THE EVOLUTION OF SWIDDEN FALLOW SECONDARY FORESTS IN ASIA

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DE JONG, W., CHOKKALINGAM, U. & PERERA, G. A. D. 2001. The evolution of swidden fallow secondary forests in Asia. Swidden agriculture in tropical Asia is a diverse practice, making it difficult to draw general conclusions on trends of the development of swidden fallow secondary forests (SFSF). There is, however, sufficient evidence to recognise trends of a gradual intensification often through the incorporation of extensive tree crop production in SFSF, or a direct conversion to intensive tree cash cropping. Factors contributing to the changes include emerging markets for cash crops or timber and pulp-wood production, government policies and development projects, fire, and population pressures. In Indonesia and mainland Southeast Asia, there is evidence of change towards tree- and cash crop-based production systems. In north-eastern India, there is improved fallow management to sustain or enhance productivity of the shortened swidden agricultural cycle to support a subsistence economy. In Sri Lanka, biophysical factors inhibit the development of intensive agroforestry systems. Although swidden fallow land use has often been stigmatised as leading to forest decline and a related decline in the environmental functions that forests provide, there is sufficient evidence suggesting that conversion of a SFSF-dominated landscape to more intensive tree cropping can have a negative environmental impact. Some general options for the evolution of swidden agriculture under different stages of a land use intensification model are considered.

Key words: Swidden agriculture - fallow - secondary forests - Asia - tree cropping - intensification

DE JONG, W., CHOKKALINGAM, U. & PERERA, D. 2001. Evolusi hutan sekunder bekas ladang di Asia. Amalan pertanian ladang yang berbeza-beza di tropika Asia menimbulkan kesulitan untuk membuat kesimpulan umum mengenai trend pembangunan hutan sekunder bekas ladang (SFSF). Bagaimanapun, terdapat bukti yang cukup untuk mengenal pasti trend pengintensifan secara beransur-ansur, selalunya melalui gabungan pengeluaran tanaman pokok secara besar-besaran dalam SFSF, ataupun pengalihan secara langsung kepada penanaman pokok kontan secara intensif. Faktor yang menyumbang kepada pengalihan termasuklah kemunculan pasaran bagi tanaman kontan atau pengeluaran balak dan pulpa kayu, polisi kerajaan serta projek pembangunan, kebakaran dan tekanan penduduk. Di Indonesia dan di bahagian

tanah besar Asia Tenggara, terdapat bukti wujudnya pengalihan kepada sistem pengeluaran berasaskan tanaman pokok dan tanaman kontan. Di timur laut India, terdapat pengurusan bekas ladang yang dipertingkatkan sama ada untuk mengekal ataupun meningkatkan produktiviti kitaran pertanian ladang yang dipendekkan bagi menyokong ekonomi sara diri. Di Sri Lanka, faktor biofizik merencatkan pembangunan sistem perhutanan tani secara intensif. Walaupun penggunaan tanah bekas ladang selalu dianggap penyebab kemerosotan hutan dan kemerosotan berkaitan fungsi-fungsi alam sekitar yang disediakan oleh hutan, terdapat bukti yang menunjukkan bahawa peralihan landskap yang didominasi oleh SFSF kepada penanaman pokok secara intensif akan menyebabkan kesan alam sekitar yang negatif. Beberapa pilihan bagi evolusi pertanian ladang pada tahap model pengintensifan penggunaan tanah yang berbeza dipertimbangkan.

Introduction

Swidden agriculture continues to be a prominent land use in many Asian countries. Consequently, swidden fallow secondary forests and secondary forest gardens, the two types of secondary forest associated with swidden agricultural systems, play an important role in the Asian forest landscape. Swidden fallow secondary forests are defined as "forests regenerating largely through natural processes in woody fallows of swidden agriculture for the purposes of restoring the land for cultivation again" (Chokkalingam *et al.* 2000a). Secondary forest gardens are considerably enriched swidden fallows, or less-intensively-managed smallholder plantations or home gardens where substantial spontaneous regeneration is tolerated, maintained or even encouraged (Chokkalingam *et al.* 2000a).

The practice of swidden agriculture is viewed with concern in many countries, mostly because of the perceived negative impacts this land use has on the forest landscape. It is often considered a progressive cause of forest destruction, or a form of land use that leads to progressive decline in soil fertility and decrease in production. In addition, many countries are concerned with the low productivity of this type of land use resulting in low rural income and contributing little to export earnings. Due to perceived problems associated with swidden agriculture, many countries have banned this kind of land use, or developed government programmes to address the problem (de Jong 1997, Potter & Lee 1998, de Jong *et al.* 2000, Perera 2000, Schmidt-Vogt 2000).

Many of the attempts to curb the practice have been largely unsuccessful because of a lack of alternative livelihood options for local people. There is evidence of decline in swidden agriculture in many regions. Areas marked by land scarcity, conflicts over resource use, high extraction pressures as well as limited livelihood options are threatened by short fallow lengths and land degradation. In some regions, there has been a trend towards more intensive agroforests and smallholder plantation systems. Thus, intensification of swidden agriculture could potentially evolve along sustainable development pathways.

What is still not very clear is under what circumstances intensification of swidden agriculture occurs and what directions it will take. Neither is it clear what the production, environmental services or biodiversity costs are of alternative routes of

swidden agricultural development. Swidden fallow secondary forests and secondary forest gardens are the components that for the larger part contribute to these functions. Their presence and condition largely determine the extent and quality of these services. This paper discusses the status of and trends in swidden agriculture in a number of countries across tropical Asia. We identify some of the forces that influence the changes, and provide some qualitative judgement of what is gained and what is lost along different possible swidden agricultural development pathways.

Agricultural practices identified as swidden agriculture are in fact quite diverse. Section 2 of this paper provides evidence of this diversity in tropical Asia. Section 3 discusses the value of swidden fallow secondary forests and secondary forest gardens. The extent and value of these forest types should be the prime determinants of the nature of any attention focused on them. Subsequently, Section 4 discusses the trends of change in the swidden-swidden fallow secondary forest landscape in countries across the region. Section 5 contrasts these trends with the policies, legal instruments and development programmes directed at or affecting swidden agriculture. Section 6 summarises the trends using the Intensification Model proposed by Chokkalingam *et al.* (2000b) and discusses the implications for different possible development pathways of swidden cultivation.

Diversity of swidden agriculture and swidden fallow secondary forests

The diversity of swidden agriculture

Swidden agriculture encompasses quite a diverse number of practices, especially if one considers its agro-technical, socio-cultural and politico-economic features. This diversity complicates the identification of general trends, but a number of authors have tried to come to grips with this diversity. Some of the early efforts to classify swidden agriculture, for instance by Ruthenberg (1976) based on the swidden length/fallow length ratio, relate to the evolutionary stages of swidden agriculture. In this case, several endogenous or exogenous forces cause rapid changes and the differentiation in swidden agriculture is a result of these changes. Alternatively, fairly constant biophysical conditions, or slowly-changing socio-cultural factors define the type of swidden agriculture that is practised.

Variation in swidden agriculture in northeast India is caused by factors of rapid change including population pressures and logging activities pursued by urban entrepreneurs, along with the quality of the soils, and the condition of the forest. Ramakrishan & Kushwaha (2000) reported 60-year-long cycles and a diverse mosaic of forests of different ages in very remote areas of northeast India. Closer to urban centres with increased population pressure and land degradation, swidden agriculture has evolved towards a bush-fallow rotational system or a weedy fallow vegetation. Increasingly, this is replaced with a variety of sedentary systems (Ramakrishnan & Kushwaha 2000). There are many examples of similar variation in swidden agriculture along multiple continuums related to various factors of change in tropical Asia (e.g. de Jong *et al.* 2000).

The impact of socio-cultural factors on swidden agricultural practices, perhaps in association with more dynamic factors of change, can be seen in Thailand. The three categories of swidden agriculture reported there—rotational swidden agriculture, pioneer swidden agriculture and supplementary swidden agriculture—are related to different ethnic groups, to different habitats, and are in response to different external incentives (Schmidt-Vogt 2000). In Indonesia, prevalent indigenous land and tree property right systems may have profound influence over the kind of swidden fallow management that is conducted (Weinstock 1989). On the island of Borneo, Dayak groups practise swidden agriculture that differs in the degree of sedentarism, largely a result of cultural preferences (de Jong *et al.* 2000). De Jong *et al.* (2000) consider these variations in swidden agriculture as still belonging to "typical" swidden agriculture systems of groups long present in the region, and as different from the swidden agricultural practices of recent migrants. The widespread occurrence of *Imperata cylindrica* grasslands is often attributed to the swidden agricultural practices of recent migrants.

The influence of biophysical conditions, as a factor of variation, is demonstrated in Sri Lanka. The current development stage of swidden agriculture in this country, resulting in extensive areas of degraded lands and the type of secondary forests that regenerate there, is largely a result of the prevailing dry conditions and the risk of elephant damage that curbs the development of more intensive agroforestry systems (Perera 2000).

In general, the type of swidden agriculture practised in a particular place and at a particular time is the result of a broad set of factors, some of which are largely driven by rapid factors of change, while others are driven by slower changing socio-cultural and bio-climatic factors. The examples presented above suggest that the particular influences of any of these factors are not easily distinguished, thus making generalised statements regarding the adaptations or changes in swidden agriculture a difficult task.

The diversity of swidden fallow secondary forest

Similar to variation in swidden agriculture, the general features of swidden fallow secondary forests are also defined by biophysical conditions, the stage of evolution of the swidden agricultural system, and the socio-cultural and politico-economic variables that define more generally the type of swidden agriculture that is practised. This, in fact, leads to a broad number of swidden fallow secondary forest types in the region, as indicated by the examples below.

Contrasts in swidden fallow secondary forest conditions related to the prevailing biophysical conditions are evident from examples in India and Sri Lanka. In the highlands of north-eastern India, secondary vegetation starts with herbaceous weedy formations during the first 8- to 10-year period, followed by bamboo forest for the next 10 to 20 years. Subsequently, in 10 to 30 years, they develop into early successional mixed broad-leaved forests at lower elevations, or mixed pine and broad-leaf forests at higher elevations. Finally, they may develop into broad-leaved

forests, which may be subtropical or subtemperate, depending on the elevation (Ramakrishnan & Kushwaha 2000).

In the dry zone of Sri Lanka, on the other hand, secondary re-growth is mostly vegetative rather than from seeds, because of the climatic conditions present (Perera 2000). Thus the secondary vegetation in the 12- to 15-year fallows that are typical of the region is very similar to that which existed prior to cultivation. It is possible that there has been a selection towards this type of secondary forest as a result of repeated cycles of cutting and burning throughout recent history (Perera 2000).

The different ways in which swidden agriculture is practised also result in related variation in swidden fallow secondary forests. In Thailand, for instance, secondary forests developing on the fallow land of pioneer swiddeners often consist of stunted trees. Their vertical structure is also less complex than that of forests in rotational systems because no residual trees are left when the fields are cleared (Schmidt-Vogt 2000). In addition, grasslands and bamboo groves are common on swidden fallows of pioneer swiddeners in Thailand. Grasses are promoted by intensive cultivation over several consecutive years and by fire. Grass cover retards, but does not entirely suppress, the development of secondary forests. Bamboo emerges in regenerating woody vegetation and soon overtops shrubs and trees. In some places, bamboo may become dominant and even suppress the regeneration of trees (Schmidt-Vogt 2000).

The value of swidden fallow secondary forests

Local versus non-local value

Swidden fallow secondary forests provide a number of benefits to local communities. Soil fertility replenishment and weed suppression continue to be the main functions of this type of secondary forest in many locations (e.g. Ramakrishnan & Kushwaha 2000, Schmidt-Vogt 2000). In addition, however, swidden fallow secondary forests provide numerous products such as fuelwood, construction wood, and non-timber forest products for household consumption and cash income. Swidden fallow secondary forests also have religious importance, for example among the Tagbanwa of Palawan in the Philippines, who believe that spirits or deities living in the forests protect their homes against human intruders (Lasco *et al.* 2000). Secondary forests provide buffers in times of drought and against pest outbreaks that affect agricultural production, and sometimes even against price fluctuations for agricultural commodities. Table 1 provides a list of the local importance of swidden fallow secondary forests in several parts of Asia.

The local importance of secondary forests is reflected in the ecological knowledge and, for instance, ethno-classification of swidden fallow secondary forests. Examples from Kalimantan demonstrate this (e.g. Momberg 1993, Colfer *et al.* 1997, de Jong 2001a). There is, for instance, a close relation between classification and subsequent land use among some groups practising swidden agriculture. De Jong (2001a) reports on practices of tree planting which are more prominent in more degraded swidden fallow secondary forest.

Table 1 Importance of swidden fallow secondary forest across different countries

Country	Some reported uses
Philippines (Lasco *et al.* 2000)	Hununuos harvest 16–35 food plants from fallows; Iguago: fallows are source of wood, bamboos, rattans, medicinal plants, betel-nuts, coffee, bananas, mangoes, jackfruit, oranges; Tabanua (Palawan) collect forest staples from SFSF when other staples are scarce; Taubuid (Mindoro) collect mushrooms, wild yams, wood grubs, snails, rats, snakes, lizards from SFSF; Tagbanwa (Palawan) maintain sacred groves where spirits reside.
North-eastern hill region of India (Ramakrishnan & Kushwaha 2000)	Soil nutrient conservation and water balance maintenance. Fuel, fodder, timber, dead wood, bamboo for home construction, medicinal plants. Nepalese alder and bamboo species now used for nitrogen fixing purposes. Relict forests are important for religious and cultural reasons.
Thailand (Schmidt-Vogt 2000)	Soil fertility restoration function. SFSF often have greater species diversity than more mature stands and provide habitat for wildlife. Lawa swiddeners of north-western Thailand: food, construction, fuel, medicine, animal food, clothes, tools, fences, string, decoration, and ritual purposes. In one single village: 295 species for food, 119 for medicine, 44 for weaving and dyeing and 27 for fuel. Also used for ritual purposes.
Sri Lanka (Perera 2000)	Grazing grounds for domestic and wild animals, hunting grounds, construction timber, poles, food (yams, fruits, leaves), fuel wood, handles for agricultural tools, medicinal plants, barks of trees to get fibre, honey, twigs to prepare brooms. They are also important for conserving biodiversity and for soil improvement
Tropical China (Zaizhi 2000)	Habitat for wildlife, watershed and soil protection. Timber, small-diameter wood, fuel wood, poles and NTFPs.

In addition to the local benefits, swidden fallow secondary forests, as part of a shifting mosaic of forest cover at the landscape level, may play an important role in watershed regulatory functions by increasing the residence time of water in the landscape, reducing the risk of flash-flooding downstream and providing a regular flow of clean water (de Jong *et al.* 2000). These are services that benefit a much wider group of people. Work on soil erosion and sedimentation at a site in Chiang Rai province in Thailand concludes that the contribution of swidden farming to soil denudation and sedimentation has been over-estimated (Schmidt-Vogt 2000). Lastly, swidden fallow secondary forests, relative to permanent agriculture or other non-forest land use, contribute to carbon storage and uptake and to the maintenance of global biodiversity (de Jong *et al.* 2000).

Changes in value with further evolution of swidden agriculture

Intensification of swidden fallow land use is likely to affect the various existing benefits or functions in different ways. De Jong *et al.* (2000) refer to some of the trade offs between alternative functions. In response to population pressure, fallow length is likely to decline. Once past a critical minimal fallow length, productivity of the cropping phase will start to decline too if no other production enhancing measurements are taken. The combined crop-fallow productivity is also likely to decline beyond an intermediate fallow length (de Jong *et al.* 2000). The relation

between carbon stock and fallow length will generally show a saturation curve. Reduction of fallow length below this saturation point will lead to a decreased carbon stock. The initial increase in biodiversity value of a swidden fallow system is slower than the increase in carbon stock and is dominated by medium and late successional species. In early phases of the intensification of swidden fallow systems, increase in productivity is linked with a reduction in biodiversity value but both productivity and biodiversity decline with further intensification of land use (de Jong *et al.* 2000).

Changes in the swidden fallow secondary forest landscape: The evidence of decline

There is ample evidence of processes usually associated with degradation of swidden agriculture in most Asian countries. Traditionally, fallow periods in the dry zone of Sri Lanka lasted 30 to 50 years, but have now been replaced by 12- to 15-year fallows. Under the dry conditions prevalent, shortened fallows may lead to soil deterioration and vegetation dominated by grasses like *Pteridium* sp. and *I. cylindrica* (Perera 2000). Similar processes are ongoing in the Philippines where the traditional fallow system of the Mangyan is declining. Forty years ago, the Mangyan kept their forest fallows for 10 to 19 years, but at present the fallow period has declined to 1 to 3 years depending on farmers' needs and seed availability (Lasco *et al.* 2000). The increase in population density and government restrictions on clearing new forest areas may have contributed to those changes. In the hill region of north-eastern India, the traditional swidden agricultural system, locally known as *jhum*, was ecologically sustainable at one time due to sufficiently long cycles. Fallows are now shortened to an average of 4 to 5 years (Ramakrishna & Kushwaha 2000). Due to the decline of swidden cultivation, the area covered by swidden fallow secondary forests is diminishing. In cases where swidden cultivation is still retained but has to be adapted to the scarcity of land resources by the shortening of fallow periods, secondary forests are replaced by more degraded types of secondary vegetation such as weed communities, grasslands and bamboo groves (Ramakrishna & Kushwaha 2000, Schmidt-Vogt 2000).

Other pressures on swidden fallow secondary forest

Besides the decline in swidden agriculture, mainly as a result of shortened fallow periods, there are other direct threats that affect the cover of secondary forest. In Sri Lanka, for instance, other major threats to secondary forests are clearing to build houses and government development projects. In addition, the fire used to prepare agricultural land escapes and spreads into adjacent secondary forests, leading to deflected succession and the dominance of *I. cylindrica* and *Cymbopogon nardus*. Fallow forests are perceived as degraded land by government agencies and new forest plantations with many indigenous species such as *Chloroxylon swietenia, Chukrassia tabularis, Azadirachta indica* and *Berrya cordifolia* are being established on them.

In Indonesia, the threats to swidden fallow agriculture and the development of fallow management are pulp and oil palm plantations. These programmes have had negative impacts on the evolution of swidden fallow-agroforestry landscapes into mixed land use with permanent and semi-permanent agriculture combined with a mosaic of anthropogenic forests (e.g. de Jong 2001b). In similar fashion, the State Agricultural Reclamation Bureaus in the Hainan, southern Yunnan and Guangdong provinces in China reclaimed large areas of secondary forests for the establishment of rubber plantations (Zaizhi 2000). Also, State Forest Farms reclaimed secondary forests below 800 m asl to plant trees such as *Illicium verum, Camellia oleifera, Cinnamomum camphora, Cunninghamia lanceolata* and *Pinus yunnanensis.*

Both new secondary forest formation and land degradation happen in spite of the low density of swidden farmers in north-east India and the absence of swidden cultivation in the Central Himalayan region, suggesting that external pressures such as timber harvesting and in-migration are the chief drivers of deforestation and degradation. Governmental policies promoting the exploitative use of resources can be identified as one of the important factors causing forest degradation, including secondary forest degradation. In addition, the replacement of traditional swidden agricultural production relying heavily on the production of keystone tree species, with pine plantations, threatens the livelihoods of local communities, and negatively affects biodiversity (Ramakrishnan & Kushwaha 2000). In north-eastern India, bamboo fallows are being over-harvested for paper pulp (Ramakrishna & Kushwaha 2000).

The evidence of evolution

There is ample evidence in many parts of Asia of the successful adaptation or modification of swidden agriculture when circumstances change. We call such change "evolution" when productivity is maintained or improved and overall monetary and non-monetary income is maintained, as opposed to "degradation".

An important trend from north-eastern India shows improved fallow management to sustain or enhance the productivity of the shortened swidden agricultural cycle. Some groups have been planting "keystone" species like Nepalese alder (*Alnus nepalensis*) to enhance the process of improving soil fertility during the fallow period. The "keystone" species tend to recycle nutrients rapidly, partly through a fast turnover of leaves, and yield fodder, fuel and timber to the farmers (Ramakrishnan & Kushwaha 2000). The use of these species is reflected in the local culture. In recent attempts to resolve problems with swidden agriculture in this region, organisational structures have been proposed based on traditional values and governance structures, pursuing solutions that are based on existing productivity enhancement practices (Ramakrishnan & Kushwaha 2000). These efforts are largely directed at preserving productivity, rather than at enhancing monetary income among farmers. Other related land use activities that evolve out of swidden agriculture include small plantations, home gardens and valley rice cultivation systems.

In Indonesia there is evidence of processes of transformation from swidden agriculture to mixed rice/tree crop-based production systems as indicated by numerous cases from Kalimantan and Sumatra. Swidden agriculturists in Kalimantan have a tradition of tree planting and forest management (Padoch & Peters 1993, de Jong 1995, 1997). Some of this tree planting results in the creation of prominent secondary forest gardens, like the *tembawang*. These secondary forest gardens have economic value because of the forest resources they contain, but they are also important socio-cultural artefacts and help to maintain kinship bonds.

These tree and forest management practices among swidden agriculturists in certain regions provided excellent opportunities to incorporate commercial tree crop production such as rubber. Rubber was initially grown in Indonesia by the Dutch in the first decades after its arrival in Asia. Swidden agriculturists obtained the seeds and started growing these trees in their fields. Incorporating commercial tree crop production became part of the 'traditional' tree and forest management method, and there is evidence that it had a positive influence on the latter (de Jong 2001b). State efforts have tried to improve smallholder rubber production encouraging single species plantations using improved germplasm. In general, their influence has been small (de Jong *et al.* 2000), but these examples show that a combination of endogenous and exogenous factors may influence the evolution of swidden agriculture and related swidden fallow secondary forest management.

The incorporation of tree cash crops into swidden agricultural systems is a widespread phenomenon throughout Indonesia. This has led to a situation where swidden agriculturists can be found along a continuum of swidden fallow production including some cash tree crop production, more intensively managed tree cash crop gardens, or pure single species plantations. Along this continuum, rice production changes from swidden production to largely permanent wet rice production, or it disappears altogether (de Jong 2001b). In addition to this evolution of swidden agriculture to tree cash crop production, in many locations, but especially in Sumatra, migrants moved in and started agricultural production that is similar to the advanced stages of this continuum.

The factors that trigger this transformation are, on the one hand, engagement with the cash economy and opportunities for cash-crop production, and, on the other hand, population density and related land use pressures. The state also plays a role, in terms of promoting commercial tree planting and some policing to limit further encroachment (de Jong 2001b). The precise direction of this transformation is primarily influenced by two factors, namely, existing tree planting and forest management practices as well as the opportunities to obtain cash from tree and estate crop production (de Jong *et al.* 2000).

Examples as found in Indonesia can also be found in mainland Southeast Asia (e.g. the production of *Styrax* spp. in secondary forest gardens in Laos). Other changes seem to bypass the integration of tree cash crop production into the swidden agricultural system. In Thailand, farmers have shifted from swidden agriculture to permanent agriculture and tree crop production with the influence of external intervention (Schmidt-Vogt 2000). When the Thai government

constructed roads into the mountain areas of the north during the 1970s and 1980s, improved market access and highland development projects led to the conversion of swidden cultivation to permanent farming with temperate crops such as cabbage, tomatoes and potatoes, fruit trees (lychees, pears, persimmons), and estate crops (coffee, tea). Often farmers brought about similar changes through their own initiative (Schmidt-Vogt 2000). In Vietnam, the development of the private sector with the reorganisation of the national economy provided better opportunities for people to develop industrial forest plantations, cash crops, fruit trees, etc. Apart from participating in forest planting and forest rehabilitation activities, the ethnic minorities are tending to plant fruit trees. The planting of cinnamon by Dao and other ethnic groups is economically very successful.

In some cases there may even be a positive influence from the wood-based industries in the evolution of swidden agriculture. Since the 1970s, the paper industry in the Philippines encouraged farmers in Mindanao, the southernmost island of the country, to plant *Paraserianthes falcataria* for pulpwood (Lasco *et al.* 2000). Although tree cover was initially limited to within a 100 km radius from the pulp mill, a wider interest in smallholder tree farming developed in Mindanao in the 1990s. There is some evidence that this relates to the logging ban on primary forests that started in 1992. Farmers grow mostly *Gmelina arborea* on farms that range in size from one to a few hectares (Lasco *et al.* 2000).

Enhancing the conditions for swidden fallow evolution

Arguably one of the most appropriate ways to positively influence the development of swidden agriculture and related secondary forests is through appropriate policy and legislation. The track record of policy and legislation in relation to swidden agriculture is not very encouraging. The prevalent environmental theories in the late 1800s to early 1900s foresaw regional and climatic disaster with the widespread cutting of forests. Swidden agriculture became widely condemned for its perceived role in creating such environmental problems. This is the beginning of the negative attitude towards swidden fallow agriculture (Potter 2000) that has persisted until today in many parts of Asia. Authorities in most countries of Southeast Asia do not recognise yet that secondary forests can be valuable as a plant cover as well as a resource. In addition, many of the measures that are proposed lack many of the potential benefits of numerous swidden agricultural practices. There are, however, also indications of a change in attitude.

Examples of the negative official attitude towards swidden agriculture abound. In Thailand, the Land Code of 1954 prohibited damaging land in mountain areas or its foothills. As a result the hill-tribe population to date do not have legal rights to the land they use for agriculture. The government of Thailand actively engages in suppressing this form of land use, and emphasises the integration of hill-tribe people and the control of opium cultivation (Schmidt-Vogt 2000). In China, the Yunnan and Hainan governments have formulated, since 1982, a series of special policies and measures for banning swidden agriculture and reforesting the land

(Zaizhi 2000). The measures have included exemption from agricultural tax, the allocation of small areas of forestland to farmers as "free-hold hills" for developing economic plantations and agro-forests, and the establishment of new residential zones and stable arable land for cropping.

Indonesia also has developed several smallholder tree planting programmes to do away with shifting cultivation. The programmes include the Rehabilitation and Expansion of Export Crops Programme, the Tree Crop Support Project and the Smallholder Rubber Development Project. Alternatively, the Ministry of Forestry developed several social forestry programmes in which farmers could obtain credit to establish tree plantations on their fields, but must form farmers' groups and work with the people who administer the loans. The re-greening programme, from the same ministry, provide funds and materials for one year to plant trees, and for two years to carry out maintenance. However, farmers obtain no rights to the trees or the land. A more recent land use stabilisation programme intends to convert upland swiddens to permanent rubber and fruit tree lots. Under this programme, farmers receive a hoe, planting material and fertilisers and obtain rights to a 0.5 ha lot.

One issue that continues to be controversial is the lack of formal recognition of property rights and its influence on swidden agriculture. Lack of formal recognition and enforcement of property rights of the swidden agriculturists has allowed for uncontrolled land grabbing for the establishment of oil palm plantations in Indonesia since the late 1990s. Similar situations exist in China and Thailand and many other countries as well. Where governments propose measures to rehabilitate land or relocate people, they do not recognise the property rights of local swidden agriculturists. Despite the fact that there are numerous other reasons why property rights should be recognised, the question remains as to whether increased recognition will encourage farmers to use their land differently. Evidence for this is mixed. Weinstock and Sunito (1989) argued that some of the differences in swidden fallow management, and related tree planting efforts, between groups in West Papua on the one hand and groups in Sumatra and Kalimantan on the other hand relate to the property rights that individuals hold over land and trees they have planted. The absence of private property in West Papua appears to discourage people in investing in tree planting, an action that contributes importantly to the management of swidden fallow secondary forests or secondary forest gardens. In Kalimantan, several authors report on tree planting by swidden agriculturists to increase their property claim over land (e.g. Mayer 1996).

The examples above suggest that a mere increase in tenure security will be insufficient to encourage sustainable management of swidden fallow secondary forests or their early conversion into secondary forest gardens. Thus, increased tenure security may contribute to sustained management of swidden fallow secondary forests or their evolution into secondary forest gardens. However, other incentives are needed too.

New signs of change

In response to widespread calls for devolved local management of natural resources including natural forests, various governments in Asia are adopting more progressive policies even in relation to swidden agriculture. In Laos, for instance, drastic measures were adopted in the late 1970s and early 1980s to terminate swidden farming, and more than 10 000 swidden households were relocated to areas of permanent cultivation. However, current forest policy although still aimed at reducing swidden cultivation pursues less drastic measures. Swidden farming is now permitted on degraded forest land on a contractual basis when viable alternatives cannot be found (Schmidt-Vogt 2000). If the terms of the contract are fulfilled for three years, the family will receive a certificate of permanent tenure.

Similarly, in the Philippines, the Indigenous People's Rights Act of 1997 recognises the vested rights of indigenous peoples over their ancestral lands, including secondary forest within forest lands. One major effect of this law is that indigenous peoples can now benefit more from the use of the forest resources, although the implementation guidelines of this law are still being finalised (Lasco *et al.* 2000).

Development pathways of swidden fallow secondary forests

Trends in swidden agriculture and related secondary forest management

Chokkalingam *et al.* (2000b) propose a land use intensification model for tropical Asia that has three stages, the extensive use stage, the intensive exploitation stage and the forest depleted stage. Table 2 indicates the intensification status of swidden agricultural systems in different Asian countries. The intensification model suggests that the principal factors of change of swidden agriculture and related secondary forest management are external forces. The model for Asia differs from that in Latin America. In Latin America, the migration of colonists towards forested areas and the subsequent incorporation of agricultural frontiers into the wider economy are the predominant causes of change. One fundamental difference between Latin America and tropical Asia is the greater importance of indigenous groups and their alteration of swidden practices in the intensive exploitation stage in tropical Asia (Chokkalingam *et al.* 2000b). Smith *et al.* (1998) have argued that in Latin America indigenous swidden agriculture and fallow management evolve along different pathways as compared to colonists' swidden agriculture. An equivalent to the colonists' swidden agriculturists of Latin America is the pioneer swidden agriculture of Asia, which often follows the external forces such as commercial logging that initiate land use change. However, due to differences in both biophysical and politico-economic circumstances, pioneer swidden agriculture in Asia follows a different trajectory compared to colonists' swidden agriculture in Latin America.

Table 2 Intensification status of swidden agriculture (SA) in different Asian countries

Countries that still have significant SA in the extensive stage	Cambodia, Indonesia (e.g. Irian Jaya and C. and E. Kalimantan), Laos, Myanmar, Papua New Guinea
Countries that have significant SA in the intensive stage	Indonesia (W. and S. Kalimantan, Sumatra, Sulawesi), Sri Lanka, Cambodia, N. Thailand, Philippines, N. E. India
Countries that have significant SA in the depleted stage	China, India, Vietnam, Philippines

In tropical Asia, a complex mix of intensification or degradation pathways can be observed once swidden agriculture enters into the intensive exploitation stage. It is not always that exogenous forces result in degradation, while endogenous factors lead to evolution. Cases are known, for instance from Kalimantan, where increased population leads to progressive transformation of the landscape into one where swiddens, swidden fallow and, in some cases, degraded swidden fallow and *Imperata cylindrica* land have evolved without too much influence from the outside. On the other hand, the exogenous forces of change may also have quite a mixed influence on the trend of swidden agriculture and swidden fallow secondary forests.

Changes in swidden agriculture and related secondary forest management lead to degradation, but also to the introduction and adoption of tree crops that are easily integrated into the existing swidden agricultural practice. Existing indigenous tree and forest management technologies have positively contributed to this adoption. Where this adoption took place without too much external interference, land use and the related landscape have tended to evolve into a mixture of permanent and swidden fields, fields with tree crops managed under various intensities, swidden fallow secondary forests, secondary forest gardens, and remnants of old growth forest.

The literature reviewed here, however, also provides examples of changes that seem to skip the gradual evolution as suggested above. These may include direct transformation to the production of fruits and vegetables, or the production of wood to be used by pulp factories. Ironically, at the same time, a number of examples can be provided of government efforts that were largely meant to achieve the same objectives, namely, achieving intensive or semi-intensive production of annuals or tree crops. Many of these efforts were ill-adjusted to the conditions of the target farmers and have failed or have caused social strife among swidden agriculturists.

Options for the development of swidden fallow secondary forest management

The evidence gathered here is still inconclusive and provides little predictive value as to which are the most appropriate measures to be taken to encourage appropriate development of swidden agriculture and related secondary forest

management, in the many different conditions in which this land use practice is found. However, some broad conclusions can be drawn. In the extensive use stage (Chokkalingam *et al.* 2000b), there is little option for any kind of commercial production, for instance of commercial tree crops. However, in some cases, productivity problems may occur and these may be resolved through some kind of enriched forest management. In general, however, such conditions are exceptional and such actions will contribute as much to the re-enforcement of "traditional" livelihoods, as it will contribute to their change.

Swidden agriculture and related secondary forest management under the intensive exploitation stage (Chokkalingam *et al.* 2000b) will mostly have to focus on some kind of commercial production. Examples suggest that there is ample opportunity under certain biophysical conditions to move along development pathways that improve swidden agriculturists' income, while still maintaining an important presence of swidden fallow secondary forests or secondary forest gardens. The less-intensively managed secondary forest options are to be preferred over more intensive cropping options, as they yield larger biodiversity conservation, environmental functions and carbon sequestration. Decisions on which pathway to follow need to be carefully considered, as options that contribute more to environmental functions may be at the expense of the income of farmers, with no compensation for the provision of environmental functions.

In the forest depleted stage (Chokkalingam *et al.* 2000b), options for developing degraded forms of swidden agriculture may include tree crop production or related alternatives. Depending on the specific conditions, these may be more or less intensive forms of tree-swidden fallow management. More intensive tree crop production may relieve pressure on some marginal land, which may be reforested provided land pressures still allow for it.

Conclusion

There are several lessons that can be drawn from the evidence presented here. Although swidden agriculture and related secondary forest will adapt when other factors change, there is no single predictable pathway. There are opportunities for socio-economically viable intensification of swidden agriculture, but initiatives to promote such change need to be adjusted to the specific circumstances of each case. The options include a direct major shift to some kind of tree cash crop production, and also a more gradual introduction of such tree crops into what still largely continues to be swidden fallow agriculture. In the latter case, the environmental services of swidden fallow secondary forests will continue to remain important. In the case of drastic change of swidden agriculture to tree cash crop production, some attention should be given to trying to maintain some of the environmental functions formerly provided by swidden fallow secondary forests.

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References

CHOKKALINGAM, U., DE JONG, W., SMITH, J. & SABOGAL, C. 2000a. Tropical secondary forests in Asia: introduction and synthesis. Paper prepared for the "Tropical secondary forests in Asia: Reality and perspectives' workshop". 10–14 April 2000. Samarinda, Indonesia. Center for International Forestry Research, Bogor, Indonesia.

CHOKKALINGAM, U., SMITH, J., DE JONG, W. & SABOGAL C. 2000b. A conceptual framework for the assessment of tropical secondary forest dynamics and sustainable development potential in Asia. Tropical secondary forests in Asia: introduction and synthesis. Paper prepared for the "Tropical secondary forests in Asia: Reality and perspectives' workshop". 10–14 April 2000. Samarinda, Indonesia. Center for International Forestry Research, Bogor, Indonesia.

COLFER, C., PELUSO, N. & CHUNG, C. S. 1997. Building on indigenous management of Borneo's tropical rain forests. *Advances in Economic Botany 11.* New York Botanical Garden, New York.

DE JONG, W. 1995. Recreating the forest: successful examples of ethno-conservation among Dayak groups in central West Kalimantan. Pp. 295–304 in Sandbukt, O. (Ed.) *Management of Tropical Forests: Toward an Integrated Perspective.* Centre for Development and the Environment, University of Oslo.

DE JONG, W. 1997. Developing swidden agriculture and the threat of biodiversity loss. *Agriculture, Ecosystems and the Environment* 62: 187–197.

DE JONG, W. 2001a. Ethno-classification of fallows, land conservation and fallow management: the case of Bidayuh farmers in West Kalimantan. In Caerns, M. (Ed.) *Improved Fallows.* In press.

DE JONG, W. 2001b. When new technologies meet traditional forest management: the impact of rubber cultivation on the forest landscape in Borneo. Pp. 367–381 in Angelsen, A. & Kaimowitz, D. (Eds.) *The Impact of Technological Change in Agricultural Change on Deforestation.* CAB International.

DE JONG, W, VAN NOORDWIJK, M., SIRAIT, M., LISWANTI, N. & SUYANTO. 2000. Farming secondary forests in Indonesia. Tropical secondary forests in Asia: introduction and synthesis. Paper prepared for the "Tropical secondary forests in Asia: Reality and perspectives' workshop". 10–14 April 2000. Samarinda, Indonesia. Center for International Forestry Research, Bogor, Indonesia.

LASCO, R. D., VISCO, R. G. & PULHIN, J. M. 2000. Ssecondary forests in the Philippines: formation and transformation in the 20th century. Tropical secondary forests in Asia: introduction and synthesis. Paper prepared for the "Tropical secondary forests in Asia: Reality and perspectives' workshop". 10–14 April 2000. Samarinda, Indonesia. Center for International Forestry Research, Bogor, Indonesia.

MAYER, J. 1996. Trees Versus Trees: Institutional Dynamics of Indigenous Agroforestry and Industrial Timber in West Kalimantan. Ph.D. thesis, University of California, Berkeley.

MOMBERG, F. 1993. Indigenous knowledge systems: potentials for social development. *Berliner Beitrage zu Umwelt und Entwicklung* Bd. 3, Technische Universität Berlin.

PADOCH, C. & PETERS, C. 1993. Managed forest gardens in West Kalimantan. Pp. 167–176 in Potter, C. S., Cohen, J. I., & Janczewski, J. (Eds.) *Perspectives on Biodiversity: Case Studies of Genetic Resource Conservation and Development.* American Association for the Advancement of Science, Washington, D.C.

PERERA, G. A. D. 2000. Secondary forest situation in Sri Lanka: a review. Tropical secondary forests in Asia: introduction and synthesis. Paper prepared for the "Tropical secondary forests in Asia: Reality and perspectives' workshop". 10–14 April 2000. Samarinda, Indonesia. Center for International Forestry Research, Bogor, Indonesia.

POTTER, L. 2000. Forest Versus agriculture: colonial government policies, environmental ideas and the regulation of land-use change in Southeast Asia. Paper presented at the symposium: Political Ecology of Tropical Forests in Southeast Asia: Historical Perspectives. National Museum of Ethnology, Osaka, 28–40 November 2000.

POTTER, L. & LEE, J. 1998. *Tree Planting in Indonesia: Trends, Impact and Directions.* CIFOR Occasional Paper No. 18.

RAMAKRISHNAN, P. S. & KUSHWAHA, S. P. S. 2000. Secondary forests of the Himalaya with emphasis on the north-eastern hill region of India. Tropical secondary forests in Asia: introduction and synthesis. Paper prepared for the "Tropical secondary forests in Asia: Reality and perspectives' workshop". 10–14 April 2000. Samarinda, Indonesia. Center for International Forestry Research, Bogor, Indonesia.

RUTHENBERG, H. 1976. *Farming Systems in the Tropics.* Clarendon Press, Oxford.

SCHMIDT-VOGT, D. 2000. Secondary forests in swidden agriculture in the highlands of Thailand. Tropical secondary forests in Asia: introduction and synthesis. Paper prepared for the "Tropical secondary forests in Asia: Reality and perspectives' workshop". 10–14 April 2000. Samarinda, Indonesia. Center for International Forestry Research, Bogor, Indonesia.

SMITH, J., SABOGAL, C., DE JONG, W. & KAIMOWITZ, D. 1998. *Bosques Secundarios como Recurso para el Desarollo Rural y la Conservación Ambiental en los Trópcis de América Latina.* CIFOR Occasional Paper No. 13. Center for International Forestry Research, Bogor.

WEINSTOCK, J. A. & SUNITO S. 1989. *Review of Shifting Cultivation in Indonesia.* Directorate General of Forest Utilization, Forestry Studies, Field Document II-1, Jakarta.

ZAIZHI, Z. 2000. Status and perspectives on secondary forests in tropical China. Tropical secondary forests in Asia: introduction and synthesis. Paper prepared for the "Tropical secondary forests in Asia: Reality and perspectives' workshop". 10–14 April 2000. Samarinda, Indonesia. Center for International Forestry Research, Bogor, Indonesia.