The Demise of Swidden in Southeast Asia? Local Realities and Regional Ambiguities

Christine Padoch, Kevin Coffey, Ole Mertz, Stephen J. Leisz, Jefferson Fox & Reed L. Wadley

Abstract

Swidden farmers throughout Southeast Asia are rapidly abandoning traditional land use practices. While these changes have been quantified in numerous local areas, no reliable region-wide data have been produced. In this article we discuss three linked issues that account for at least some of this knowledge gap. First, swidden is a diverse, complex, and dynamic land use that data gatherers find difficult to see, define and measure, and therefore often relegate to a "residual category" of land use. Second, swidden is a smallholder category, and government authorities find it difficult to quantify what is happening in many dynamic and varied smallholdings. Third, national policies in all countries of Southeast Asia have tried to outlaw swidden farming and to encourage swiddeners to adopt permanent agriculture land use practices. Drawing on specific, local examples from throughout the region to illustrate these points, we argue that an accurate assessment of the scale and pace of changes in swidden farming on a regional level is critically important for identifying the processes that account for these shifts, as well as evaluating their consequences, locally and regionally.

Keywords

Land use change, land use policy, land use classification, shifting cultivation, Southeast Asia, upland farming.

Christine Padoch
Institute of Economic Botany, New York Botanical Garden, Bronx, NY 10458, USA.
Email: cpadoch@nybg.org

Kevin Coffey
Earth Institute, Columbia University, New York, NY, USA.
Email: kcoffey@aya.yale.edu

Ole Mertz (corresponding author)
Department of Geography and Geology, University of Copenhagen, Øster Voldgade 10, 1350 Copenhagen K, Denmark.
Email: om@geogr.ku.dk

Stephen J. Leisz
Department of Geography and Geology, University of Copenhagen. Current address: Bishop Museum
1525 Bernice Street, Honolulu, Hawaii 96817, USA
Email: steve.leisz@bishopmuseum.org

Jefferson Fox
East-West Center, 1601 East West Road, Honolulu, HI 96848-1601, USA.
Email: FoxJ@EastWestCenter.org

Reed L. Wadley
Department of Anthropology, University of Missouri-Columbia, 107 Swallow Hall, Columbia, MO 65211, USA.
Email: wadleyr@missouri.edu

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Guo et al. (2002) recently asserted that, "from the mountains of Yunnan Province in southwestern China to the interior of Kalimantan," the ways of life of smallholder farmers throughout Southeast Asia are changing at rates and scales that "are unprecedented." They suggest that "hill farmers with their hundreds of rice landraces, their many intercropped vegetables and fruits, and their cyclic way of farming are disappearing throughout the region," and report on what they called a "landscape in transformation" using data from communities in the Xishuangbanna Dai Autonomous Prefecture of southern Yunnan Province in China.

Almost 3,000 kilometers away, Padoch et al. (1998) documented the gradual, fitful demise of shifting or swidden cultivation over the last decade of the 20th century in the community of Tae in West Kalimantan, Indonesia. Across the border, in the Malaysian states of Sabah and Sarawak, farmers are under increasing pressure from government and private companies to convert swidden land to large scale plantations (Ngidang, 2002), though the sys-

tem persists in certain places, but on a smaller scale (Hansen & Mertz, 2006). Other studies report rapid changes across mainland Southeast Asia (Rerkasem & Rerkasem, 1994; Fox & Vogler, 2005); it has become all too apparent that shifting cultivation is a waning land use in many communities of the region. These observations are, however, hardly new or surprising. Swiddens and swiddeners have always been dynamic and varied, with households and communities periodically migrating, adopting new crops, and frequently changing the way they farmed. Somewhere in Southeast Asia one can imagine, some farmers have always been dropping swiddening as a predominant land use while others are newly embracing it or returning to it. What is different now is the scale and magnitude of the change.

In the Xishuangbanna study, Guo et al. (2002) tried to generalize results from reliable quantitative village level data to the prefecture level and then to broader regional patterns. But although the evidence they assembled in the Xishuangbanna case was convincing, Guo and his colleagues had trouble supporting the broader assertions with trustworthy numbers. Making the case for widespread change in southwest China was not as straightforward as expected, and evidence for Southeast Asia, more generally, was even more difficult to piece together. Ultimately, they were unable to substantiate quantitatively the contention that shifting cultivation was waning regionally, and data on how swiddens were changing were largely unavailable.

Earlier attempts at quantifying regional land use change in Southeast Asia have been made, but the data are at least 20 years old. Richards & Flint (1994) provided a good overview of land-use changes in Southeast Asia between 1880 and 1980. However, their categories of land-use/land-cover analysis (e.g., temporary crops, permanent crops, forest/woodland and "interrupted" forest) give little clue to the changes in swidden, which finds itself in the overlap between these categories. Indeed, they stated that "coverage often was incomplete, especially for lands under shifting cultivation". Uhlig et al. (1994) – aiming at estimating the effects of swidden on the global carbon cycle – used secondary sources in assessing the number of swiddeners and the area under swidden in Myanmar, Thailand, Sarawak and Sabah. They estimated that in the early 1980s approximately 15-20 million people were supported by swidden and that an area of 5.5-6 million hectares was under some sort of swidden management in the region (though no area estimates were provided for Myanmar). Mittelmann (2001) reviewed various data sets for changes in secondary forest cover in Cambodia, Laos, Thailand and Vietnam between 1993 and 1997. Swidden as a distinct land cover category appears to be absent from most of the data sets, and the forest cover categories presented are 'high cover density', 'medium-low cover density', 'mosaic' and non-forest. Mittelmann considers the 'medium-low cover density' and 'forest mosaic' categories to be proxies for secondary forests; we consider them to be proxies for swidden fallow as well. In all five countries the vast majority of forest cover falls into these two categories. To our knowledge no later studies have attempted to quantify the regional extent of swidden in Southeast Asia as a whole. The study by Mittelmann (2001) provides some information on the rate of secondary forest formation but its link to swidden still remains uncertain (Tottrup et al., 2007).

In addition, gradual alteration of swidden farming, especially a focus on managed fallows, has recently changed not only the practice but also the scenario for the possible demise of swidden fallow systems in Southeast Asia (Burgers et al., 2005). In the past, many studies had forecast that virtual environmental and social collapse, would occur when some supposed threshold for shortening fallow was reached by growing populations farming in limited spaces (Mertz, 2002). A considerable amount of research now shows that, rather than collapse, swiddeners around the world are gradually modifying their practices. Many shifting cultivators have developed cultivation cycles that more closely resemble crop rotation systems and agroforestry operations than what has conventionally been called swidden, or they may have always done such things but it was overlooked by researchers who focused on the more dramatic "slash and burn" image (Wadley, 2007). A World Bank report asserts that "few genuine examples of traditional farmers who practice rotational swidden farming" are left in Indonesia (World Bank, 2001), though the difficulties we outline here show how little we can actually say with regard to the extent of these shifts.

Similar changes occurring in thousands of small communities and among millions of smallholders throughout Southeast Asia have not gone unnoticed by those who observe communities and farmers up close. But many of the permanent rubber gardens, wet rice fields, and fruit orchards that are replacing swiddens and fallows may still fall outside the established categories. These plots tend to be more diversified than industrial-level plantations; they are often planted in unconventional (i.e., not straight-row) patterns; and sometimes, despite their design as perma-

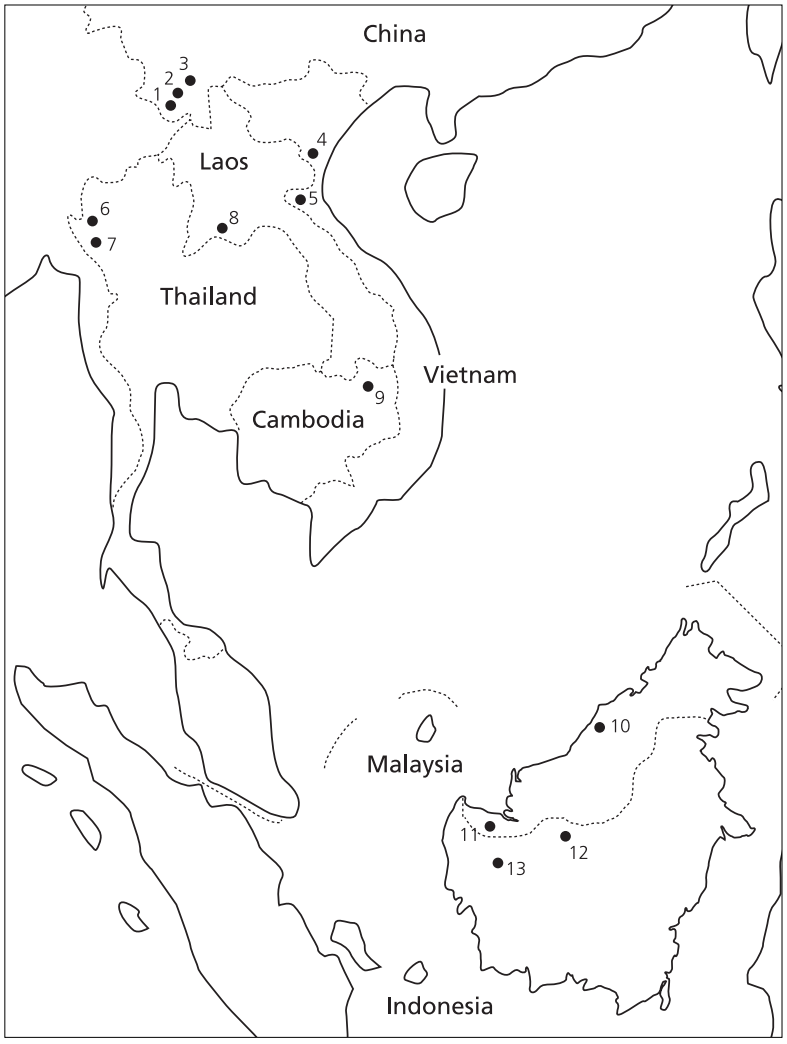

Figure 1: *Map of Southeast Asia showing the location of the case study sites referred to in this article.*

1) Mengsong
2) Menglong
3) Baka, all Xishuangbanna, Yunnan, China

4) Tat Village, Tan Minh Commune
5) Nghe An Province field sites, all Vietnam

6) Ban Khun
7) Mae Tho, both Thailand

8) Ang Nhai, Laos

9) Ban Lung, Cambodia

10) Rumah Muyang and Rumah Ulat
11) Parang and Assom, all Sarawak, Malaysia

12) Sungai Sedik
13) Tae, both West Kalimantan, Indonesia.

nent plots, are still cyclical and subject to "slashing and burning" when unexpected opportunities or needs arise.

In this paper, we suggest several reasons for why knowledge of the current extent of swidden is important and suggest three interconnected issues that account for at least some of the difficulty in obtaining such knowledge. Using field studies from across the region carried out by the authors over the past decade (see Figure 1), we illustrate the problems of reliable region-wide information on swidden change and why such data (for which proper meta-studies are necessary) are so difficult to obtain. We do not intend this exploration as a comprehensive meta-study, but rather hope to bring to more explicit attention the empirical and methodological problems that must be overcome before proper meta-analysis can be attempted.

Why measure swidden and why it is so difficult to do so?
The possible demise of swidden is likely to have a range of consequences for the environment and its services in the region. The replacement of swidden systems by permanent agriculture could result in a tree-dominated landscape (e.g., rubber, oil palm, cardamom, tea), a land cover composed of agricultural crops (e.g., maize, upland rice, cassava) or a combination of trees and agricultural crops. Regardless of whether the swidden landscape is replaced by trees, annuals, or a combination of the two, biodiversity, as measured by the number of species found on the landscape, will decline (Lawrence et al., 1998). In contrast to commercial agriculture, field surveys have shown that secondary vegetation following swidden cultivation often has a diversity of species that is comparable with more mature forests (Padoch & Peters, 1993; Xu et al., 1993; Lawrence et al., 1998; Schmidt-Vogt, 1998; Finegan & Nasi 2004), and its disappearance may be detrimental for the gathering of foods, medicines, firewood and other forest products that poor people depend on.

Hydrological impacts such as soil erosion and run-off under commercial agriculture could be considerably more severe than those experienced under secondary vegetation of the traditional swidden system (Zinke et al., 1978; Alford, 1992; Forsyth, 1994). Evidence from field surveys suggests that the negative impacts of swiddening on water- and soil-holding properties may be exaggerated, especially when compared to more permanent alternatives, such as commercial agriculture, plantation forestry (Zinke et al., 1978; Alford, 1992; Forsyth, 1994, 1996;), or even roads (Ziegler et al., 2004).

Upland areas of Southeast Asia are in a constant state of flux among old growth forest cover, various forms of secondary vegetation, and open swidden fields (Lawrence et al., 1998; Schmidt-Vogt, 1998; Cramb, 2005; Jepsen, 2006), and failure to account for forest regrowth on fallow swidden fields throughout the region could well mean that scientists are missing another important carbon sink. Indeed, carbon sequestration under swiddening – with the landscape mosaic of fields and fallow in various stages of regrowth – may be approximately the same as under intensive tree-crop systems while it is negligible under permanent agriculture and horticulture (Tomich et al., 1998). Examples of how potentially large carbon sinks have been missed in the past are seen in the work of others. Fan et al. (1998) suggest that much more carbon dioxide is absorbed in North America than previously believed because earlier forest inventories missed forest regrowth on abandoned farmland and formerly logged forests, a condition similar to the situation with secondary regrowth on fallow swidden fields in Southeast Asia. Another example is seen in Philips et al. (1998) who argue that humid tropical forests concentrated in South America act as a larger "sink" for atmospheric carbon dioxide than previously calculated, and Keeling et al. (1996) suggest that the tropics as a whole – and the southern tropics in particular – are not large sources of biogenic carbon.

Hence, swidden can be considered an important provider of environmental services compared to alternative land use systems, but quantification of these services is not possible unless we know the extent and dynamism of swidden in the region. In a time of GIS and remote sensing based land use planning, it may sound odd that such information is not available. However, there are at least three linked reasons why measuring swidden is not easily achieved.

First, swidden is a diverse, complex, and dynamic land use that data gatherers have difficulty seeing and defining, much less measuring. Swidden, a temporally and spatially complex form of farming, is typically represented in the landscape by a large number of distinct landscape features, each of which may be "in transition" and easily confused with other land uses. Because of this complexity or "illegibility," as well as other characteristics of the practice and its practitioners, government agents often relegate swidden fallow lands to categories such as "wasteland/ abandoned/unused" or "residual/miscellaneous" in reports presented on provincial, national, and regional levels. The same situation is found in regional land cover analysis projects, such as the FAO's decadal forest inventory assessment, the European Space Agency's TREES Project, and NASA's Pathfinder Project. Each of these projects regularly collects remote sensing, and other data, that is used to interpret land cover for Southeast Asia. However, Fox (2000) notes that, in many of these large-scale land-use classifications for Southeast Asia, from one third to half of "non-forested" land may be placed into "unclassified" or "other" categories. Much of this land may represent swidden fallow or swidden-in-transition areas, but because the data is not interpreted with the goal of identifying swidden/fallow areas, and, indeed, the identification of swidden/fallow areas may not be possible given the above noted complexity and the remote sensing techniques that these projects are using (Leisz & Rasmussen, in press), the location of swidden fallow areas has not been extracted from the remote sensing data available.

The second reason is closely related: swidden is a smallholder category, and government agents find adding up what is happening in all those temporally and spatially divergent and dynamic smallholdings far more difficult than summing up a few hundred monocultural plantations of a thousand hectares each. Many new plantings in the landholdings of current or ex-swiddeners continue to be small and diverse in nature, and therefore, although they may no longer be swiddens or swidden fallows, these newly permanent plots remain difficult to spot and even harder to classify. Some communities and production landscapes have been or have become, of course, more homogeneous and may even have been traditionally farmed in large continuous blocks. But many Southeast Asian upland farmer households make small, dispersed farms and frequently switch what they do from year to year, typifying what Sturgeon refers to as "landscape plasticity" (Sturgeon, 2005).

Third, the very existence of shifting cultivation is and long has been a politically contentious issue (Dove, 1983; Thrupp et al., 1997). Most countries in the region have

subjected swidden to limitations and controls with widely varying levels of enforcement. Classifying and measuring the extent of swiddening involves not only an admission of its existence but also a prediction that lands will continue to be used for swiddening, often reflecting great differences in "landscape visions" between government officials and shifting cultivators – see Sturgeon (2005) for a fascinating discussion on northern Thailand and southwest China. Regulations that outlaw shifting cultivation, forest clearing, or protected area encroachment officially remove many swidden lands – particularly older fallows – from the pool of lands available for future swidden farming. Yet these regulations frequently cannot effectively restrict use or accurately predict the actual future fate of these plots, thus adding to the difficulty of measuring land use in swidden zones. In addition, as swiddening has become widely but inaccurately accepted as a prime cause of deforestation and floods, some advocacy groups have shied away from fighting for local people's rights to continue the practice, and instead emphasize other aspects of local production systems that better fit under the banner of community forestry, such as "indigenous forest management." Such legal and political revisions of landscapes find their way onto land-use maps, further complicating the task of obtaining reliable numbers on changes in shifting cultivation.

Swidden change in Southeast Asia

Recent research on swidden in Southeast Asia presents many examples of the diversity of changes affecting present and former swidden lands, as well as the insufficient knowledge of swidden areas and classification. These show that while we know a lot about what is happening in specific locales, it remains very difficult to scale up these observations with any precision. Indeed, it is partly the sheer diversity of swidden at the local scale that confounds our ability to generalize to the regional level. In the following we discuss four cases of swidden change that typify the situation in the region.

Yunnan, China: Defining and measuring swidden

The attempt by Guo et al. (2002) to understand land-use change in Xishuangbanna exemplifies the difficulties of defining and measuring swiddens and their associated fallows. Current statistics on land use suggest that three types predominate in Xishuangbanna: (1) swidden cultivation accounting for almost half of all farmed land, (2) forests occupying almost 32% of the total land area of the Prefecture, and (3) rubber plantations on 7% of the land. However, official categories do not adequately reflect actual land uses or practices of farmers. swidden fallow lands, especially those that appear abandoned or as secondary forests, are often not noted by officials as lands integral to swidden systems (Menzies, 1995). If on-farm investigations and interviews are not done, swidden fallow lands are routinely underestimated and such important land uses as swidden fallow agroforestry are ignored in the official land-use statistics.

As a follow-up to the study by Guo et al. (2002), Padoch and colleagues attempted to use secondary data sources to document changes in swidden cover in Xishuangbanna. The lack of reliable contemporary figures required them to carefully read and interpret a series of "proxy" data sets, combining statistics that were estimated in a series of government reports (Fu et al., personal comm.). On a prefecture-wide level, farmed land tripled from 1949 to 1998 and irrigated paddy fields increased in area faster than did dry land farms. Rubber planting began in the 1960s, and by 1998 rubber plantations occupied more than 136,000 ha. Before the 1980s, rubber was grown only on state farms, but under new economic and land policies beginning in the 1980s, farmers living in local communities began to grow rubber. In 1965 there were almost no community rubber plantations, but by 1998, this had increased to 41,449 ha, with much of this production being on lands designated as community forests. Most often the forests replaced by rubber plantations were actually swidden fallows, many of which were presumably estimated to be forest in government estimations – for more detailed description of land use in Xishuangbanna, see Guo (1993), Cui et al. (2000) and Zeng et al. (2001).

The manner of data collection and the classifications used make it difficult to estimate the total loss of swidden lands in the prefecture, though data from individual Xishuangbanna townships suggest the total is large. For instance, local-level statistics state that total swidden fields decreased from 21,600 ha in 1980 to 14,000 ha in 1999 in Jinuo Township in Xishuangbanna, but during this period the total area devoted to rice cultivation in the prefecture increased to 65,450 ha. The extent of rice cultivation reached its peak in 1980, with the land area devoted to both paddy rice and upland rice declining since then. But the apparent change in extent of upland rice farming does not give an accurate view of the decline of swidden farming. During the past 50 years, the fallows that are the heart of a swidden fallow system have changed. What

were once largely natural fallows have now become largely planted ones, and fallow periods have changed from long-term (averaging more than 13 years between rice cropping) to herbaceous fallows of 3 to 5 years, and even to permanent farming. For instance, in 2000, 36.33% of what had been swidden fields two decades earlier was now cash crop plantations and "reforestation lands." The tools used for preparing fields and planting have also changed from dibbles to hoes and, in some instances, even to the use of ploughs. Some of the plowed "swiddens" have doubtless crossed the line from swidden into another class of farm.

West Kalimantan, Indonesia: Diversity of land use change

Reed Wadley's work in the Iban community of Sungai Sedik in Kapuas Hulu District, and Christine Padoch's work in the community of Tae in Sanggau District, West Kalimantan, Indonesia, exemplify some of the difficulties in enumerating the diverse land-changes smallholders have adopted. Wadley (1997, 2002) documented land-use changes in a longitudinal study that now spans 21 years of cultivation history (1979-2000). Over this time, fallow length in hill swiddens declined on average from 21.4 years (1979-1985) to 14.5 years (1993-2000), and swidden field size shrank from an average of 4.03 ha (1979-1985) to 1.84 (1993-2000). However, the usually cited culprit of population pressure may have less to do with this than a decline in household size through the formation of new households and the aging of older ones (both with smaller labor pools), as well as the lack of old growth to open new property claims. Furthermore, the decrease in field size may actually allow Sungai Sedik to maintain long fallow regimes for the foreseeable future, though changing economic conditions may encourage other land uses in addition to the managed forest gardens and short-fallowed swamp swiddens (still secondary to hill swiddens) already in practice. Although prices for small-scale commercial pepper and rubber continue to push fallow into more long-term cultivation (Wadley & Mertz, 2005), and pressures to join oil palm estate projects increase, the community may be able to forestall, to some extent, moving along a trajectory that resembles the community described next, with its emphasis on wet rice and managed forest gardens, surrounded by oil palm plantations. Critical to the direction of these changes are market connections through improved transportation along provincial roads (Wadley, 1998).

Padoch's work suggests that, since the early 1990s, land use in Tae has been an island of diversity in a spreading sea of industrial oil palm plantations (Padoch et al., 1998). Most of Tae's 41 households manage complex assemblages of upland swiddens, irrigated rice fields, rubber-dominated gardens, mixed rubber and fruit gardens, managed fallows of various configurations, complex house gardens, and any number of smaller plots. The swiddens farmed (and in the mid-1990s from more than a third to more than two-thirds of Tae households farmed no swiddens at all in each year) are largely under a half a hectare in size. Rubber gardens tend to be small and diverse, as are irrigated rice fields. While still widely classed as shifting cultivators, the farmers of Tae are moving away from dependence on swiddening and increasingly toward the farming of irrigated rice and tree crops. This change is undoubtedly profound, but it is not sudden and it has most probably passed unnoticed in larger-scale assessments.

Many of Tae's neighboring communities sold their land and became shareholders in large oil palm schemes in the 1980s, but in contrast Tae's no-less-progressive farmers changed their agricultural endeavors in incremental steps and, above all, in small and diverse ways. Most lowland, well-watered sites have been gradually converted into permanent, irrigated rice fields. Mixed fruit and rubber plantings increasingly dominate hill slopes that had once held swidden fields and fallows. Neither of these developments is entirely new. Many Dayak farming households, including Tae's farmers, have long managed swamp or irrigated paddies for rice production. And the recent enthusiasm for "jungle rubber" and other forms of heavily managed fallows and forests is new only to some researchers and NGOs. But the dynamics are now different in rate and scale: The rubber trees, especially if they are newer improved varieties, may no longer be cut, burned, and replanted as integral parts of a swidden cycle (de Jong, 2001), and wet rice cultivation is gaining on swidden as the central rather than the auxiliary source of daily rice.

In such places as Tae and Sungai Sedik, smallholder activities – even plantations and permanent fields – may be difficult to spot, to classify, and to count. Even though the emerging forms of land use (rubber gardens, fruit orchards, paddy fields) are more familiar to national surveyors, monitors, and census gatherers, accurate data on these important land-use transformations may still elude provincial, national, or regional censuses and summaries. A simple reason for this is their small size, which is not easily captured – or may be confused with other vegetation classes – in earth observation data. Recently collected

province-wide statistics on land uses in Kalimantan (as well as the rest of Indonesia) do include smallholder plantations as a distinct and growing category, but astute commentators on these figures suggest that this class of resource use continues to be under-reported and underestimated (World Bank, 2001; Potter, 2003). In Indonesia where smallholders occupy an overwhelming percentage of farmed land, this shortcoming in data collection is significant and makes it difficult to know what is happening to ex-swidden and transforming swidden lands on a broader level.

Sarawak, Malaysia: Persistence and decline

While swidden is disappearing in much of Southeast Asia, in some areas it conspicuously persists, and communities throughout Sarawak, Malaysia reflect this seeming paradox. Mertz and his colleagues (Mertz et al., 1999; Hansen & Mertz, 2006; Nielsen et al., 2006) study land-use practices in Sarawak, Malaysia, where a majority of the population depended on shifting cultivation just a few decades ago. Precise data on the area under swidden in Sarawak are hard to come by, and while the area is most likely declining, many farmers continue to include swidden as an important component of their farming systems (Mertz et al., 1999; Hansen & Mertz, 2006). This is the case despite the proclaimed policies of the Sarawak Government to reduce the spread of shifting cultivation in the Permanent Forest Estate, its concerted efforts to convert swidden lands to large-scale plantation agriculture (Ngidang, 2002; Hansen, 2005), and the ample job opportunities throughout Malaysia spurred by economic growth.

A case in point is the centuries-old Iban community of Nanga Sumpa '– just across the border and culturally linked to the community of Sungai Sedik in West Kalimantan studied by Wadley – located in Lubok Antu District upstream from the Batang Ai Hydroelectric Dam in a protected water catchment area. Although tourism and other off-farm income provide important income sources for the residents and permanent cash crop cultivation (mainly pepper) is on the rise, all but one household farm hill rice in swidden fields (Mertz et al., 1999; Wadley & Mertz, 2005; Hansen & Mertz, 2006). Fields have become smaller over time, but swidden is, with a few exceptions, considered the main economic activity by the households even if yields are rarely sufficient for subsistence requirements. The frequent use of forest products – often from secondary forest fallow – complements swidden production (Christensen, 2002) and may be an important reason to maintain swidden.

This situation, however, cannot be generalized to other communities in Sarawak. The Iban communities of Rumah (Rh) Muyang, Rh Ulat and Rh Ranggong in Niah Sub-District, for instance, are located along roads in an area where intensive logging has been followed by large-scale oil palm plantation development (Hansen, 2005; Nielsen et al., 2006). The area under swidden increased from the 1970s to the 1980s but subsequently declined in 2002, mainly because land was converted to large-scale oil palm plantations (Hansen & Mertz, 2006). In Rh Ranggong and Rh Ulat, all households still farm hill rice in swidden fields, though field sizes have been reduced significantly. In Rh Muyang, only half of the households continue to farm swidden fields, partly because of conversion into fruit tree plantations and pepper gardens, and partly because non-farm work has become important for many households. Over a three-year period of study (2000-2003), however, no decline in the number of households farming swidden fields was documented, but rather a substantial fluctuation was noted as some households stopped farming temporarily while others started again.
Finally, most households of the Bidayuh communities of Kampung (Kpg) Assom and Kpg Parang, located only some 30-40 kilometers from the Sarawak State capital, Kuching, in Padawan District, maintain swiddening on the steep slopes of the hills close to the Indonesian border. Here, commuting to the booming employment market in Kuching is possible and indeed practiced by many people, but holding onto hill rice and vegetable farming in swidden fields remains a high priority.

Despite different local conditions for development, it is obvious from these cases that swiddening, while declining, is not disappearing completely in Sarawak. Reasons vary, but include farmers' preference for producing their own staple food, lack of suitable land for wet rice cultivation, a taste for hill rice varieties and links to traditions. Moreover, Nielsen et al. (2006) show that the labor productivity of hill rice production in the Niah area is superior to the income from unskilled jobs in plantations and the service sector and hence a rational allocation of economic activity.

That information on swidden areas are difficult to come by may have several reasons, which resemble the other case areas. First of all, swidden lands lying fallow are easily confused with other forest classes or 'idle land' abandoned for other purposes when analyzing remotely sensed data. Secondly, the current 'wave' of establishing plantations under joint venture companies (JVC) makes accurate classification of swidden lands highly controver-

sial (communities get 30% of the shares in the JVC, a plantation company gets 60% and the Government 10%, see Ngidang (2002) for further details). Disputes over State Land vs. Native Customary Rights (NCR) Land are common in land negotiations prior to establishing the JVC as only land classified as NCR is included in the JVC and State Land simply is leased to the plantation company. Accurate maps of swidden in Sarawak are therefore not likely to be published.

Thailand and Vietnam: Politics of land use / cover mapping

A recent 1:1,000,000 map of Northern Thailand compiled by the Land Development Department displays 3.28% of Thailand as under "swidden cultivation" and roughly suggests that, including fallowed lands, the total amount of land under active swidden cultivation is approximately 10-15% (Kuneepong, 2002). Most researchers of agricultural systems in Northern Thailand, however, would find this estimate of shifting cultivation highly inflated. As far back as the 1960s, researchers had noted that shifting cultivation in Northern Thailand was decreasing (Geddes, 1976). In a detailed study on the state of shifting cultivation in Northern Thailand, Rerkasem & Rerkasem (1994) concluded that there was very little evidence that the swidden systems described by Kunstadter et al. (1978) in the 1960s can still be found.

However, to evaluate any estimate of how much swidden land is actually left and where, one must understand the political environment in which these assessments are conducted. In Thailand (as well as elsewhere in the region), the national and provincial governments along with the general public regard swidden as a destructive land-use practice associated with "uncivilized" hill tribes that randomly devastate valuable natural resources—forest, water, soil (Vandergeest, 2003). By claiming that farmers still practice swidden across vast portions of Northern Thailand, government agencies can justify strong measures for regulating land-use practices as well as programs for resettling people elsewhere. Conversely, any acknowledgment that swidden is not a destructive land-use practice or that many of these people now practice permanent farming of temperate vegetable and fruit crops would weaken the government's ability to regulate smallholder land-use practices.

Likewise, those who struggle for hill tribe rights in Thailand also have reasons to misrepresent the amount of swidden found on the landscape (Isager and Ivarsson, 2002; Vandergeest, 2003). Through community land-use schemes and "counter mapping" projects, NGOs have teamed with local farmers to stake claims to the land they currently occupy (Tan Kim-yong, 1993). Recently, such groups have rallied around the concept that indigenous peoples can better manage local forests using their own knowledge systems. These "counter maps" stress different aspects of indigenous production systems than those previously emblematic of hill tribe land use. With a community forestry law as an incentive, attention has been focused on community forests while swidden has been deemphasized. These maps are careful to detail and describe the varying types of community forest arrangements (including sacred forests, woodlots, and local watershed forests), while forms of shifting cultivation that traditionally overlapped some of these "indigenous classifications" are downplayed. Other classifications have shunned shifting cultivation in return for land use "rights," such as the new practice of ordaining trees, which requires that locals participate in a Buddhist ceremony and vow to protect the forest from being cut in the name of the king in order to maintain possession of the land (Isager & Ivarsson, 2002). With around 150 communities now managing "ordained forests," this political construction of space has become a significant land use and made its way onto local maps.

Scholars such as Anderson (1991) and Vandergeest & Peluso (1995) have noted how Thailand has used maps as a means of inclusion and exclusion in defining its history. Thongchai (1994) suggests that "a map anticipates spatial reality, not visa versa. In other words, a map is a model for, rather than a model of, what it purported to represent." While this topic has received particular notice in Thailand, the institutional idiosyncrasies of scientific mapping techniques as well as the power of particular individuals or groups to classify landscapes has also been a recurrent theme in literature on GIS and remote sensing (Robbins, 2001). In order to assess the fate of swidden agriculture in particular, one must navigate the blurred lines between advocacy, land-use planning, law and the ways in which these forces are represented on maps. The spatial and temporal complexity of swidden systems allows for great variation in interpretation, and the political power associated with certain classifications of space and the "flexibility" of swidden cultivation measurement has made this particular land use a key in the battle for land and water in Thailand. In this political climate, it is virtually impossible to obtain a reliable estimate of land under swidden cultivation.

Unlike the case in Northern Thailand where land-cover maps show swidden where arguably there is none,

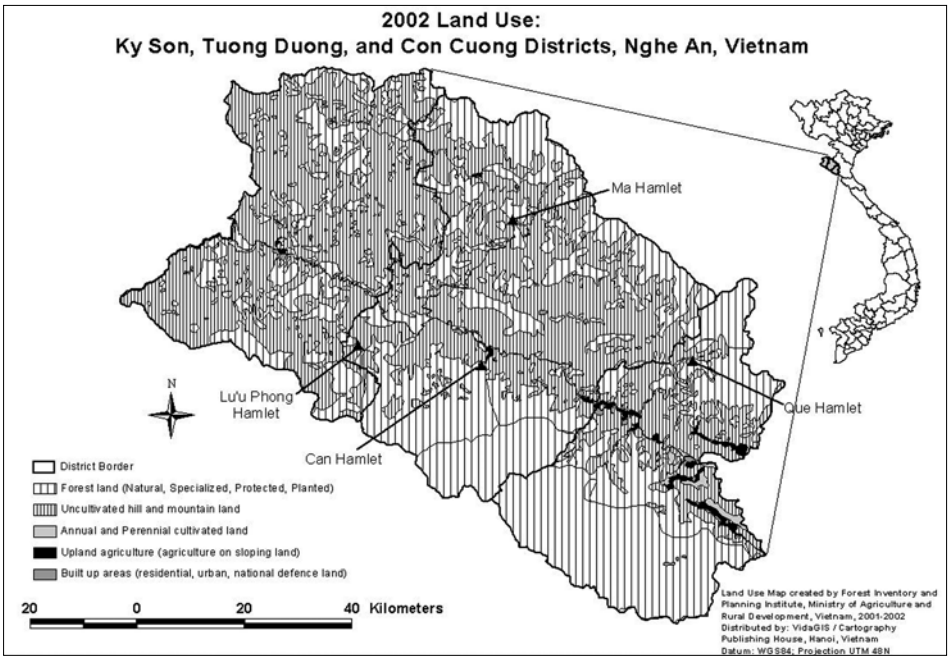

Figure 2: *Land use in Con Cuong, Tuong Duong, and Ky Son Districts in Nghe An Province, Vietnam in 2002.*

in Vietnam official land use/cover maps produced by the Forest Inventory and Planning Institute (FIPI) and distributed by the Cartographic Publishing House show no swidden fallow land where, undoubtedly, swidden is being practiced (Figure 2). Con Cuong, Tuong Duong, and Ky Son Districts in Nghe An Province are inhabited by Thai and H'mong peoples, both of whom are known to have traditionally relied on swidden fallow farming systems. Leisz & Rasmussen (in press) classified yearly satellite images for this area from 2000 through 2003. This five-year longitudinal classification combined with field studies resulted in maps that delineate swidden areas from other land use types for each year, as well as a final map for 2003 that delineates overall swidden areas for the three districts.. The results, validated by ground-truthing indicate that there are large areas of uplands in these districts where swidden fallow systems are found. However, the land use/cover map produced by FIPI shows no swidden fallow and not even any upland agriculture in this area. Instead, the areas classified as swidden fallow land from the satellite image analysis appear on the official map as "dat su dung," which is translated into English as either "uncultivated hill and mountain land" or "wasteland." This category of land is considered "forestland" by the government and officially protected from cultivation.

Conclusion

Perspectives for assessing swidden change

To categorize a piece of land as swidden fallow land requires government agents and academic researchers alike to predict that this piece of land will be used again—that it will be cleared and burned some years hence. Even when a field is cut, burned, and planted with traditional crops, to call this piece of land a swidden suggests that it will become part of a cyclical system for years hereafter. But the pace of change in Southeast Asia makes such assumptions difficult. Predicting that swidden systems will soon be relegated to only a few limited areas of Southeast Asia is, however, not as difficult. The combined forces of agricultural, forestry, and conservation policies, increased global demands for tropical commodities, and continued population growth are not to be stopped in any part of Southeast Asia for long. We will know when the farmers in Xishuangbanna no longer fallow their fields, and when those in Tae and Sungai Sedik obtain all their rice from irrigated paddy fields and local shops. We will also know when plantations have replaced most of the swiddens in Niah or at least shrunk their size to what may be termed hobby farming. Indeed, it appears that swidden is gradually disappearing in most parts of Southeast Asia, and only remains stable in few areas. But we do not know precisely how fast, how much, or where these changes occur. The change will continue to be highly visible and extremely important locally, but difficult to meas-

ure on a regional scale.

The short-term economic returns of converting from swiddening to commercial agriculture are probably higher than maintaining the system. In fact, as people in Southeast Asia continue to participate more fully in a market economy, as the road system is expanded and improved, and as farmers become more or less secure in their rights to use hill lands, we can expect to see farmers changing from swidden to permanent agriculture over the next few decades. An analysis of the erosion in commodity prices paid to developing nations since the 1970s suggests, however, in the long run that a commitment to commodity production poses real risks for swidden farmers who convert their swidden fields to commodity crops (Xu et al., 2005). Integrating such crops into the swidden system, thus allowing for more flexibility of land and labor, is often a more appropriate and economically safer strategy, as smallholders throughout Southeast Asia have shown over the last century (Dove, 1993; Ducourtieux et al., 2006).

Given this situation, documenting changes in swidden and achieving the accurate assessment of their scale and pace on a regional Southeast Asian level is critically important. Having reliable information in hand will facilitate the identification of processes that account for these shifts, as well as make possible an understanding of their consequences and further implications. We also suggest that extensive changes in such an important, long-standing, and wide-spread land-use practice that has resulted in a particular spatial pattern of fragmentation and a temporal pattern of disturbance will be of great importance. We especially need to be able to comprehend trends in swidden on a regional level in order to detect emergent issues that might not appear in smaller scale assessments.

A wide range of remote sensing based techniques are available for assessment of local level change in swidden land use, but the complexity of swidden land use makes assessments on a wider scale more complicated. Tottrup et al. (2007) tested the accuracy of four continental or global maps in a location in Vietnam and found that they provided reasonable estimates of total forest areas but failed to capture the anthropogenic influences such as swidden in the landscape. New approaches of combining regression tree modeling and multi-temporal MODIS 250-m data show more promise for accurate separation of mature forest, secondary forest, and non-forest cover on a regional scale. Combining such tools with demographic data, ethnographic studies, and spatial information databases would make it possible to obtain a better picture of the current area under swidden as well as the number of people depending fully or partially on this system for their livelihoods. Improvements in the knowledge, awareness, and commitment to understanding complexity that government agents and scholars bring to the task are also needed. With a concerted effort we can document these changes and their profound environmental and social implications.

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