

Mitigating climate change and transforming lives in forest margins: Lessons from swiddens in Indonesia

Slash-and-burn clearance of forests leads to large emissions of CO₂ and other greenhouse gasses. Often the blame is on 'shifting cultivators', although migrants to the forest margin and companies clearing land for plantations have used the same method for 'land clearing'. In promoting livelihoods that help maintain high carbon stocks in the landscape, many lessons can be learned from the way 'shifting cultivation' or 'swidden' systems evolved in Southeast Asia.



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A hazy debate

Thick smoke has blanketed areas of Indonesia for hundreds of years, according to historical records, but the fires of 1986 and 1997–1998 became notorious for the smoke and haze they produced. In the political climate of 1986, the blame fell on 'slash-and-burn farmers', otherwise called shifting cultivators or swiddeners.

In 1997–1998, better remote sensing pinpointed fire locations at night and revealed that many were on large commercial concessions. The role plantation companies played in creating the choking haze was more openly discussed, as was fire used as a weapon in conflicts over land. The issue of fire was recognized

as being more complicated than had been thought in 1986. Also, the evidence of global warming focused attention on the greenhouse gas emissions rather than the more visible (or visibility blocking) haze.

Still, people's response to protection of forests for their carbon stocks and for avoiding smoke and haze reflects their concerns and agendas. Different stakeholders have starkly different perceptions of what the problem is, describing it variously as (1) environmental destruction and loss of natural forest, (2) persistent rural poverty and backwardness for lack of economic growth, or (3) interference in local affairs and disrespect for local culture.

Key points

1. How swidden, the origin of all current agricultural systems across Asia, has evolved in different settings depends on which period and products in the cycle—the food cropping phase or the regenerating fallow phase—emerged as the most economically important.
2. The evolution of agricultural systems is, like the evolution of species, a process of gradual change in response to selection pressures, not the predictable emergence of ‘higher’ forms.
3. Carbon stocks decline as forest is converted into intensively managed plantation or cropland, whether by burning or not, and focusing on fire does not mitigate the loss of diversity in traditional crops and the wild component of agroforests.
4. By refusing to accept the shifting cultivation of food crops when and where sustainable, and by restricting access to forest resources, existing forest policies in Indonesia have forced intensification on nearby unprotected land and fomented conflicts over land use.
5. The Indonesian government’s early focus on jumpstarting intensive permanent cropping shifted to supporting tree crop monocultures but would better support the gradual evolution of swiddens and their daughter systems in accordance with local expectations.

Forest ≠ trees

‘Forest’ derives from the Latin ‘forestis’, or ‘unenclosed’, referring to land beyond the direct influence of villages or farmers and controlled by the central government. It originally did not refer specifically to woody vegetation. Today, the internationally accepted definition of forest has two components. One specifies canopy cover of at least 30% and tree height of at least 5 metres. The other refers to the institutional framework of forestry, which includes parts of the forest area that are temporarily unstocked because of human activities such as harvesting or natural causes but are expected to revert to forest.

Similarly, institutionally established forests in Indonesia do not necessarily have trees, and some tree-covered areas are not protected (Figure 1). Out of a total land area of 190 million hectares, Indonesia classifies 120 million hectares as permanent forest land. To sustain forests’ biodiversity

while providing the country with income, the forest area is divided into forests for conservation under central government control, for protection under local governments, or for production under timber concessions supervised by the central government. Policies for each forest type define ‘adat’ (customary) communities’ access to them.

Considerable areas beyond the permanent forest estate have actual tree cover. The Ministry of Forestry claims some of them despite their registration under the National Land Agency as communally or privately owned. Competing economic and political interests slow the reconciling of these territorial claims and place many Ministry of Forestry logging and plantation concessions in a legal grey area.

Loaded terminology

A ‘swidden’ is land cleared of woody vegetation for the temporary production of staple food crops mixed with other annuals and/or perennials for local use and/or markets. ‘Swiddening’ is a quaint term for a way of life associated with cultural traditions. ‘Shifting cultivation’ is a technical description of a land-use system that alternates cropping and fallow. ‘Slash and burn’ describes a method of clearing land that generally carries negative connotations of forest destruction. Fire is used by, and associated with, shifting cultivators but is also used by large plantations and migrant farmers, both spontaneous and participants in government transmigration programmes (shifted cultivators). Though these terms are largely synonymous, how they are used sets the tone and colours the debate.

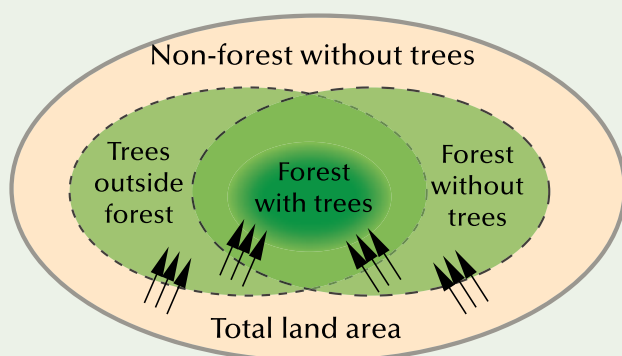


Figure 1: The combination of tree-based and institutional forest definitions creates four categories of land in Indonesia: forests with trees, forests without trees, non-forests with trees and non-forests without trees. The terms ‘deforestation’ and ‘reforestation’ have multiple meanings depending on the land to which they are applied.

It should be noted that shifting cultivation is a forest-management practice within the internationally accepted definition of forest, as long as the woody regrowth phase achieves the minimum for tree canopy cover and height. By definition, shifting cultivation therefore cannot be called a cause of deforestation unless or until the intensification of the system shortens the fallow enough to keep the woody vegetation phase below the definitional limit.

Historical background

Swiddening is the origin of all current agricultural systems across Asia, though this may now be hard to recognize. Swiddens themselves evolved from opportunistic farming in naturally occurring forest gaps to supplement a diet of forest products including game and fish (Figure 2). Over time, people learned to open larger gaps with fire and became swiddeners.

How swiddens have further evolved in different settings depends on which period and products in the swidden cycle—the food cropping phase or the regenerating fallow phase—emerge as the most economically important. Swiddens can turn into agroforests if the value of the woody regrowth equals or exceeds the utility of the annual food crop phase, often ‘progressing’ from agroforest into intensive cropping of tree monocultures. Alternatively, if grazing domestic animals on grassy fallows gains prominence, swiddens evolve into pastoral systems. Otherwise, crop-fallow rotations intensify toward crops, reaching the endpoint of permanent cropping, in which farmers replace the fertility-restoring functions of the fallow with legume cover crops, fertilizer trees, manure transferred from grazing systems, or chemical fertilizers.

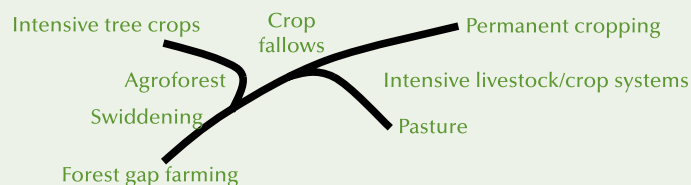


Figure 2: Simplified view of the gradual change in farming systems, with swiddening occupying a phase in the history of permanent cropping, tree cropping and livestock systems, with the latter two evolving from the fallow period.

Rather than aim for a sharp delineation of pure forms of land use, it is more productive to emphasize how processes and patterns form a continuum. And we should bear in mind that evolution, either natural or socioeconomic, is a process of gradual change in response to selection pressures, not the predictable emergence of ‘higher’ forms.

In Indonesia, swidden had largely given way to intensive agriculture on the islands of Java and Bali by 1880 and was rapidly on the way out in West and North Sumatra (Figure 3). A century later, Papua still depended heavily on swiddens, and East and Central Kalimantan were only just joining the transition experienced by the rest of Indonesia toward lower reliance on swidden.

The percentage of Indonesia’s rural residents fully dependent on swidden was 1.4% in 1980, but swidden involved 14.2% of the land area and 18.9% of the forest because it is practised in lightly populated, forested areas. For 5.5% of the population, 48% of the area and 58% of the forest, the swidden index was at least 0.6, indicating a livelihood strategy mixing swiddens with

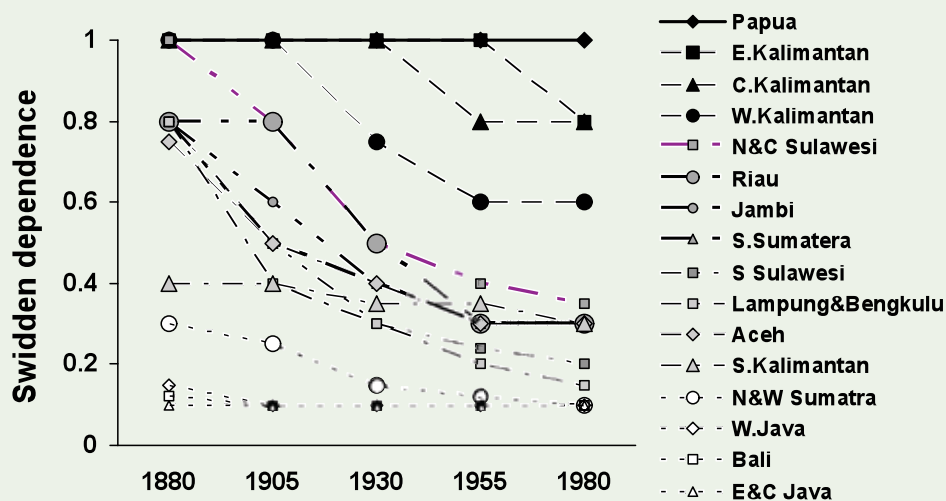


Figure 3: Historical change in land use in selected provinces of Indonesia, as reflected in the index of swidden dependence based on Richards and Flint (1994).

other agricultural pursuits. For 24.9% of the population, 80.5% of the area and 87.9% of the forest, the swidden index was at least 0.3, indicating the continued relevance of swidden in livelihood patterns. For the remaining 75.1% of the population outside cities, 19.4% of the area and 12.1% of the forest, swidden played a minor or negligible role. The trend toward reduced dependence on swiddens has probably continued, but recent data compatible with that of the Richards and Flint (1994) study do not exist.

The most rapid decline of swidden occurred between 1905 and 1930, as rubber gained prominence as a smallholder crop. This supports the observation that modern swidden transitions in Indonesia have been triggered primarily by increased market integration for native non-timber forest products and the introduced tree crops rubber and coffee, rather than for food crops. As many forest and agroforest products have higher value per unit of weight than food crops, they provide options for fairly remote communities. However, the agroforest solution that combines high biodiversity at the landscape level with medium market integration is not necessarily an evolutionary endpoint. Agroforest may evolve into more intensive tree crop monoculture, as is the current trend in rubber agroforests.

Pure subsistence systems hardly exist anymore in Indonesia, as most forest dwellers and farmers have at least some economic exchange with the outside world. But the transition to fully market-integrated systems has tended to be gradual, adding a cash crop such as rubber or rattan to the existing system. Using swiddens to grow rice or sweet potatoes for local consumption often conveys social status beyond the direct financial benefits. Even in parts of largely post-swidden West Java, people are not considered wealthy or of high status if they do not have a swidden plot.

The vagaries of commodity markets can turn a cultural preference for swiddening into a lifeline. Prices for export crops follow boom-and-bust cycles, pests and diseases may catch up with a widely cultivated cash crop, or the urban economy may slump. Suddenly, growing one's own food has direct survival value, and one can be thankful for a local tradition that treasured it. In the transition of much of the lowland forest area of Sumatra and Kalimantan into rubber forest, the relevance of maintaining swiddens was recognized. In the local tradition, planting trees secures land tenure, so the common pool of land for swiddens shrank when rubber was planted and locked land up in a long production cycle. Many villages established rules that forbade planting trees on the remaining land available for swiddens, to keep this communal land, or 'sesap nenek', available for local food security, especially for the poor.

Alternatives to slash and burn

Since the global community realized that it cannot ignore that the 20% of global greenhouse gas emissions that arise from land use and land-use change in the tropics, efforts to reduce emissions from deforestation and degradation have been hotly discussed. Fire is widely regarded as the main culprit, but swidden fires are not the worst that can happen to a landscape.

The direct impacts of haze on health and air traffic are caused mostly by peat land fires that smoulder for a long time. These relatively cool, wet fires also produce methane, which is a much more potent greenhouse gas than the carbon dioxide released in controlled swidden burns. Where the concern is loss of biodiversity and terrestrial carbon stocks, the nature of the fire does not really matter. That said, land-use change that does not use fire can cause as much or more loss of carbon stocks.

Sequestering carbon dioxide in plant tissues and soil organic matter limits atmospheric greenhouse gas concentration. High carbon stocks in the soil and plant biomass indicate effective sequestration. High organic matter content in the soil indicates fertility, but the transition from forest to swidden and to continuous cropping tends to lower it. Bruun et al. (2006) found in Sarawak, Malaysia, only a slight decrease in soil carbon as forest is converted to swidden. However, further intensification of swidden into permanent agriculture depleted soil carbon by nearly half, from 56 to 29 tonnes per hectare (Figure 4).

The trend in the stock of carbon above ground is similar to that below ground, except that the magnitude of the decrease is much higher as forest is converted into swidden and swidden is converted into permanent cropping (Table 1). Valuable plant biodiversity also declines.

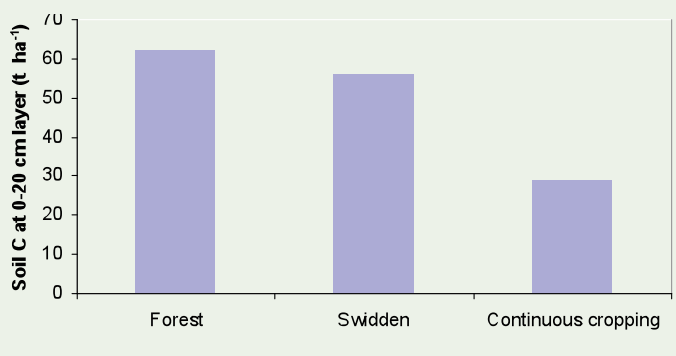


Figure 4: Soil carbon in the layer from the surface to 20 centimetres down under different land uses (Bruun et al. 2006).

Table 1: Above-ground carbon stock and number of plant species under different land uses

Land use	Carbon (tonnes per hectare)	Plant species per plot
Primary forest	254	120
Rubber forest	116	90
Monoculture oil palm	91	25
Shrub (about 8-year fallow)	74	45
Vegetables	2	16
Cassava	4	15
<i>Imperata</i> fallow	2	15

Source: Adapted from Tomich et al. 1999, Palm et al. 2005.

Regarding flooding, drought and erosion, a study in Southeast Asia has demonstrated that the threshold for a significant increase in stream flow is crossed when more than 30% of forest vegetation is removed from the landscape. At the landscape scale, swidden systems steadily maintain a good portion of the land well covered by vegetation. This controls—better than clear cutting for timber or plantation establishment—surface runoff and thus regulates stream flow.

While banning the use of fire does little on its own to maintain carbon stocks, it can significantly harm local livelihoods, as financial benefits are unlikely to be provided to offset legitimate opportunity costs. If implemented without considering local livelihood impacts, banning fire can worsen conflict and rural poverty and even risk the increased use of fire as a weapon, negating any environmental gains.

Further, the current focus fire does not mitigate long-term ecological concerns over the conversion of natural forest into intensively managed plantations. The loss of diversity in traditional crops and the wild component of agroforests continues, though the loss is less visible than smoke.

The way forward

Government support for rural development in Indonesia once focused on jumpstarting intensive permanent cropping then switched to supporting tree crop monoculture systems. A better policy would be to support the gradual evolution of swiddens and their daughter systems in accordance with local expectations. Policies need to balance interventions to counter environmental destruction and persistent rural poverty with avoiding interference in local affairs and disrespect for the local culture.

The institutional establishment of a separate forest domain does not jibe with local perceptions of land rights, the actual dynamics of land use or the way swidden systems evolve. Separate forest and agricultural institutional frameworks artificially split systems of land use that exist along on continuum from forest to non-forest. Forestry institutions' claims on land and the transfer of rights to logging and plantation companies trigger sudden, often catastrophic change in swiddening communities. Respect for local traditions and support for gradual change are the necessary first steps to improve local policies.

We can distinguish situations in which swidden is still appropriate and accepted as the best form of locally adapted land use (situation C in Figure 5) from situations in which swidden evolves into other land uses spontaneously (as in situation A) or by force (situation B). At various times, governments throughout Asia have attempted the approach described in B by combining forest protection with assistance to end 'backwardness'. This has met with considerable resentment. Given time, more voluntary change would often have emerged if the alternatives had been made sufficiently attractive.

By refusing to accept the shifting cultivation of food crops when and where sustainable, and by restricting access to forest resources, existing forest policies in Indonesia have forced intensification on nearby unprotected land and fomented conflicts over land use. Yet the evidence in Indonesia and other parts of Asia suggests that swiddeners are highly adaptive to local circumstances, demonstrate intimate ecological knowledge, and locally regulate negative impacts and dynamic change. Problems develop when pressure on the land—from population growth, restrictions on land use or both—forces swiddeners to intensify toward less sustainable short-fallow systems.

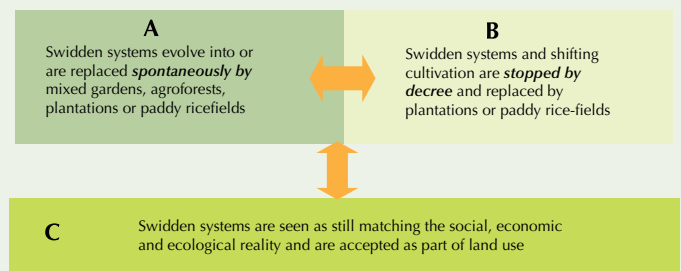


Figure 5: Three policy domains with regard to swidden systems and their transformations.

Agencies that try to stop shifting cultivation have an unimpressive track record in terms of actually protecting forests and the environment. The links among deforestation, development and poverty are complex and context specific. Better site-specific diagnostics of issues are needed to avoid the one-size-fits-all response that still characterizes much land-use policy.

Quantifying the local and external benefits from the goods and services derived from a mosaic of land-use systems would help. Developing markets for forest commodities through basic certification that distinguishes domesticated and semi-domesticated resources from wild ones that require protection would support the utilization of existing agrobiodiversity. Improved data collection and analysis would support the formulation of more evidence-based policies to maintain environmental services. This would turn the focus away from symptoms like smoke and toward the underlying causes of the loss of natural capital.

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