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Learning from Indigenous Fallow Management (IFM) in S.E. Asia:

A Promising Approach to Stabilization of Stressed Swidden Systems

Malcolm Cairns

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'Learning from Indigenous Fallow Management (IFM) in S.E. Asia: A Promising Approach to Stabilization of Stressed Swidden Systems'[1]

Malcolm Cairns
Associate Scientist
Southeast Asian Regional Research Program
International Center for Research in Agroforestry (ICRAF)[2]

SUMMARY

Swidden cultivation that continues as the economic backbone of many upland farming systems in S.E. Asia, is under mounting pressure to intensify into more permanent forms of land use. Both S.R. Vietnam and Lao P.D.R. share the challenges posed by mountainous terrain populated by a myriad of diverse ethnic minority groups; sparse road infrastructure and distant markets have limited development of alternative livelihood options and it is estimated that 337,000 Lao households and up to 3 million Vietnamese rely to some degree on variants of swidden cultivation for their survival. However, the preconditions that have historically underpinned the sustainability of long-fallow swiddening - extensive tracts of forested lands, sparse population densities, and no pressures to produce surpluses for outside markets, have largely vanished. Instead, pressures of rapid population growth (both endogenous and in-migration), gazettement of remnant wildlands into protected areas, and state policies to sedentarize agriculture and discourage use of fallow and fire, are all converging on the need to intensify swiddening.

Swidden intensification pressures are further amplified in Vietnam and Laos as both countries have embarked on experimental programmes to allocate state lands to the control of individuals and communities. Although the implications of this land privatization are not yet fully clear, an early problem has been the failure of policy makers to recognize fallow lands as an integral and essential component of rotational swiddening. Officials tend to view swidden fallows as forestal lands frequently despoiled by marauding shifting cultivators - rather than as agricultural lands on which trees are intentionally encouraged to grow on a cyclical basis. The increasing role of both states in organizing access to land resources suggests that farmers' access to customary fallow lands will be increasingly restricted and swidden systems subjected to rapid intensification pressures. Swiddening can not be legislated out of existence in the absence of viable alternatives however, and decades of research have yielded few solutions that have attracted wide farmer adoption.

Recent surveys have revealed that, while rejecting outside technologies, swidden cultivators faced with mounting land use pressures have been remarkably innovative in devising their own ways to manage fallow lands more productively. These farmer-generated fallow management technologies may generally be classified as innovations to achieve:

- more *'effective'* fallows - wherein the biological efficiency of fallow functions is improved, and

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[2] ICRAF, P.O. Box 161, Bogor 16001, Indonesia. Tel: 62-251-315234 (O), 62-251-331247 (H); Fax: 62-251-315567; E-mail: icraf-indonesia@cgnet.com OR icrafind@server.indo.net.id.

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 economic perennial species; or

- ***combinations*** of the two trends, where a degree of both biophysical and economic benefits may be accrued (see Figure 1).

More effective or accelerated fallows often provide an intermediate step in a transition to permanent cultivation of annual crops. This direction of intensification would be most appropriate for upland communities where food security is the primary concern. Alternatively, in more productive fallows, the phase of reopening and cultivation of annuals may eventually be foregone altogether as the farmer chooses to plant and protect perennial vegetation, allowing it to develop into semi/permanent agroforests. This option is attractive in the presence of strong market opportunities for tree products and the ability to use cash receipts to purchase rice needs. The spectrum of technologies suggested in Figure 2 provides an organizational framework for analysis of indigenous fallow management practices and beginning to catalogue variations of these models in the region. Common characteristics that appear to cut across IFM models include:

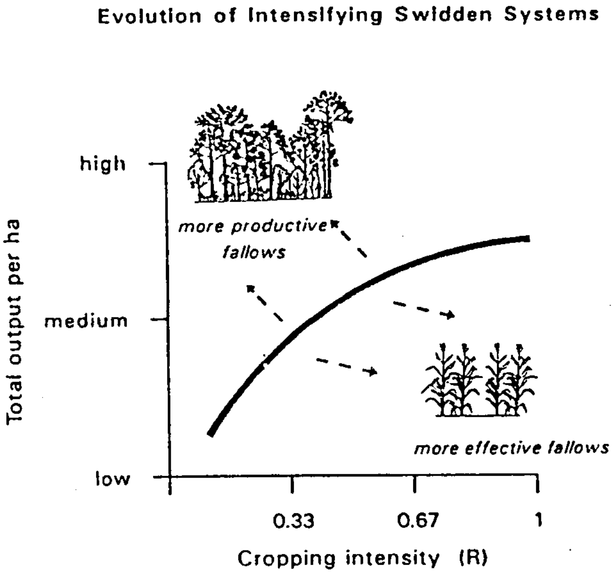

Figure 1.

I. Respond to farmers' felt needs;

II. Build on indigenous knowledge - and have evolved with little or no extension services;

III. Usually allow extensive management - with few or no additional labor inputs;

IV. Require little or no outside technologies;

V. Require little or no capital and are low risk;

VI. Use local resources and do not rely on continually imported germplasm;

VII. Can readily be modified to fit local farming systems;

VIII. Evolve in the context of secure land and tree tenure; and

IX. Can be gradually refined and intensified in response to increasing labor supply and land use pressures.

Mucuna and other viny legumes that have earned wide popularity as cover crops and green manures at other tropical latitudes are much less commonly used in the S.E. Asian context. Asian fallow enrichment more typically draws on an assortment of shrubs and trees, carefully chosen for N-fixation, efficient nutrient scavenging, and/or provision of economic products. Factors contributing to this dichotomy may include: 1) the emphasis on rice and lower consumption of beans in S.E. Asian diets; 2) S.E. Asia's long history of producing spices for world markets; 3) the widespread use of trees by S.E. Asian swiddenists to demonstrate land occupation and thereby stake private claim to it; and 4) P-scavenging may be more critical than N-fixation in many of S.E. Asia's upland soils. A preliminary checklist of criteria for evaluating candidate species for improved fallow management might include:

1. Provide fast and easily recognizable benefit / income to farmer adopters, e.g., food, livestock fodder, firewood, construction poles;

2. Ease of establishment / availability of seed;

3. Time of planting and other management activities do not conflict with other labor demands;

4. Adaptability to marginal upland soils with low pH;

5. Shorten the fallow period by more efficient performance of fallow functions, e.g., weed suppression and soil rejuvenation;

6. Fast provision of plant cover after harvest of swidden crops;

7. Dense canopy that shades out light-demanding weeds;

8. Have high biomass production;

9. Mobilize nutrients from lower soil layers / efficient nutrient scavenging;

10. Can withstand cyclical pollarding and exposure to fire;

11. Strong coppicing ability; repeated planting is not necessary;

12. Ease of clearing when reopening fallow.

13. Low potential to become a problem weed; and

14. Not vulnerable to pest / disease outbreaks.

Despite the difference in approach, IFM strategies in S.E. Asia are designed to accomplish essentially the same objectives as green manures / cover crops in Latin America and West Africa. Most critical of these is their ability to respond to rising demographic pressures by enabling a sustainable intensification of land use. The carrying capacity of sloping uplands is bolstered as increasingly sophisticated (and labor intensive) variations of fallow management evolve to absorb the expanding rural labor force. This intensification is accompanied by a sharp decrease or even elimination of field burning as more the woody biomass is harvested for small diameter timber and firewood. The frequency of wildfires is reduced dramatically as more of the landscape is planted to economic perennials and local communities have a strong vested interest in protecting them. Although subsistence-oriented swiddenists tend to develop diverse tree gardens that supply a wide variety of household needs, marketization of these rural

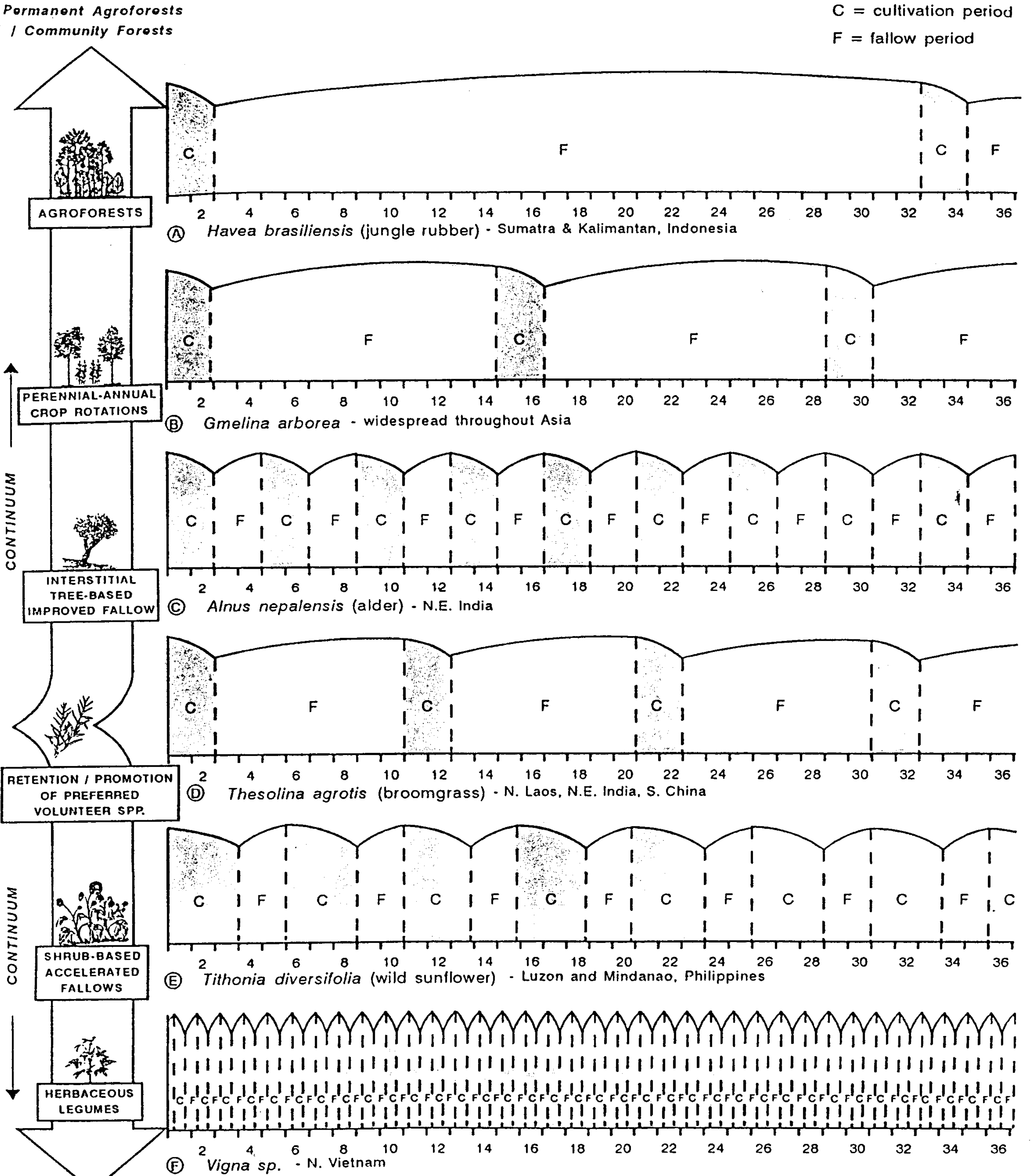

Figure 3. Examples of Swidden Cycles Under Representative Fallow Management Practices Cultivation : Fallow cycles of managed fallows vary widely according to farmer strategies to: A. develop long-term agroforests; B. introduce commercially important perennials as 'fallow crops'; C manage trees in interstitial patterns; D. simply retain or promote spontaneous fallow spp. with economic or ecological value; E. encourage domination of successional communities by pioneer shrubs associated with soil-building properties; and F. introduce herbaceous legumes as a component of permanent cropping patterns.

economics invariably leads to specialization in the tree crop that is viewed as most profitable. Diverse agroforests are thus often displaced by monoculture orchards (fruit, nuts, condiments and spices) and plantations (timber, rattan, bamboo). In all cases, managed fallows arguably play a valuable role in biodiversity conservation *ex situ* simply by permitting an intensification of land use and hence ameliorating agricultural pressure on adjacent forest margins.

It should be noted that at both poles of the IFM spectrum (Figure 2), fallow management has intensified to the point where the land use system no longer falls under the conventional definition of ***'swiddening'*** - but would more accurately be considered as permanent agroforests (left pole) or permanent cropping patterns with a herbaceous legume component (right pole). They are included in the continuum because each has its evolutionary origins in swidden cultivation; maintains the basic structure of a fallow-cropping cycle (see Figure 3); and to show the full logical progression of intensifying IFM. The salient issue is that these are all farmer-generated and tested pathways that enable an incremental intensification of swiddening into more permanent models of land use.

Semantics may be important however, in sensitizing decision-makers to the value of an IFM approach to stabilizing stressed swidden systems. In view of most governments' policies to sedentarize shifting cultivation, ***'fallows'*** may be a problematic term because of its close association with what is officially perceived as an undesirable practice. ***'Managed fallows'*** may be construed as implying a continuation of shifting cultivation, which in turn is equated to slash-and-burn, forest destruction, nomadism and other negative political baggage. The philosophical underpinnings of this official disfavor lies not only in the state's loss of timber assets, but also in the widespread perception of fallow lands as unmanaged, idle and unproductive. This misconception will be challenged as further case studies are examined and a growing body of literature documents farmers' often intricate management of fallow vegetation to achieve biological and/or economic benefits. Indeed it may be more politically palatable, and accurate, to abandon the term ***'fallow management'*** altogether - and instead popularize these as ***permanent, rotational cropping systems***.

This would resonate strongly with government policy to encourage permanent forms of land use and may widen the political space for a more liberal interpretation of what constitutes ***'agricultural land'***. Demonstrating clearly that these are managed lands will strengthen farmers' arguments that they should be classified as agricultural and their customary tenure over them sanctioned by the state. Conversely, state recognition and normalization of indigenous land tenure institutions will remove uncertainty and further encourage farmers to invest scarce labor resources in adopting intensified management of fallow lands.

After completion of the lecture, the course participants undertook a participatory exercise to synthesize key lessons learnt (Table 1) and formulate recommendations on the conditions under which specific typologies of fallow management (Figure 2) would be most appropriate (Table 2).

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Table 1. *Synthesis of Key Lessons Learnt by Participants*

1. There is wide flexibility in the pathways by which farmers can begin to modify fallow vegetation and move towards more intensive land use. Researchers and extensionists need to assist farmers in choosing technologies that are most appropriate to their circumstances.

2. Retention and promotion of any fallow species that is useful to farmers constitutes the simplest and most basic form of fallow management.

3. Managed fallows will ideally provide a combination of economic and ecological improvements. Work needs to identify candidate fallow species that can provide these dual benefits.

4. Improved fallow husbandry should combine elements of food security and environmental protection.

5. Fallow management generally integrates strong soil conservation components, e.g., soil cover and arrangement of vegetation into contour strips.

6. Selection of most appropriate fallow species must consider soil type, altitude and other agroclimatic conditions.

7. Many agroforest patterns evolve from enrichment planting of economic perennials into swidden fields during the cropping phase.

8. Complex agroforests that evolve from swidden systems are multi-strata, biodiverse and perform the same ecological functions as natural forests. However, other categories of fallow management tend to promote a particularly valued tree, shrub or viny legume, and displace the biodiversity of natural succession communities.

9. In the presence of market opportunities, fallow land may undergo rapid conversion to fruit orchards, e.g. expansion of lychee in northern Vietnam, aimed at Chinese markets.

10. Lao holds a competitive advantage in producing fruit and livestock for sale to some of its more prosperous neighbors. Fallow management strategies should therefore focus on horticulture and silvopastoral options.

11. In Vietnam, there is confusion between '*fallow*', '*barren*' and '*forest*' lands; this needs to be clarified to provide the basis for sound policy formulation.

12. Fallow management technologies hold promise for rehabilitating Vietnam's barren lands and bringing them back into productive use.

13. Now that the Vietnamese government is allocating private land to individual households, extension services should disseminate promising fallow management technologies and explore with farmers how they can best fit current farming systems.

Table 2. *Participant Recommendations for Application of Fallow Management Technologies*

1. Fallow management should integrate indigenous technical knowledge (ITK) with modern science.

2. Indigenous agroforestry practices of minority groups should be built onto and refined to produce timber, fruit, nuts, resins and other tree products on formerly fallow land.

3. Biologically improved fallows permit an acceleration of the swidden cycle and seem to be most appropriate where food security is the primary concern. In the presence of market opportunities for tree products however, S.E. Asian farmers generally prefer economically more productive fallows that provide salable commodities at the time of reopening the fallow for cultivation of annual crops.

4. Vietnam's high population pressures demand an intensification of land use. Biologically more effective fallows should therefore be prioritized with the objective of shortening the fallow phase and increasing the land's carrying capacity. More extensive agroforestry models might be more appropriate for Laos where land is more plentiful.

5. Bamboo forests are widespread in the hilly areas of Cao Bang Province, Vietnam, and should be protected and promoted as desired fallow species.

6. Inclusion of legumes with fodder value can provide both biological benefits through generation of organic matter and N-fixation, and indirect economic dividends through increased sales of ruminant livestock. The livestock also play an important role in accumulating nutrients and returning them back to the swidden through the dung.

7. Cover crops should be used on sloping lands in Laos.

8. In Laos, modified fallow vegetation should promote leguminous components to improve soil fertility.

9. Modification of fallow vegetation into agroforests is most appropriate for the hilly lands of Son La Province, Vietnam.

10. Evolution of swidden land into agroforest patterns is most appropriate for Binh Dinh Province, Vietnam, where the soils are generally poor and environmental protection is needed.

11. In the sloping uplands of Lam Dong Province, Vietnam, agroforests integrating fruit and forest tree components are recommended.

12. Conversion of fallow land into fruit or nut-based agroforests is widely suitable for those swidden communities in Laos with market integration.

13. Enriching fallows with fruit trees and then propagating an understory of fodder grasses / legumes will provide farm cash receipts from both livestock and fruit sales.

14. In isolated areas, agroforests should emphasize spices, nuts, resins and other tree products that are low volume, low perishability but high value.

15. Research needs to delineate fallow lands in upland rural communities of Vietnam and clarify how

they are being managed. Land use statistics and policy then need to be adjusted accordingly to reflect this more accurate understanding.

Protocols for the measurements briefly described below can be found in Murdiyarso, et al. (1995). Carbon stocks are measured as tons of carbon per hectare, averaged over the life cycle of a land use system. There are net carbon dioxide fluxes from land use changes, but not for land use types *per se*. For methane and nitrous oxide, each land use will have a net flux. Fluxes of methane and nitrous oxide are measured directly. Estimates of annual flux per hectare of the greenhouse gases are aggregated on the basis of net radiative forcing (IPCC, 1990), with their "greenhouse effect" in the atmosphere expressed in carbon dioxide equivalents.

Measurement of **biodiversity** richness of the alternative land use systems for major groups of organisms above and belowground is a particularly complex challenge (Giller, et al., 1997). In this research program, aboveground measurements are done for plant functional groups as well as using the more conventional taxonomic approach (Gillison and Carpenter, 1997). Gillison's "plant functional attributes" (PFA) approach provides an overall indicator of biodiversity richness that is suitable for cross-continent comparisons. Belowground assessments focus on organisms that influence agronomic sustainability. Two of the hypotheses to be tested in the ongoing biodiversity component of this research are: (a) that PFAs are highly correlated with plant species richness as well as other aboveground taxa; and (b) that aboveground biodiversity is highly correlated with belowground biodiversity. At this stage, the first hypothesis rests on a firmer body of evidence than the second.

Still, this research overcomes only some of the methodological difficulties associated with biodiversity assessment, and cannot alone answer the question of how much biodiversity will be lost for each hectare of forest converted to another land use. The main methodological gaps concern scaling over space and over time. As one samples biodiversity over larger and larger areas of a particular ecosystem, the number of additional species observed will increase, but at a decreasing rate. This complementarity across space means that one cannot simply "add" indicators of biodiversity richness across plots. Nor can the number of species seen on a small study area tell us how much land is needed to conserve those species. These species' long-term survival prospects depend on the extent of their habitat, but this is influenced by the pattern of land cover in the landscape. For example, although the plots of Sumatran rubber agroforests studied so far may harbor half to two-thirds of the biodiversity of an equivalent area of natural forest (Michon and de Foresta, 1995), it is not known whether the same is true if one were to compare a million hectares of rubber agroforests to an equal amount of natural forest. Even less is known about what happens if these million hectares occur in a mosaic with undisturbed forest patches.

ICRAF

ICRAF Southeast Asian Regional Research Programme
Jl. CIFOR, Situ Gede, Sindang Barang
P.O. Box 161, Bogor 16001, Indonesia
Phone: (62-251) 625415; Fax: (62-251) 625416; Email: icraf-indonesia@cgnet.com