade

Most of the predominant shifting cultivation areas in Northeast India are generally weak in marketing facilities and trading facilities. Lack of communication and transport facilities are other bottlenecks in these areas. In order to ensure success of JFM in managing shifting cultivation areas, it is extremely necessary to develop these facilities. Some lessons from elsewhere in marketing forest and agricultural products are discussed in Practices in Marketing Forest and Agricultural Products: Lessons from Resource Managers, pages 281-288.

Monitoring and evaluation

The VFPCs should be sensitized and facilitated to undertake the monitoring and evaluation of its own activities under the overall guidance or supervision of the implementing agencies, viz., forest department. Such committees may receive training and educational support to enable them to undertake reviews and term-corrections and help in the re-orientation of their programs as the need arises. The Forest Department would monitor and evaluate JFM programs periodically.

Networking, extension services & adoptive research

A mechanism may be evolved to facilitate networking of the villages adopted under JFM programs in the North East. Through such networking the VFPCs may be able to learn from each other. Successful JFM programs could also be disseminated through such networking for replication elsewhere. External input in the form of new ideas and experiences can also be shared.

While extension services would be required to be provided by the Forest Department to the VFPCs from time to time, each VFPC may also identify extension workers among its members who would constantly keep linkages among the members, the forest authorities, and other adjoining VFPCs of JFM sites. Such village level extension workers may be specially trained for the purpose.

> Conflict prevention mechanism would also have to be worked out for the possible conflicts between the Traditional Village Authorities/Institutions and the VFPCs. The best preventive measures would be to allow the two authorities in a given village to work in close co-ordination right from the initiation of the JFM programs.

Documentation and reward systems for best performing JFM villages/ sites

A mechanism may be evolved to identify the best performing village or villages in JFM program. There may also be a reward system for the best performing village or villages to encourage, recognize and appreciate the efforts of the communities. Such a system may go a long way in fostering the mood and spirit of participatory or joint forest management in the areas not owned by the government.

Conflict prevention and resolution mechanism

While conflict prevention and resolution mechanisms are already in place in almost every traditional society, it may be appropriate to sensitize the members of the VFPCs to the need to look at conflicts that should be resolved before introducing JFM. Moreover, in many traditional societies, the conflict resolution system arising from conflicts over natural resources are not well defined. It may, therefore, be prudent to allow the VFPCs to prepare their own 'Charter for Conflict Prevention and Resolution Mechanism' for their respective JFM sites. Some of the areas that may require special attention could be forest fire prevention due to jhum burning, finer details of benefits sharing mechanism between the members out of the JFM areas, penal system to those who cause fire to the forest, or kill wildlife without the sanction of the authorities.

Conclusion

The Community Biodiversity Conservation Projects (with 1:1 ratio of project costs being distributed between forestry development and revolving funds for micro-enterprises), under implementation in different states of Northeast India, are very promising. Similar approach, being planned for implementation/ adoption of Joint Forest Management in the areas affected by shifting cultivation holds promising results due to peoples' excitement and confidence in the concept of 'revolving funds'. Added to this, the JFM 'Enabling Resolutions' as in Nagaland clearly indicated that the benefits accrued would be for the people and government's share would only be by levying minimal 'royalty tax' if and when the produce (only timber) are sold outside the state.

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Resource book produced through a participatory writeshop organized by IFAD, IDRC, CIIFAD, ICRAF and IIRR.

Community-based Forest Management in the Philippines Evolution, Lessons and Challenges

Traditional systems of land ownership and sustainable shifting cultivation practices had long existed among forest communities in the Philippines. These systems were affected when the mode of ownership and control over forestlands was altered.

Forest management until the 1970s had been primarily under government supervision in partnership with the industry sector. Slash and burn cultivation and occupancy within forestlands were strictly prohibited by law. Still, punitive measures did not stop people from moving into the forests for shifting cultivation and livelihood.

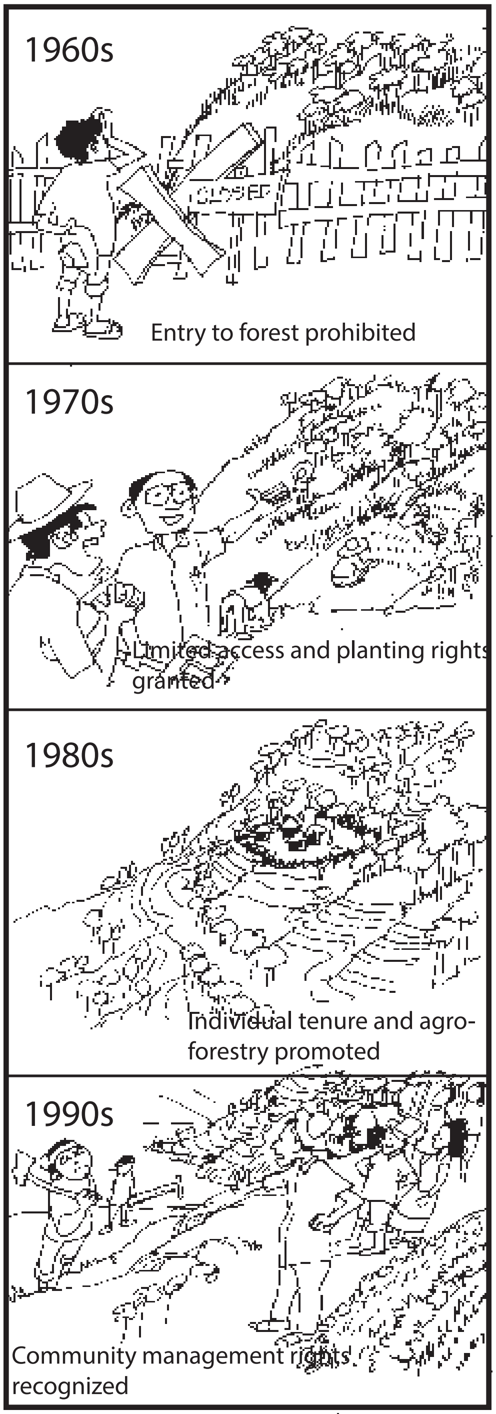
Deforestation continued despite good intentions and regulations. It was attributed to such factors as illegal logging, slash-and-burn farming, land conversion, forest fires, poverty and inadequate forest protection and rehabilitation practices.

Having realized the social and economic dimensions of the situation as well as the limitation of past forest management models, the government modified its policy giving due recognition of the capabilities of upland communities. Eventually, Executive Order No. 263 was issued in 1995, adopting Community Based Forest Management (CBFM) as the national strategy for sustainable management of forest resources.

Evolution of the CBFM strategy

Awareness and interest in the 1960s

In 1964, a Council meeting was held where representatives from the government, private sector and academe agreed that the problem on forest occupancy could neither be solved by fines, imprisonment nor eviction. A Multi-Sectoral National Conference followed and came up with policy recommendations for forest occupancy management.



Pilot approaches in the 1970s

The government initiated the following approaches to address poverty and occupancy problems in forestlands:

1. Forest Occupancy Management wherein forest occupants were either resettled or granted a two-year permit to manage a 2-hectare lot. Resettlement however, was not successful.
2. Family Approach to Reforestation wherein families where contracted for seedling production and plantation establishment.
3. Communal Tree Farming (CTF) wherein communities established tree plantations under a 25-year Memorandum of Agreement. Provisional CTF certificates were issued to individual participants which allowed them to harvest the products from the trees and crops they planted.

Initial lessons

- Resettled families went back to their original areas.
- The CTF approach was well received nationwide. However, the psyllid attack on Leucaena leucocephala, one of the recommended tree species, and the lack of market for its wood, discouraged participants.

Limitations of the pilot approaches

- Focused only on cultivated areas;
- Only short-term tenure arrangements were provided;
- Lack of community participation in planning, decision-making and benefit-sharing; and
- Resettlement sites not appropriate.

- Because of the experience with Leucaena, monocropping is discouraged.

Integration of the Pilot Approaches in 1980s

In 1982, the three pilot approaches were combined under

one umbrella program, the Integrated Social Forestry (ISF). The area coverage and participants were expanded to include associations and indigenous communities. They were granted renewable 25-year Stewardship Contracts for the development of agroforestry or tree farms.
Certificate of Stewardship Contracts (CSC) were granted to individual participants while Community Forest Stewardship Agreement (CFSA) were given to associations or indigenous communities.

Lessons prior to the adoption of CBFM

- Upland people and communities have diverse needs.
- Indigenous social structure and technologies exist in forest communities.
- Communities with secure tenure over their areas showed more efforts in protecting and nurturing their environment.
- Individual and family approaches were ineffective in promoting proper planning.

Challenges

- A credible, comprehensive database supported by process-oriented research needs to be linked with their policy and action.
- Government agencies and other groups working in social forestry must be flexible, dynamic and decentralized.
- There is a need for a model where the different agencies and group work toward a shared vision: the empowerment of local communities.

Expansion and adoption of CBFM in the 1990s

The growing support for a community-based approach in forest management was exemplified by the implementation of nine modes of people-oriented forestry programs with local and/or foreign funding from various sources. Having a common objective of improving the well-being of forest-dependent communities while ensuring the sustainable management, rehabilitation and protection of forestlands, these programs were unified under the CBFM program by virtue of Executive Order No. 263.

Basic principles underlying CBFM

Partnership among stakeholders
Enabling policy environment
Organizational reform
Participation of communities
Local management of resources and livelihood
Equity
Sustainability

Key strategies promoting CBFM

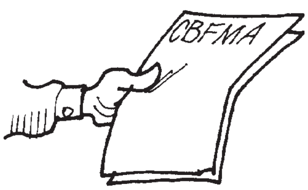
Decentralization and devolution
Education and advocacy
Community empowerment
Integrated management approach
Deregulation
Establishing network

Tenure instruments under CBFM

- Certificate of Stewardship Contract – for individuals
- Community Based Forest Management Agreement - for migrant communities
- Certificate of Ancestral Domain Claim – for indigenous communities
- Certificate of Ancestral Land Claim- for indigenous family/ clan

- Community-Based Forest Management Strategy supports the idea of "giving the management of forests back to the people". It provides long-term security of tenure and promotes integrated approach to resource management.
- CBFM is a priority thrust of the Department of Environment and Natural Resources (DENR). It is incorporated in its Master Plan for Forestry Development as well as in the proposed Sustainable Forest Management Act which is now on second reading at the Philippine Senate.
- DENR aims to place nine out of its 15 million hectares of forestlands under CBFM by the year 2008. At present, there are already over 4000 communities under CBFM covering an aggregate area of 3 million hectares.

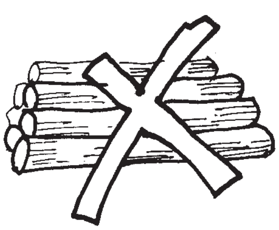
Vignettes from the field



1 The awarding of CBFM Agreement over 4000 hectares of forestland to the Quibal Multi-purpose Cooperative in Peñablanca, Cagayan, encouraged members' participation in the rehabilitation and development of the once cogonal land. The cooperative refused a cash offer for 87 hectares of Gmelina arborea because of the protective and aesthetic values it provide to the community. They believe it also helps improve corn production downhill.

2 Training capability of some members of the Sta. Catalina CBFM project in Atimonan, Quezon was enhanced. These local trainers conduct courses in leadership and agro-forestry. They can effectively provide information on CBFM to visiting local and foreign students.

3 The people's organization in the CBFM site in Napnapan, Davao del Norte is gaining reputation for successfully preventing illegal logging. The teamwork between the community members and the forest protection committee led to the confiscation of nearly P4 million worth of illegal logs. According to the cooperative's chairperson, "Forest protection is a commitment of our members; the forest is our gift to our children's future."



Lessons from CBFM implementation

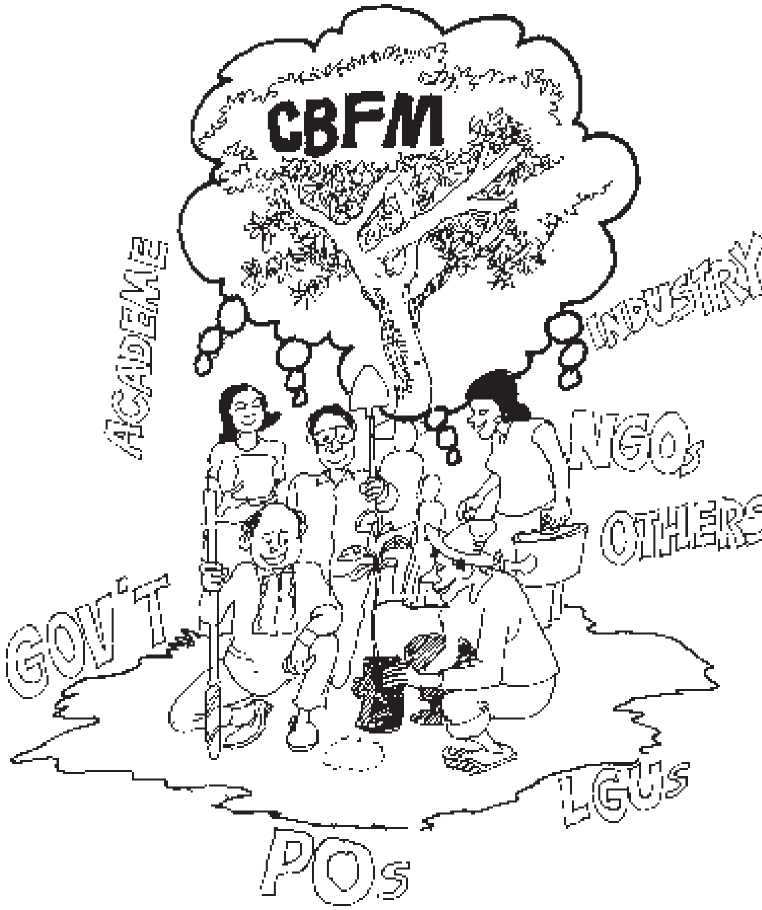
- The security of tenure and control over local resources provided under CBFM is evidently enhancing forest protection, conservation and rehabilitation objectives.
- Community organizing is an effective tool for empowering people to manage resources.
- Government contracts and subsidies created dependency among some people's organizations (POs). Some would be hesitant to participate in similar programs if the compensation was lower than the previous contract.

- Traditional sustainable ways of managing resources exist in the uplands.
- Direct involvement of primary stakeholders in planning, implementation, and management of development project is important for project sustainability.
- Local Government Units (LGUs) and communities are capable of being stewards of natural resources provided that they are engaged in the management process, and proper capacity-building measures are provided based on their specific needs.
- Once tenure is in place and the traditional ways of managing resources by communities are recognized and respected, less input is needed for sustainable resource management.
- Cross-farm visit or farmer-to-farmer demonstration of practices proved to be a very effective approach to technology transfer and adoption.
- Decentralized authority facilitates program implementation and provides impetus for local initiatives.

Challenges for CBFM stakeholders and advocates

1. Focus on felt needs of the community so that community organizing or intervention will be relevant.
2. Build on existing social systems and local capabilities for sustainability.
3. There is a need to develop quantitative criteria and indicators for CBFM as its approaches are process-oriented.
4. The selection of non-government organizations (NGOs) to assist communities should be based on track record and past performance.
5. Strengthen institutional linkages and support systems at the local-level where the direct managers and key players in CBFM are.
6. Strengthen POs to become strong players in the market by providing mechanisms for livelihood development.
7. Conduct more in-depth comparison and evaluation of processes among the various CBFM models to identify critical factors of success or failure.
8. Responsibilities and use rights of various CBFM stakeholders should be clearly defined, acknowledged, and respected.
9. Enhance information campaign and policy advocacy for the passage into law of the Sustainable Forest Management Act.

The CBFM strategy recognizes the inherent capabilities of communities to manage forest resources on a sustainable basis. With the growing demand for resources, the need for complementation among various sectors is indispensable. The relevance of CBFM will depend upon the roles and interaction among its stakeholders. The challenge, therefore, is how to develop a "dynamic fit" & harmony among the various players to make CBFM a success.



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Chapter Five

future directions

Future Directions for Shifting Cultivation

Traditional and modified shifting cultivation is changing under the impact of many internal and external factors. The shifting cultivators themselves are considered among the world's poorest people but simultaneously manage some of the world's richest biodiversity. In many cases, they are adapting to the changing environment and the factors below have been identified as being important to further this process. Participants in this shifting cultivation workshop were divided into two groups in order to identify and further discuss these factors. The summarized outputs from this workgroup are as follows:

FACTORS IDENTIFIED	DISCUSSION
A. Policy/ Institutional	
■ Land tenure and security of access	Land generally means more to shifting cultivators than just tenure and access rights. It is an essential element of their culture and lifestyle and tenurial security is essential to any efforts in long-term planning and sustainable development with these communities.
■ Providing alternatives, not blanket prohibitions	Policy initiatives regarding shifting cultivation have generally been negative - reactionary and restrictive. More proactive and creative alternatives generated from the "grassroots" are required and, as always, much more attention must be given to implementation. More specific policies on diversification and intensification are required.

FACTORS IDENTIFIED	DISCUSSION
■ Infrastructure development in shifting cultivation areas	Infrastructure is severely lacking in most shifting cultivation communities. Together with the lack of water,power and transport systems, there is a chronic lack of government services. Sensitive development of these is required to minimize adverse socio-cultural and economic impacts.
■ Balance between conservation goals and livelihood goals	Forest conservation is a direct or implicit goal of most shifting cultivation development projects. Goals must be overt and relate to the aspirations of the communities, perhaps including socio-economic advancement.
■ Allocation and zoning and its impact on the people	Land use allocation and zoning has, at times, resulted in the alienation of shifting cultivators from their traditional lands or limited their rights to those perceived by outsiders as "environmentally sustainable". Care must be taken to ensure that personal and biased perceptions do not detract from overall goals.
■ Cultural links in borderlands stronger than political boundaries	In a number of border areas (e.g., China- Lao PDR- VietNam) some ethnic communities have practiced shifting cultivation for many generations. They are often harassed and threatened by governments wishing to stabilize these populations. More cooperative arrangements similar to those operating on other borders, such as India-Nepal, may be more appropriate to permit some socio-economic advancement of the communities.
■ Continuity of policies despite changes in officials	Shifting cultivators require a stable policy environment for much needed socio-economic advancement. This entails policy that is coordinated and complementary and enshrined into law rather than transitory departmental directives. It also requires government officials who are not transferred or replaced at the whim of departmental directors or political leaders.
B. Partnerships and Capacity Building Various levels of partnerships ■ Across countries ■ Across stakeholders ■ Across disciplines	Very few, if any, development projects and programs in Asia have a particular focus on shifting cultivators. Maore integrated and holistic programs are needed and only concerted cooperation across countries, stakeholders and disciplines will achieve sustainable development od shifting cultivation communities. Networking and sharing are a crucial component in this aspect.
■ Highlight principles behind technology	Too many development projects continue to focus on technologies and content rather than the underlying principles and practices.
■ Strengthen people's capacity to innovate	The starting point for development should be the existing situation of the shifting cultivators. Effective participation involves the proposed beneficiaries not as "targets" but as partners. Sustainability can only be achieved when it is the shifting cultivators themselves who feel responsible for their development.

FACTORS IDENTIFIED	DISCUSSION
■ Document traditional and indigenous knowledge and practices	Many traditional practices of shifting cultivators across Asia are disappearing or being modified. This is neither inherently good nor bad, but efforts should be made to institutionalize the memory of these practices for possible future reference. Documentation should be undertaken with all due care to intellectual property rights and cultural senisitivity.
■ Models for development not tested enough in the context of shifting cultivation	Many traditional practices of shifting cultivators across Asia are disappearing or being modified. This is neither inherently good nor bad, but efforts should be made to institutionalize the memory of these practices for possible future reference. Documentation should be undertaken with all due care to intellectual property rights and cultural senisitivity.
C. Socio-Cultural	
■ Differences between traditional cultivators and recent migrants	Traditional or indigenous populations and more recent forest migrants practice very different forms of shifting cultivation. This is continually ignored by many decision-makers. Just as opponents of shifting cultivation mistakenly term migrant forest farming as shifting cultivation, so do proponents of traditional practices ignore that not all such practices are sustainable.
■ Differences of resource use within the same community	Shifting cultivation communities are far from a homogenous unit and there are many differences in the nature of resource use between the rich and the poor, ethnic and migrant, young and old, etc. Development workers should be guided more by the "rules of evidence" when it comes to assigning behavioral characteristics to various community sub-groups.
■ Impact of urbanization/ modernization	Typically, this polarizes traditional shifting cultivation communities into the (generally older) population who retain traditional practices and the remainder who regard these practices as "primitive". Comunities should be prepared for these eventualities.
■ Migration/ population increase	Shifting cultivation in many areas is becoming less sustainable as populations increase on a fixed or declining land base. Specific strategies should be developed to address this issue e.g., family planning, "assisted" migration (rather than "forced").
■ Assimilation/ loss of ethnic identity	It should be recognized that not all shifting cultivators want or need to join "mainstream society". Many do, but equally, many do not wish to become assimilated and possibly lose their ethnic identity.
■ Empowerment as a key to change e.g., not only men but also women	As with most development, there remains a tendency to regard the shifting cultivators as men rather than mixed families, groups and communities.

FACTORS IDENTIFIED	DISCUSSION
■ Community-based education	Legal and other imperative force many shifting cultivators to accept education systems foreign to their culture and oriented towards teaching rather than guided learning. Curricula should be tailored to the specific needs of the shifting cultivation communities i.e., experiential and culturally appropriate. A congruous strategy of educating "outsiders" about the people and practices of shifting cultivation would be appropriate in many instances.
■ Gender participation	As with most development, there remains a tendency to regard the shifting cultivators as men rather than mixed families, groups and communities.

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glossary

definition of terms

a

Agroecosystem

- The interrelated system of plants and animals in a particular environment may be referred to as an ecosystem and the term used to indicate a particular focus on those plants and animals used within an agricultural system is agroecosystem

Agroforestry

- “The mixture of woody perennials with cultivated crops, pastures and other agricultural enterprises . . . the most widespread and adaptable practice on land that is marginal or unsuited for intensive cultivation, or where seasonal drought favors tree production”

Alley cropping

- An agroforestry model in which trees or shrubs are planted on contour rows and managed by periodic cutting and pruning, often for green manure. A crop is grown between the rows. The row species grown may include fruit trees and other multi-purpose species as promoted in the Sloping Agricultural Land Technology (see SALT, page 410).
- “an improved bush fallow system in which the fallow functions are performed simultaneously with the cropping phase”

Ancestral lands and domain

- The physical sphere of activity or concern for indigenous communities. Some legislation recognizes these customary or traditional rights to land or domain which may predate other tenures such as the state or regalian tenures (see below)

ASB (Alternatives to Slash-and-Burn) Consortium

- “a system wide program of the Consultative Group on International Agricultural Research (CGIAR) . . . works on two interlinked global problems: the environmental effects of forest destruction and persistent rural poverty in the tropics”

b

Biodiversity

- the total diversity of living things often expressed in genetic, species, ecosystem or temporal dimensions
- Some particular focus may be indicated by refined terms e.g. agrobiodiversity is used to describe the biodiversity which occurs within an agricultural system

Buffer zone

- A zone established around a Protected Area (see page 409) which serves as a buffer and transition zone between the PA and the surrounding landscape. Typically, some conservation friendly activities are permitted within the buffer zone (e.g. agroforestry, medicinal plants etc.)

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c

Cation Exchange Capacity (CEC)

- a measure of the predominance of "cation exchange sites" in soil where nutrients can be retained
- "a soil with a low CEC is one that can only hold on to very few nutrients"

Clone

- An organism descended asexually from a single ancestor, such as a plant produced by layering or a polyp produced by budding

Commercialization

- The process of developing a market system for a product. This includes managing information, arranging supply, transport and sale but is distinct from "marketing" which refers more to the process of selling alone

Conservation (biodiversity, in situ, ex situ)

- Conservation refers to the controlled use and systematic protection of natural resources, such as forest, soil and water systems. Related more to living organisms the term "biodiversity conservation" may also be used.
- In situ conservation is on-farm conservation in which genetic resources are maintained and conserved under "normal conditions"
- Ex situ conservation is where the genetic resources are maintained or conserved on "conditioned" land, usually not in the actual farm but on special agricultural fields and laboratories

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d

Domestication

- "The judicious use of human skills, scientific knowledge, physical and natural inputs, as well as the traditional knowledge of local people in the production and management of NTFPs inside and outside their natural habitats."

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e

Ethnobotany

- The study and particularly the methods of classification of plants as undertaken or perceived by ethnic populations

Ethnoecology

- indigenous perceptions of "natural" divisions in the biological world and plant-animal-human relationships within each division

Extension

- In the context of shifting cultivation, the process of enlarging coverage (either in terms of total area, total awareness etc.) of research and development programs. It involves extension personnel working with communities to encourage adoption of practices, participate in certain activities etc.

f

Fallow

- "follows the cropping stage, typically after a swidden field has been used for several years. The native vegetation is allowed to regenerate so as to improve the physical properties of the soil and capture nutrients from the sub-soil"
- "often perceived by outsiders as abandoned or wasted land . . . in reality shifting cultivators usually manage these lands . . . for planting trees or crops, for collecting edible and commercial products, or for hunting and pasturing animals"
- "Improved fallow is defined as the targeted use of planted species in order to achieve one or more of the aims of natural fallow within a shorter time or on a smaller area"

g

Gender

- the distinction between males and females but beyond the physical or sexual differences to also include societal roles and behavior
- "gender is a cultural and social construct, therefore it changes over time and from one culture to another"

Genetics

- The branch of biology that deals with heredity, especially the mechanisms of hereditary transmission and the variation of inherited characteristics

Green manure / cover crops

- These crops are often grown by farmers to produce large amounts of organic material often with the additional fixation of nitrogen by the crop roots and other benefits (e.g. food, fodder, shade etc.)

h

Home gardens

- Intensively managed gardens usually close to the family home and often containing a complex arrangement of many species mainly devoted to food production

Homo sapiens

- the modern species of human beings

i

Indigenous fallow management

- "Indigenous management strategies are directed at the integration of the fallow and its function into the total farming system to sustain or improve the livelihoods. These strategies were developed and tested by farmers, and are flexible and able to respond and adapt to changing needs and aspirations of the households over time, without the involvement of formal research and extension services"

Information

- "In addition to the conventional concept of information, the term can mean:
  - Structural information contained in social institutions and habits
  - Cultural information contained in concepts and symbols
  - Cultural programming (culture perceived as the 'software' of a social group or individual)"

Integral swidden

- traditional upland farmers with a cultural practice of shifting cultivation

Intellectual Property Rights (IPR)

- Internationally accepted principles to extend copyright protection to include intellectual property (i.e. ideas, concepts, knowledge)

Intensification

- "intensification in sustainable agricultural systems generally refers to the fuller use of land, water and biotic resources to enhance the agronomic performance of agroecosystems"

---

j

Joint Forest Management (JFM)

- A program in some states of India which institutes benefit sharing from forest products with local communities

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l

Lapat

- "A traditional practice of bereaved Isnag families (Philippines) where material resources are declared off-limits to people to show their respect and value for a dead family member"

---

n

Natural process

- shifting cultivation relies heavily on natural processes of plant growth and succession, soil formation, fire, water movement etc.
- "letting nature do most of the work is actually a very intelligent way to arrange a farming system in order to economize on labor when land is abundant"

Niche

- A situation or activity especially suited to one's interest or capabilties. In an ecological sense, the space occupied by an organism or species with respect to the food web, habitat and social structures of the environment. In an economic sense, the market position most suited for a particular product with relation to price, consumer preferences, demand and supply etc.

Non-Timber Forest Products (NTFPs)

- "Non-Timber Forest Products refer to biological products and related services derived from forest and related land-use systems"
- Examples are: rattan, leaves, resins, gums, lac, oil seeds, essential oils, medicinal herbs, tanning materials, honey, mushrooms, fruits, nuts, tubers, bush meat etc.

o

Organic matter

- Carbon based material generally from living organisms. Upon death this material is broken down into its constituent compounds many of which are required for subsequent uptake by plants and animals
- Soil Organic Matter (SOM) is that organic material which exists within the soil (including the litter, humus, roots etc.)

p

Pioneer swidden

- "basically lowland farmers pushed into upland areas through demographic pressures or resettlement programs. Without experience and tradition . . . to guide them, their lowland practices become unsustainable and tend to give shifting cultivation a negative reputation"

Pollarding

- A form of coppicing which tends to leave a high stump remaining after the main stem is cut at 2 to 2.5m above the ground. Some species (e.g. Alder) produce numerous coppice shoots following this operation which are removed and used without damaging the main tree trunk

Protected Area

- This refers to the more formal designation of some lands and landscapes as protected by law, mostly from human disturbance. Typically there are a range of degrees of protection from strict (national parks, wildlife reserves etc.) to non-strict (recreation reserves).

r

Regalian tenure

- a land tenure where "royal lands became public domain and were placed under the jurisdiction of the state"

Relay cropping

- The practice of planting a subsequent crop prior to the harvest of the first

Ruminants

- Hooved and horned grazing mammals (e.g. cattle, sheep, goats) that regurgitate and chew cud

s

Sedentarization

- The process of making sedentary or limiting movement. This is often applied to government programs seeking to stop or reduce the movement of shifting cultivators in order that they may adopt more permanent, settled or stable agriculture
- Also referred to as "stabilization"

Shifting Cultivation

- "the sequential rotation of forest vegetation and cultivated food crops . . . closely linked with socio-cultural values that are central to the lives and livelihood of shifting cultivators and their communities"
- also termed "slash and burn" and "swidden farming", the latter being favored here because of the former's perjorative connotation
- "Most shifting cultivation systems blend agriculture with hunting, fishing, gathering, and other resource use systems"

- Rotational farming is the common term used in Thailand characterized by "short cultivation and long fallow"
- The Indian term for shifting cultivation is Jhum
- "Traditional shifting cultivation is . . characterized by a rotation of fields rather than crops, by a short period of cropping alternating with long fallow periods, and by clearing by means of slash and burn"

Slash and burn
- "partial clearing of vegetation (in forest or brush fallow) . . . followed by flash burning and short-term mixed intercropping"
- it may be within a shifting cultivation context or used in more permanent land-use transformations

Slash and mulch
- A practice of not burning or only partly burning the debris and slash from land preparation prior to cultivation. This debris may serve to physically support some crops (e.g. vines, yams) and provide some nutrients on decomposition

Sloping Agricultural Land Technology (SALT)
- A range of agroforestry models developed by the Mindanao Baptist Rural Life Center (MBRLC), Mindanao, Philippines.
- Simple, practical and low-cost farming methods suitable for upland areas. Typically involves a mix of agricultural and forestry crops in various ratios and models have been closely monitored regarding inputs and outputs.

Soil compaction
- Soil may become dense and compacted as a result of various factors. In the shifting cultivation context these are generally non-mechanical, mostly due to a loss of structure and organic material

Soil erosion
- The loss of soil from a site through various elements (wind, rain, accretion, fire). When topsoil is removed in this way, lower horizons and even parent material with a higher bulk density may be exposed

Soil fertility
- "traditional thinking says that the level of fertility in a soil basically depends on the quantity of nutrients the soil contains . . . the soil is therefore thought of as a bank"
- More recently, fertility is seen to be more a function of the ability of the plant roots to access the nutrients than the absolute level of nutrients. This has become known as the "nutrient access theory" of soil fertility

Succession
- an ecological term describing the natural progression of species from pioneer species through various seral stages to climax species on relatively undisturbed sites
- "shifting cultivators typically manage such successions (and) . . . the products of the manipulated succession can equal or exceed the returns generated from the annual cropping phase or off-farm wage labor"

- In relation to shifting cultivation, this usually refers to the ability of shifting cultivators to continue these practices into the future given the many changes, both internal and external to the practice (e.g. population increases, declining land availability etc.)

- the holding of something such as an office or real estate

- The non-use of machinery and implements to plow the soil and disturb the horizons; instead there is a reliance on plant roots and earthworms to maintain soil structure and fertility

annexes

Shifting Cultivation: Towards Sustainability and Resource Conservation in Asia

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