Intensifying Shifting Cultivation in Southeast Asia By Building On Indigenous Fallow Management Strategies

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Abstract

Swidden cultivation continues as the economic mainstay of upland communities in many countries in Southeast Asia. These communities may be located on the forest margins or in grassland ecosystems (particularly the *Imperata cylindrica* grasslands that occupy about 35 million hectares in the region). They share the challenges posed by mountainous terrain: sparse road infrastructure and distant markets constrain alternative livelihood options. The circumstances that historically underpinned the sustainability of long-fallow swiddening, however, have largely vanished. These conditions included extensive tracts of forested lands, sparse population densities, and few opportunities to produce surpluses for outside markets. In addition, the imperative to intensify swiddening into more permanent forms of land use has been exacerbated by rapid population growth, gazettement of remnant wildlands into protected areas, and state policies to sedentarize agriculture and discourage the use of fallows and fire. In the absence of mitigating adaptations, farmers are forced to shorten fallow periods and extend the cropping phase, eventually pushing their swidden systems beyond their ecological resilience and into a tailspin of degradation. Weeds proliferate and crop yields decline. They earn decreasing returns to labor, and food security is threatened. Upland tribal groups, already on the economic, political and geographic fringes of society, find their resource base and standard of living declining even further. The urgent need to increase human carrying capacities of upland farming systems is clear. Regardless of the merits of the long-fallow forms of shifting cultivation of the past, pathways to stabilize and improve productivity of today's declining systems are essential, preferably building on indigenous practices. However, there are many compelling examples where swidden cultivators have successfully managed local resources to solve local problems. The relevant issue is HOW TO INTENSIFY. This is a high priority research and development issue across many Southeast Asian countries. Technical approaches to stabilizing and improving productivity of shifting cultivation systems in the sloping uplands of Southeast Asia have not been notably successful in identifying alternate technologies widely adoptable by farmers. Farmer rejection of researcher-driven solutions has led to greater recognition of farmer constraints such as labor availability, access to planting materials, and uncontrolled fires or communal grazing. This experience underlined the need for participatory, on-farm research approaches to identify solutions sharply focussed to farmer circumstances. This paper reviews the status of current knowledge about indigenous strategies to intensify shifting cultivation. It examines the pathways by which indigenous intensification has occurred and categorizes these solutions. It summarizes the outputs of a workshop that was convened in June, 1997, to focus on farmer-generated strategies as a basis for intensification. It reviews the progress made to evolve a network of research and development focussed on these processes, discusses the emerging process for research and development on indigenous strategies, and the unique methodological challenges that must be addressed. Finally, it takes a brief look ahead at the challenges for the future.

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Indigenous Strategies in a Regional Context

Much of Southeast Asia is dominated by mountainous topography populated by diverse cultural minority communities. Historically, expansive forests, sparse populations, and few needs to produce surpluses for external markets allowed these mountain-dwelling communities to coexist in relative harmony with their environments based on variations of shifting cultivation. However the annual cycle of slashing and burning that characterizes land preparation in shifting cultivation systems has often drawn criticism as being inefficient and a leading cause of tropical deforestation. The relationship between foresters and shifting cultivators has been characterized by mutual antagonism, deep suspicion, and open conflict. Finding ways to discourage shifting cultivation and facilitate adoption of more permanent forms of agriculture continues to be a high priority policy of national governments across southeast Asia.

On the other end of the spectrum are more detailed anthropological studies. Starting with Conklin's (1954, 1957)work in the Philippines, these began to build 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, and pointed to its long history of use as evidence of sustainability. Far from wanton destruction of forests, they argued, shifting cultivation is an admirable land-use practice that reflects indigenous knowledge accumulated through centuries of trial and error; an intricate balance between product harvest and ecological resilience; and an impressive degree of agrodiversity. More recent literature points to the custodial role often played by shifting cultivation communities in preserving forest ecosystems and contained species, and the inextricable linkages between biological and cultural diversity. This suggests that efforts towards biodiversity conservation will remain ineffectual until they broaden their scope to address cultural preservation as well.

It is unlikely that these two extremes of opinion will be reconciled in the near future. We need to reframe the debate in order to move forward in identifying research and development interventions that can stabilize declining upland agroecosystems and bring improved standards of living to some of the most marginalized upland communities in the region. Regardless of opinion on the merits or demerits of shifting cultivation as a land-use practice, there is strong consensus that both a human and environmental tragedy is unfolding in the uplands of southeast Asia. With dramatically increasing population densities (both endogenous growth and in-migration by large numbers of lowlanders), lost access to large tracts that have been gazetted as protected wildlands, and other competing land uses, the preconditions that had underpinned the sustainability of 'traditional' forms of shifting cultivation are now rare. In the face of increasing land use pressures, farmers can no longer afford the luxury of long fallow periods that allow recovery of secondary forest and rejuvenation of exhausted soils. The resulting trend of shortening fallows, lengthening cropping periods and rapidly degrading environments is endemic throughout southeast Asia's montane areas. Crop yields are declining, labor required to control weed growth is increasing, and household food security is threatened. Badly degraded fields are often abandoned as *Imperata* grasslands, and farmers move further upslope to clear more forested land and avail fertile, humus soils.

This is obviously a cross-cutting issue of direct relevance to several research and development priorities in Southeast Asia. If successful indigenous strategies for managing fallow land in more productive ways (community-based natural resource management) can be identified and diffused to other upland areas with degrading shifting cultivation, this will enable an intensified land use and improved living standards for some of the most marginalized communities in the region (impact on low income groups). The resulting increased productivity per unit of land will more ably support the upland's growing population densities - and alleviate the pressure to convert remnant forests into agricultural land.

Pathways to Intensification

Farmer responses to intensification pressures may generally be classified as innovations to achieve:

- more 'effective' fallows - where the biological efficiency of fallow functions is improved, and the same or greater benefits can be achieved in a shorter time frame;
- more 'productive' fallows - in which fallow lengths stay the same or actually lengthen as the farmer adds value to the fallow by introducing perennial economic species; and
- combinations of the two trends, where a degree of both biophysical and economic benefits may be accrued.

The implications to land use of these pathways towards swidden intensification are profound (**Figure 1**). More effective or accelerated fallows often provide an intermediate step in a transition to permanent cultivation of annual crops. Alternatively, in more productive fallows, the phase of reopening and cultivation of annuals may eventually be foregone altogether as the farmer chooses to protect perennial vegetation, allowing it to develop into semi - or permanent agroforests.

If Southeast Asia's forest remnants and contained biodiversity are to be protected, and swidden communities afforded a better standard of living, pathways towards intensification of shifting cultivation systems are urgently needed. One of the most promising approaches to identifying biophysically workable and socially acceptable technologies is to document and understand case studies of indigenous adaptations towards intensification of shifting cultivation. Unfortunately there is little documentation of such innovations to feed into the national and international research agenda or to inform policy makers. They are either unobserved or misinterpreted.

ICRAF is collaborating with partner institutions in developing a regional research initiative on '***Indigenous Strategies for Intensification of Shifting Cultivation in S.E. Asia***'. A coordinated team approach will enable a thorough and systematic investigation of a wide variety of improved fallow systems that have evolved in different agroecozones across S.E. Asia. The approach will showcase indigenous knowledge and practices as the point of departure in the search for pragmatic and adoptable solutions to intensify and reinforce the sustainability of highly stressed swidden systems. The work will be guided by the hypothesis that shifting cultivators have successfully responded to intensification pressures by quietly evolving improved variations of land husbandry. These practices are of immense scientific and development interest for their potential for further refinement and dissemination to a range of contexts in communities facing similar swidden degradation problems. This is not suggested as a panacea, but as a promising approach that builds on indigenous practices and needs to be added to our repertoire of technical responses to declining swidden systems.

There is a wide menu of components from which shifting cultivators may choose to intensify land use (**Figure 2**). 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. We are trying 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 2** attempts to categorize indigenous strategies for fallow management that fall along this continuum and **Figure 3** portrays roughly where we know them to be in practice in the region. These representative case studies provide a foundation for the development of a longer-term and coordinated effort to stabilize shifting cultivation across Southeast Asia. The work will explore the relationship of such knowledge, its promise, and the peripheral position of indigenous minorities in Southeast Asia, to elevate the value of such knowledge for both researchers and policy makers. This will assist in formulating more robust arguments for empowerment of local communities to manage their own natural resource bases.

The general strategy of the work is to document and evaluate indigenous strategies for intensification of shifting cultivation in Southeast 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. The project will focus on indigenous fallow management (IFM) systems as a promising approach to the search for sustainable pathways to intensify collapsing swidden systems in S.E. Asia's uplands. This research thrust on IFM will be nested within ICRAF's broader Alternatives to Slash-and-Burn (ASB) programme - linking it directly with global efforts to mitigate the impacts of deteriorating swidden systems, providing opportunities to draw on methodologies developed by ASB, and participate in ASB events.

Regional Workshop

As part of its ASB activities, the ICRAF S.E. Asia Program hosted a regional workshop on 'Indigenous Strategies for Intensification of Shifting Cultivation in Southeast Asia' in Bogor, Indonesia on June 23rd - 27th, 1997 (ICRAF, 1997). This bottom-up focus on farmer-generated technologies has been adopted by ICRAF in response to the long history of failure of researcher-driven agendas to identify solutions that have earned wide farmer adoption. Although the notion of improved fallows is not new, and many years and resources have been devoted to a litany of on-station trials and demonstration plots across the region, most of these were designed in isolation from farmer realities; despite ambitious extension programs, few ever extended much beyond the perimeter fences of the research stations. Farmer rejection of outside solutions has highlighted the imperative for participatory research approaches that emphasize more genuine farmer-scientist-extensionist partnerships in jointly identifying practical technologies that resonate with farmer needs and 'fit' local farming systems. This initiative on Indigenous Fallow Management (IFM) focuses research attention on a compelling array of case

studies in the region where swiddenists confronted with mounting land use pressures have successfully developed their own technologies to manage fallow land more productively, thus permitting a sustainable intensification of the swidden system. We recognize the need, however, to avoid over-investment in anthropological curiosities that are very situation-specific. The focus must be on exploring those systems with wide extrapolation potential.

The Bogor workshop was successful in launching the initiative by bringing together 120 scientists, practitioners and policy-makers from across S.E. Asia to review 67 such case studies. Building on the momentum of the meeting, a regional IFM Network was formed as a forum for collaboration and sharing of experiences between 5 cores institutions representing those areas where stressed swidden systems are most endemic: northern Vietnam, northern Lao P.D.R., northeast India, southwest China, and the northern Philippines. ICRAF is strongly committed to working with its national partners in Southeast Asia in developing a coordinated and sustained regional research initiative on IFM technologies and their promise to contribute solutions towards the stabilization and intensification of collapsing swidden systems. After the Bogor meetings the delegates from Vietnam and the Philippines judged fallow management to be such a crucial issue to their own uplands that they formed national working groups focussed around the IFM theme. ICRAF has now begun to consolidate their efforts into a unified regional thrust and provide technical backup as needed.

Refining a Research and Development Process For Promising Indigenous Fallow Systems

This section discusses the development of a process for research and development on improved fallow systems. The process involves:

- Characterization of promising IFM systems;
- Defining their extrapolation domain and generation of preliminary extension materials;
- Agronomic trials designed and set up to validate farmer perceptions of the superiority of these systems and test technological refinements;
- Extrapolation through adaptive trials in other locations; and
- Advanced extension materials generated and disseminated.

There are numerous unconventional aspects to consider when conducting research on indigenous fallow innovations intended to benefit a wider population of upland people.
These features need to be recognized and critically assessed. Special attention must be given to methods targeted to the unique conditions of shifting cultivation. This section discusses some of these issues, with emphasis on some the methodological pitfalls.

The research and development process for improved fallow management systems is a continuum of tasks. The process begins with the identification of a promising system or practice. Limited observation has suggested that the system has elements that may be of real value to other smallholders elsewhere. The practical returns to investing in a research effort look positive. This leads to a characterization of the systems: a more thorough description and analysis based on rapid or participatory appraisal methods, perhaps complemented by more in-depth surveys. An indicative analysis of the pros and cons of the system, and the nature of its contribution to sustainability is conducted.

If at this point the system still appears to have development and extrapolation potential, it is time to validate this assumption by more in-depth sampling of soils, fallow vegetation, and crop performance. The analysis might be done through comparisons among fields where the practice is employed with fields in which it is not. Valid comparisons using this approach may be difficult because of site factors that confound the comparisons. Therefore, and because it may be useful to test additional management variations, it will often be necessary to run new field trials. If the innovation still demonstrates wider promise, we move on to a dissemination process.

To extrapolate the innovation to other communities, it will be necessary to study the local conditions and select new locations where the agroecological and social factors are not too dissimilar. One needs to keep in mind how the innovation's success is affected by specific biophysical conditions (soils, rainfall, elevation, etc) and by culture and land tenure. After selecting new locations it is tempting to barge ahead with an extension program. But its best at this point to verify the practice with a several key farmers before embarking on wholesale dissemination. This provides the chance to adapt the innovation to the realities of the new environment before

a major failure deflates everyone's enthusiasm. As the promising experience of the key farmers becomes evident, then its time to develop an effective extension program that expands adoption widely from our base of key farmers. They become the foundation for its diffusion.

Let us now examine some of these steps in more depth. First, we discuss some of the special challenges in doing the research to characterize and validate an innovation. Second, we examine some of the constraints to extension that will be encountered in disseminating an innovation among shifting cultivation communities.

Critically Assessing the Benefits and Costs of an Improved Fallow Innovation

Assessing the utility of an improved fallow innovation is complex. There are many snags that researchers and extensionists may fall into along the way. This section will address a few key ones to look out for, and some guidelines on how to cope with them. A selection of several of these pitfalls follows:

1. Analyses that show the innovation has better returns per hectare, but ignores the labor requirements.

Shifting cultivation is a system where labor is a dominant constraint. Increasing returns to labor is usually much more important than merely increasing yields. Thus, realistically estimating labor requirements for the innovation and calculating the returns to labor for the innovation is crucial.

2. Failure to examine the benefits and costs over the entire shifting cultivation cycle.

The implication of any innovation has to be considered in terms of the whole cycle, not just for one or two crop seasons. Thus, it is crucial to project benefits and costs over the entire cycle, even if this has to be done hypothetically, since actual observations may not be feasible over cycles that extend for years or even decades.

3. Invalid or inconclusive sampling of soils and crop performance.

It is difficult to detect unambiguous changes (improvements) in soil fertility during a period of a few years' fallow. Many soil scientists have concluded that conventional soil analyses simply are not precise enough, or even succeed in measuring the really important parameters. Also, the results of samples analyzed in successive years may be badly confounded by variation caused by the analysis itself. This often muffles or negates the modest changes expected in the bulk soil properties.

The fertility benefit of an innovation may also be do relatively little to changes in the fertility of the soil during the fallow period. A more important effect may be the nutrients accumulated in the biomass of the fallow vegetation, which are rapidly dissipated upon slash-and-burn.

Attempts to compare the performance of an innovation by sampling fields where it is practiced, and comparing the results with nearby fields where it is not practiced, are often fraught with sampling methodological problems. Soils, slopes, cropping history, and many other farm-to-farm management differences confound such comparisons and may easily overwhelm the effects of the innovation, or falsely suggest that the innovation is better than it is. Comparisons based on such sampling methods must be designed very carefully. Even in the best of cases such results are only indicative. This is why it is often necessary to install new trials with farmers that are set up specifically to make valid comparisons. The simplest approach is to conduct paired-plot trials comparing the innovation with the conventional fallow system side-by-side on either half of a field, and replicating this across a number of farms.

The above caveats direct our attention to the definitive challenges of conducting research on indigenous innovations. Collecting valid results is the fundamental first step. Subjecting them to a robust sustainability analysis that takes into account the real nature of the smallholder shifting cultivator's situation is the second step. This sustainability analysis itself must be validated and enriched by iteration with local people's reactions. At this point let's assume that we have solid evidence that our innovation is widely useful and deserves to be disseminated widely. What special constraints are we likely to encounter in extending the message to shifting cultivation communities?

Facing the Constraints to Extension

There are perhaps four major constraints that arise in conducting extension among shifting cultivation communities:

1. They are usually remote from roads and market infrastructure. This means not only that they are constrained in participating in the market economy, and may be limited in their livelihood options. It also means that extension agencies usually have little presence in these areas.

2. There may also be problems with extension agency jurisdiction. Shifting cultivation communities often live on land classified as forest land and claimed by the state. If forestry extension services exist, and if they are available to assist smallholders, they are usually very understaffed.

3. Land tenure uncertainty plays an important role in household land use decisions. There is often conflict between the claims of the state and local land tenure systems. This may be exacerbated by land conflicts within the community as well. Adoption of fallow management innovations will be very sensitive to these realities.

4. Land use in shifting cultivation communities is often transitional. Land use intensification is a near-universal process spanning a continuum from long cycle fallows to permanent annual farming. Any particular improved fallow management system may be relevant to a farm or community at one point this ever-evolving trajectory, but not at others. Thus, successfully introducing innovations in fallow management is quite literally shooting at a moving target.

Conclusion

Based on the papers and experiences presented during the workshop, it is clear that a significant amount of IFM research has already been initiated, particularly in the form of descriptive case studies and characterization of IFM systems. Future actions should sensibly build upon this foundation, and seek ways to strengthen mechanisms to share the valuable information and knowledge emerging from IFM research and development work in the field. However, many challenges remain in charting the future mission, vision, objectives and modalities of an IFM network in the Asia-Pacific region. The workshop helped to set the stage for future actions, but it also left some key questions that must be addressed as we continue our IFM-related work across the region in the years to come.

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Figures:

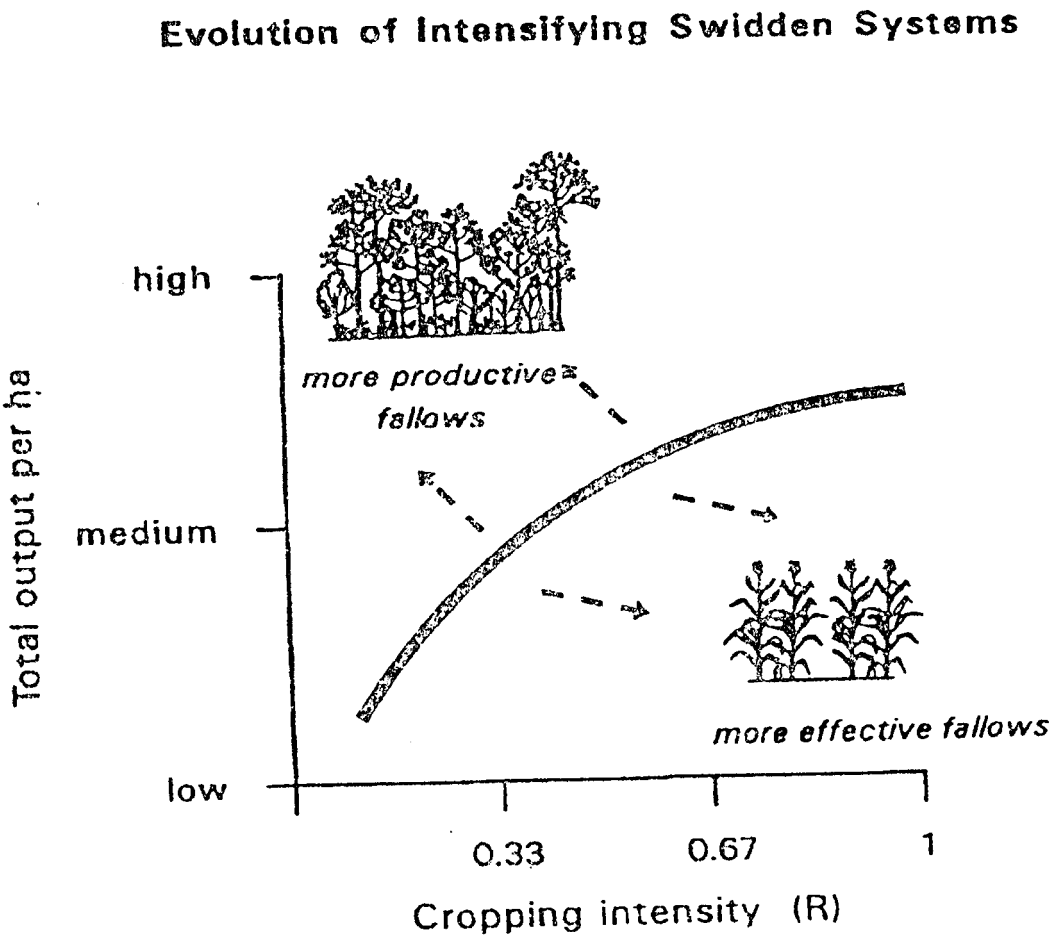
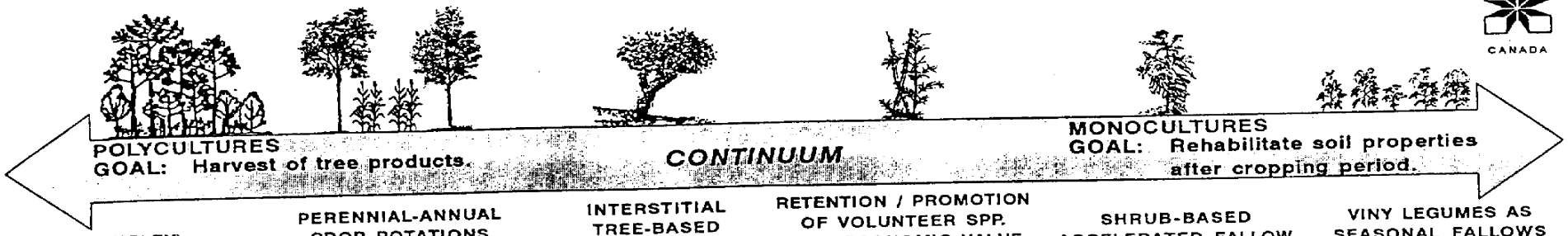

Evolution of Intensifying Swidden Systems
high
medium
low
Total output per ha
more productive fallows
more effective fallows
0.33
0.67
1
Cropping intensity (R)

Figure 1.

IDRC CRDI

CANADA

Fig. 2. Spectrum of Indigenous Approaches to Manipulate 'Fallow' Vegetation in S.E. Asia



POLYCULTURES
GOAL: Harvest of tree products.

CONTINUUM

MONOCULTURES
GOAL: Rehabilitate soil properties after cropping period.

(COMPLEX) AGROFORESTS

Permanent:

- *Shorea javanica*
  - Krui, Sumatra, Ind.
- *Durio zibethinus*
  - Kalimantan, Ind.
- Ifugao woodlots
  - Ifaguao, Phil.
- *Borassus sundaicus*
  - Roti & Savu Islands, Ind.

Semi-Permanent:

- *Havea brasiliensis*
  - Sumatra, Kalimantan, Ind.
- *Styrax tonkinensis / S. benzoides*
  - northern Laos
- *Camellia sinensis*
  - southern China
- *Calamus sp. / Plectocomia himalayana*
  - southern China
- Fruit orchards
  - northern Thailand
  - northern Laos
- Kenyah / Iban fallow enrichment
  - Kalimantan, Ind.

PERENNIAL-ANNUAL CROP ROTATIONS *(cyclical taungya system)*

Timber-Based:

- *Cunninghamia lanceolata*
  - southern China
- *Paraserianthes falcataria*
  - Mindanao, Phil.
- *Melia sp.*
  - N.W. Vietnam
- *Tectona grandis*
  - Laos
  - India
- *Gmelina arborea*
  - India
  - Philippines
- *Eucalyptus spp.*
  - Thailand
  - Philippines

Non-Timber:

- *Cinnamomum burmanii*
  - Sumatra, Ind.
- *Coffea spp.*
  - widespread
- *Amomum compactum*
  - northern Laos
- *Calamus sp.*
  - Kalimantan, Ind.
- *Broussonetia papyrifera*
  - northern Laos
- bamboo spp.
  - Timor, Ind.
  - southern China
- 'Talun kebun' (mixed)
  - West Java, Ind.

INTERSTITIAL TREE-BASED IMPROVED FALLOW

Spatial:

- *Alnus nepalensis*
  - Nagaland, India
- *Leucaena glauca / Gliricidia sepium*
  - Naalad, Cebu, Phil.
  - Claveria, Phil. (contour hedgerows-cum-fallows)
- *Sesbania grandiflora / Leucaena leucocephala*
  - Sumba / Flores, Ind.
- *Erythrina sp. / Desmodium sp. / Hybiscus sp.*
  - Flores, Ind.
- *Albizzia chinensis*
  - Sumba, Ind.
- *Leucaena leucocephala*
  - Amarasi, Timor, Ind.
  - South Sulawesi, Ind.
  - Mindoro, Phil.
- *Ficus spp.* - (fodder)
  - eastern Bhutan
- *Acacia villosa*
  - Timor, Ind.
- 'damar merah'
  - Timor, Ind.
- protecting existing coppices
  - northern Thailand
  - Kalimantan, Ind.

Temporal:

- *Sesbania spp.*
  - Isabela / Cagayan, Phil.
- *Alnus nepalensis*
  - southern China
- *Casuarina oligodan*
  - New Guinea

RETENTION / PROMOTION OF VOLUNTEER SPP. WITH ECONOMIC VALUE

Food:

- bamboo shoots
- wild vegetables

Fiber:

- construction materials
- *Imperata cylindrica*
- other spp. of thatch-grass
- broom grass

Fodder:

- *Imperata cylindrica*

Fuel

Medicinal Herbs:

- all widespread in subsistence swidden communities

SHRUB-BASED ACCELERATED FALLOW

***Compositae spp.* (Non-N fixing)**

- *Austroeupatorium inulifolium*
  - West Sumatra, Ind.
- *Tithonia diversifolia*
  - Mindanao, Phil.
- *Chromolaena odorata*
  - Luang Prabang, Laos
  - Nusa Tenggara, Ind.
  - Kalimantan, Ind.
  - Yunnan, China
  - northern Thailand
  - widespread below 1000 m asl

Other spp. (N-fixing)

- *Mimosa spp.*
  - Leyte, Phil.
  - northern Thailand
- 'bokot-bokot' - (unidentified)
  - Leyte, Phil.

VINY LEGUMES AS SEASONAL FALLOWS

- *Vigna sp.*
  - northern Vietnam
- *Calopogonium mucunoides*
  - Leyte, Phil.

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