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Improving shifting cultivation in Southeast Asia by building on indigenous fallow management strategies

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Abstract. Shifting cultivation continues as the economic mainstay of upland communities in many countries in Southeast Asia. However, the conditions that historically underpinned the sustainability of rotations with long fallows have largely vanished. The imperative to evolve 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. There are many compelling examples where shifting cultivators have successfully managed local resources to solve local problems. Technical approaches to stabilizing and improving productivity of shifting cultivation systems have not been notably successful. Farmer rejection of researcher-driven solutions has led to greater recognition of farmer constraints. This experience underlined the need for participatory, on-farm research approaches to identify solutions. The challenge is to document and evaluate indigenous strategies for intensification of shifting cultivation through a process of research and development. This process involves identification of promising indigenous practices, characterization of the practices, validation of the utility of the practice for other communities, extrapolation to other locations, verification with key farmers, and wide-scale extension.

Indigenous strategies in a regional context

Much of Southeast Asia is dominated by mountainous topography populated by diverse cultural minority communities. Expansive forests and sparse populations allowed these mountain-dwelling communities to practice variations of shifting cultivation, which enabled them to coexist 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. Mutual antagonism, deep suspicion, and open conflict have characterized the relationship between foresters and shifting cultivators. 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.

Detailed anthropological studies, starting with work by Conklin (1954, 1957) in the Philippines, built 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 they pointed to its long history as evidence of sustainability. Far from wanton destruction of forests, they argued, shifting cultivation is a land-use practice that reflects (i) indigenous knowledge accumulated through centuries of trial and error, (ii) an intricate balance between product harvest and ecological resilience, and (iii) an impressive degree of agrodiversity. More recent literature (for example, De Foresta and Michon, 1997) points 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 towards biodiversity conservation will remain ineffectual 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 need to reframe the debate in order to move forward in identifying research and development interventions that can stabilize declining upland agroecosystems and improve standards of living of the most marginalized upland communities.

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. The preconditions that underpinned the sustainability of ‘traditional’ forms of shifting cultivation are now rare because of dramatically increasing population densities arising from both endogenous growth and in-migration by large numbers of lowlanders, lost access to large tracts of land that have been gazetted as protected wildlands, and other competing land uses. 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 trends of shortening fallows, lengthening cropping periods, and rapidly degrading environments are 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 to imperata grass [*Imperata cylindrica* (L.) Raeuschel] infestation. Farmers consequently must move further upslope to clear more forested land and crop the more fertile soils.

This is a cross-cutting issue of direct relevance to several research and development priorities in Southeast Asia. Successful indigenous strategies for managing fallow land in more productive ways must be identified and diffused to other upland areas with degrading shifting cultivation. 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.

Pathways to intensification

Farmer responses to intensification pressures may generally be classified (van Noordwijk et al., 1996) as innovations to achieve:

(1) More 'effective' fallows – where the biological efficiency of fallow functions is improved, and the same or greater production benefits can be achieved in a shorter time frame.
(2) 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.
(3) A combination of the two – where a degree of both biophysical and economic benefits is obtained by productive perennials alternated infrequently with annual crop cultivation.

These alternative pathways towards intensification have different implications for land use (Figure 1). More effective or accelerated fallows enable output per unit land area to increase and cropping frequency to increase. They often provide an intermediate stage in a transition from shifting cultivation to the

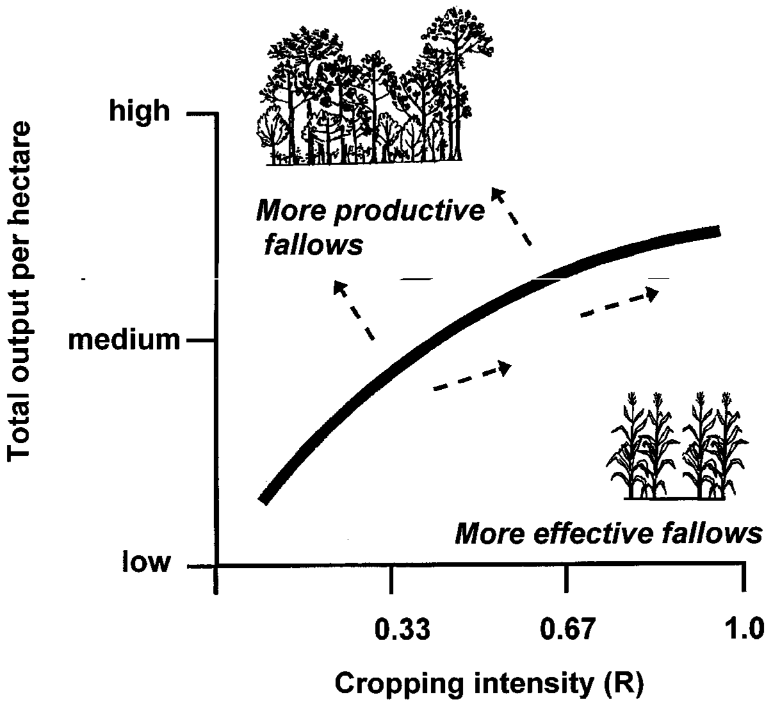

Figure 1. Alternative pathways to the evolution of more productive shifting cultivation systems. More effective fallows increase output as cropping intensity increases. More productive fallows increase output as cropping intensity decreases (adapted from van Noordwijk et al., 1996).

continuous cultivation of annual crops. In more productive fallows, on the other hand, the output increases while the frequency of annual cropping declines. The phase of reopening and cultivation of annuals may eventually be foregone altogether as the farmer chooses to protect the perennial vegetation, allowing it to develop into semi-permanent 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 have proved successful. There is unfortunately little documentation of such indigenous innovations to feed into the national and international research agenda or to inform policy makers. Indigenous innovations are generally unobserved or misinterpreted.

ICRAF is collaborating with partner institutions in developing a regional research initiative on ‘indigenous strategies for intensification of shifting cultivation in Southeast 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 the region. The approach will emphasize indigenous knowledge and practices as the point of departure in the search for pragmatic and adaptable solutions to intensify and reinforce the sustainability of highly stressed shifting cultivation systems. The work is 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 other communities facing similar problems. This is not suggested as a panacea, but as a promising approach that builds on indigenous practices and must be added to our repertoire of technical responses to declining productivity of shifting cultivation 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 categorizes indigenous strategies for fallow management that fall along this continuum from productive to effective fallows. Figure 3 portrays roughly where we know these various systems are practiced in the region. These case studies provide a foundation for the development of a longer-term, coordinated effort to stabilize shifting cultivation. The work will explore the value of this knowledge for both researchers and policy makers. It will also help formulate more robust arguments for empowerment of local communities to manage their own

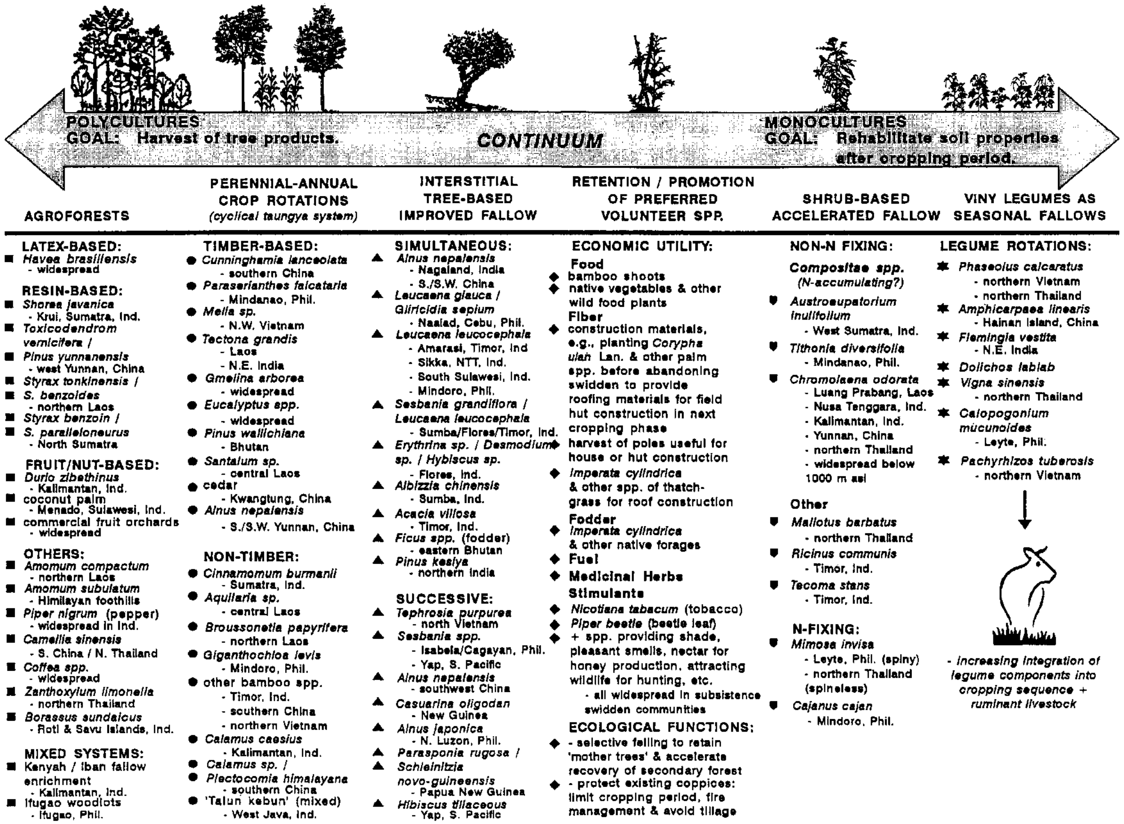

Figure 2. A compilation of indigenous approaches to manipulate fallow vegetation in Southeast Asia classified along the continuum from productive fallows (polycultures) to more effective fallows (monocultures). Many of these cases are documented in ICRAF (1997).

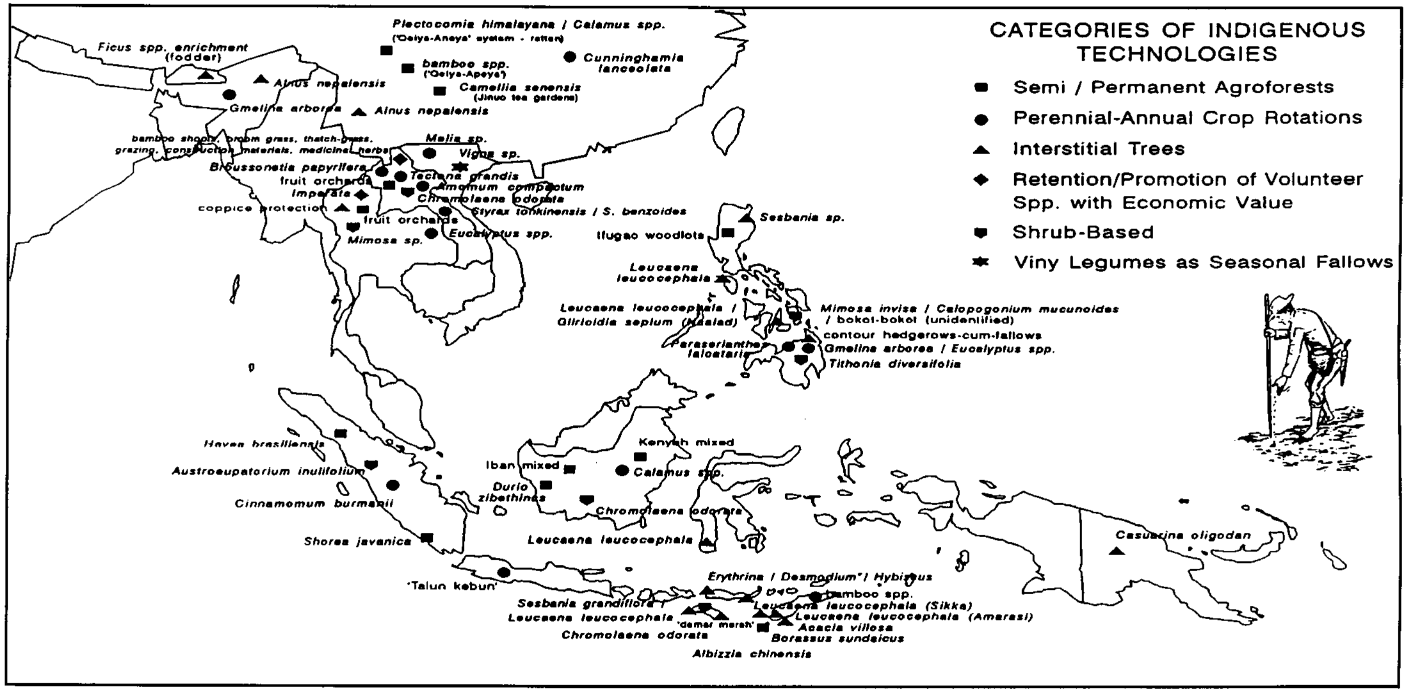

Figure 3. A map of indigenous approaches to manipulate fallow vegetation observed in Southeast Asia.

robust arguments for empowerment of local communities to manage their own natural resource.

The general strategy of the work is (i) to document and evaluate indigenous strategies for intensification of shifting cultivation in Southeast Asia and (ii) to 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 (IFM) is within ICRAF's broader Alternatives to Slash-and-Burn (ASB) program, linking it directly with global efforts to mitigate the impacts of deteriorating shifting cultivation systems.

Regional workshop

The ICRAF Southeast Asia Program hosted a regional workshop in June 1997 (ICRAF, 1997; Cairns and Burgers, 1999) to document and analyze the compelling array of case studies in the region where shifting cultivators confronted with mounting land-use pressures have successfully developed technologies to manage fallow land more productively, thus permitting sustainable intensification. The focus was on innovations with wide extrapolation potential rather than on situation-specific, anthropological curiosities.

The workshop brought together 120 scientists, practitioners, and policymakers from across Southeast Asia to review 67 case studies. Building on the momentum of the workshop, a regional IFM network was formed as a forum for collaboration and sharing of experiences among five cores institutions representing those areas where stressed shifting cultivation systems are most endemic: northern Vietnam, northern Lao Peoples Democratic Republic, northeast India, southwest China, and the northern Philippines. After the workshop, 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 focused around the IFM theme.

Refining a research and development process

The development of a process for research and development on improved indigenous fallow systems involves (i) characterization of promising IFM systems, (ii) definition of their extrapolation domain and generation of preliminary extension materials, (iii) design and set up of agronomic trials to validate farmer perceptions of the superiority of these systems and test technological refinements, (iv) extrapolation through adaptive trials in other locations, and (v) generation and dissemination of advanced extension materials. Numerous unconventional aspects must be considered when conducting research on indigenous fallow innovations intended to benefit a wider population of upland people. These aspects must be recognized and critically assessed, and special attention must be given to methods targeted to the unique conditions of shifting cultivation.

The research and development process for improved fallow management systems is a continuum of tasks (Figure 4). The process begins with the identification of a promising system or practice for which limited observation suggests (i) elements of real value to other smallholders elsewhere and (ii) positive practical returns to investing in a research effort. This leads to a characterization of the system, which provides a more thorough description and analysis based on rapid or participatory appraisal methods and perhaps complementary 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 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. The work may be done through comparisons of 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, and because it may be useful to test additional management variations, it will often be necessary to conduct field trials. If the innovation still demonstrates wider promise after careful evaluation, we then 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 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. After selecting new locations it is tempting to move ahead with an extension program, but it is best at this point to 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 before a major failure occurs. As the promising experience of the key farmers becomes evident, then it is time to develop an effective extension program that expands adoption widely. The key farmers become the foundation for diffusion of the innovation.

Critically assessing the benefits and costs of an innovation

Assessing the utility of an improved fallow innovation is complex. This section addresses a few key pitfalls that researchers and extensionists may encounter and provides some guidelines on how to cope with them.

(1) *Analyses that show the innovation has better returns per hectare but ignore the labor requirements*. Labor is a dominant constraint in shifting

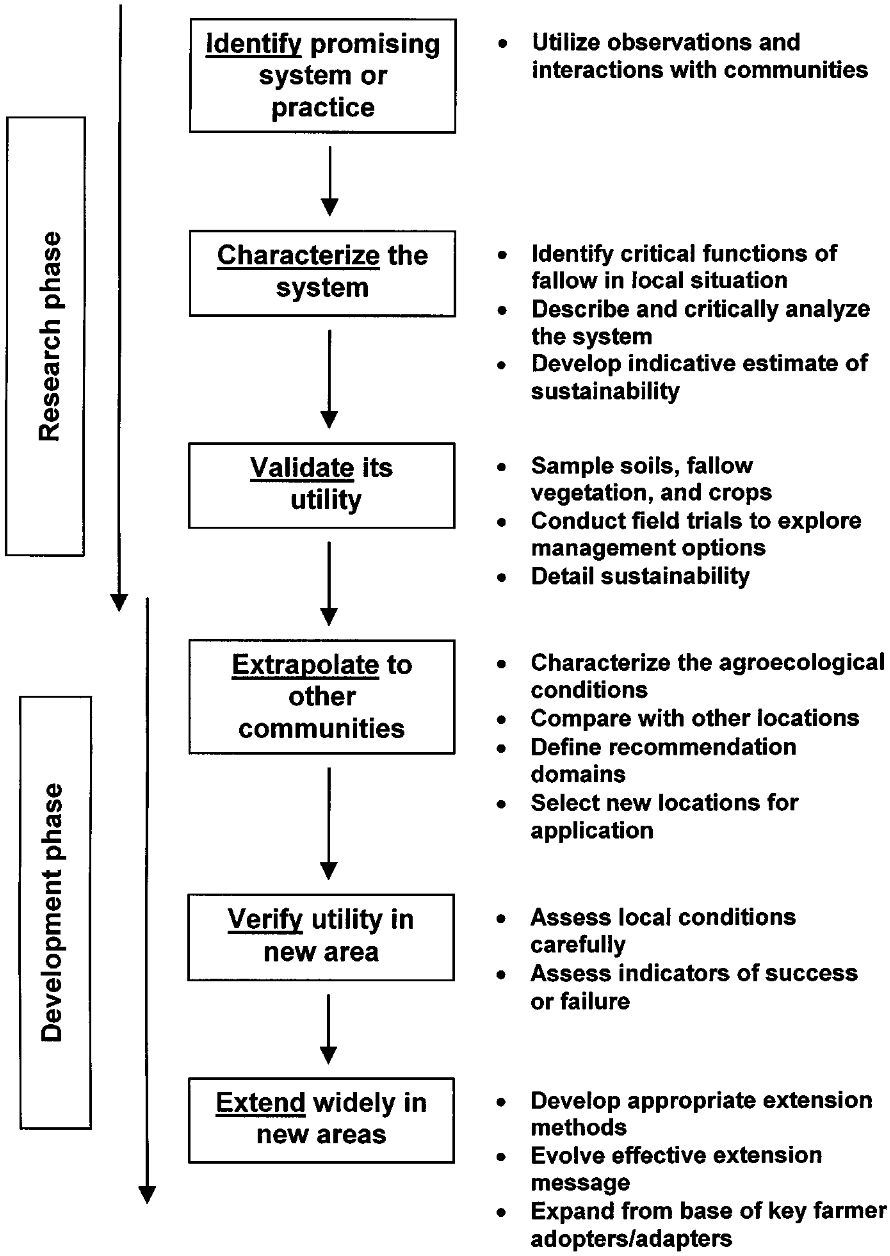

Figure 4. A diagram of a process for research and development on indigenous fallow management systems.

cultivation. Increasing returns to labor is usually much more important than merely increasing yields per unit land area. Thus, estimating labor requirements for the innovation and calculating the returns to labor for the innovation are crucial to the evaluation of the superiority of the practice.

(2) *Failure to examine the benefits and costs over the entire shifting cultivation cycle*. The returns to an innovation must 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 they must be estimated without complete data. Actual observations may not be feasible over cycles that extend for years or even decades, but an analysis of presumed benefits and costs for the whole cycle is critical.

(3) *Invalid or inconclusive sampling of soils and crop performance*. It is difficult to detect unambiguous changes (improvements) in soil fertility by a fallow within a few years. Many soil scientists have concluded that conventional soil analyses are either not sufficiently sensitive in detecting changes or do not measure the really important parameters. In addition, the results of samples analyzed in successive years may be confounded by variation among different times of analysis. The fertility benefit of an innovation may also have relatively little effect on the fertility of the soil during the fallow period. A more important effect may be the amount of nutrients accumulated in the biomass of the fallow vegetation, which are rapidly dissipated upon slash-and-burn.

Attempts to assess the performance of an innovation by comparing results from fields where it is practiced with results from nearby fields where it is not practiced can be confounded by differences in soils, slopes, cropping history, and many other farm-to-farm management differences between the fields. These differences may overwhelm the effects of the innovation or bias the assessment of the innovation. Even in the best of cases, comparisons based on such sampling methods are only indicative. Hence, it is often necessary to set up new trials with farmers specifically to make valid comparisons. The simplest approach is to conduct paired-plot trials, which compare the innovation with the conventional fallow system – with each system occupying one-half of a field. These paired plots are replicated across a number of farms, and each farm thus becomes one replication of the experiment.

Collecting valid results is the fundamental first step of conducting research on indigenous innovations. Subjecting the results to a robust analysis that takes into account the real nature of the smallholder's situation is the second step. This analysis itself must be validated and enriched by iteration with local people's inputs and reactions. At this point, we assume 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) *The communities are usually remote from roads and market infrastructure*. This means these communities are constrained in participating in the market economy, and they may be 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. If forestry extension services exist and are available to assist smallholders, they are usually 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, and they may be exacerbated by land conflicts within the community. Adoption of fallow management innovations will be very sensitive to these realities. Clear land rights are essential for successful intensification.
(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 in 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.

Conclusions

A substantial amount of IFM research has already been initiated, particularly in the form of descriptive case studies and characterization of IFM systems. A large body of promising indigenous strategies have been identified and classified into a continuum that extends from effective to productive fallows (Cairns and Burgers, 1999). Future actions should 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. A fundamental challenge will be to develop and refine a research and development process that provides a practical but rigorous tool to identify, validate, and extrapolate promising indigenous systems so they may benefit a much wider range of shifting cultivation communities.

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