Conservation Biology

Diversity

Recognizing Contemporary Roles of Swidden Agriculture in Transforming Landscapes of Southeast Asia

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Rapid transitions in land use in humid tropical uplands of Southeast Asia often involve replacement of swidden agriculture, also known as slash-and-burn or shifting cultivation (Mertz et al. 2009*a*). Swiddening was once the dominant agricultural system on sloping forested lands in the region, but it is now generally denounced by governments, who associate it with deforestation and degradation of soil and water resources (Fox et al. 2009). Land uses that are replacing swidden agriculture include extensive, long-term cultivation of annual crops, cultivation of monoculture tree plantations (particularly rubber and oil palm), cultivation of horticultural plants in greenhouses, and livestock grazing (Schmidt-Vogt et al. 2009). These commercial systems are often favored by antagonists of swiddening and agriculture entrepreneurs, who claim these agricultural practices are more productive and cause fewer environmental problems (Ziegler et al. 2009b). We think, however, in some situations swiddening is still a productive agricultural system that has a role in the preservation of species diversity, soil and water conservation, and climate-change mitigation.

During the last century when awareness of high rates of deforestation in the tropics increased, colonial governments commonly criticized swiddening (Fox et al. 2000). Concurrently, accelerated soil erosion and landslides were observed in areas where traditional long-fallow swiddening was replaced by more intensive cultivation systems (Ziegler et al. 2009*b*). In the past, gathering accurate information on those who practice swidden agriculture and distinguishing landscapes temporarily deforested for swidden agriculture from those permanently deforested for other purposes was nearly impossible (Mertz et al. 2009*b*; Messerli et al. 2009; Schmidt-Vogt et al. 2009). Thus, the total amount of degraded land deemed the result of swiddening was probably overestimated, which contributed to widespread negative public sentiment (Fox et al. 2000). Regional governments responded by restricting swiddening. Upland areas were divided into forest and agriculture land-use categories largely on the basis of degree of slope. Forest agencies expanded so as to enforce bans on tree cutting and limit cultivation on steep slopes. Ethnic minorities were resettled or, if nomadic, were encouraged to settle in one location, and most were encouraged (or forced) to plant permanent cash crops (e.g., cabbage in northern Thailand) (Fox et al. 2009).

The emergence of regional markets for upland agricultural products and subsequent expansion of commercial agriculture continue to drive land-use changes in former areas of swidden agriculture (Fox et al. 2009).

Paper submitted September 11, 2010; revised manuscript accepted November 29, 2010.

DOI: 10.1111/j.1523-1739.2011.01664.x

Because customs are often adapted to seasonal swidden activities, substantial cultural changes are occurring as rural livelihoods become more linked with urban economic forces (Cramb et al. 2009). Although we agree that commercial agriculture allows many former swidden farmers to earn more money, the vulnerability of farmers to economic losses related to crop failures or market reversals can increase with specialization in one product (e.g., rubber production in Yunnan, China, or oil palm in Borneo) (Sturgeon 2005; Cramb et al. 2009). Pursuit of income solely through commercial agriculture can leave farmers, such as those producing coffee in the central highlands of Vietnam, with large debts (Cramb et al. 2009).

In addition to effecting permanent deforestation, efforts to increase agricultural productivity on slopes have contributed to, for example, relatively high rates of erosion and increases in the probability of landslides (Sidle et al. 2006; Ziegler et al. 2009*b*). Moreover, the greatest contributors to high loads of river sediment are often the road systems that make commercial agriculture possible (Ziegler et al. 2004). Water quality in highly modified landscapes is reduced by the use of fertilizers and pesticides in areas where commercial agriculture has replaced swiddening (Ziegler et al. 2009*b*). Extraction of surface and ground water for irrigation of annual crops increasingly results in stream desiccation (Forsyth & Walker 2008). There is also the possibility that regional water availability will be reduced as a result of the uncontrolled expansion of monoculture plantations of nonnative tree species, such as rubber (Guardiola-Claramonte et al. 2008, 2010), which is now grown in former swidden areas of relatively high latitudes and elevations in mainland Southeast Asia (Ziegler et al. 2009*a*).

Swidden agriculture requires relatively large forested landscapes and provides lower short-term economic return per unit area than intensive agricultural systems, but it provides several benefits that permanent agriculture does not (Padoch & Pinedo-Vasquez 2010). Soil fertility, plant biomass, and species richness of plants typically decline over time in swidden systems, yet the maintenance of lengthy fallow periods and short cropping periods not only helps slow this decline but fosters the regeneration of diverse secondary forests (Finegan & Nasi 2004; Lawrence 2004; Rerkasem et al. 2009; Lawrence et al. 2010). The diversity of sources of human food in particular is well maintained by swiddening (Padoch & Pinedo-Vasquez 2010). For example, Conklin (1957) found 280 food crops—including more than 90 rice varieties—grown naturally and planted in the Hananoo swiddens on Mindoro Island, Philippines. More recently, nearly 370 plant species were identified in the swiddens, home gardens, paddy fields, and forests surrounding a Karen community in Thailand (Rerkasem et al. 2009). Although swidden fallows have substantially different structure than old-growth forest, they nonetheless provide essential habitat for birds and small mammals within a managed landscape (Naughton-Treves et al. 2003; Zhijun & Young 2003). Therefore, landscapes that contain swidden systems rather than being converted entirely to permanent agriculture would be expected to facilitate the conservation of many varieties of useful, endemic plants (e.g., rice varieties and medicinal plants), as well as populations of wild animals (in the absence of hunting).

Transitions from traditional swidden agriculture to many intensive cropping systems also reduces total carbon stocks. Aboveground carbon may decline more than 90% when swidden systems with long fallow periods are replaced by rotational systems with short fallow periods or by continuous cycles of annual crops (Bruun et al. 2009). Reductions of soil organic carbon of 10–40% result from the conversion to continuous annual agriculture, with the largest declines associated with plantations that are established using heavy machinery for excavation (Bruun et al. 2009). Uncertainty of how much carbon is sequestered in swidden systems compared with other tree-based or biofuel plantations is now an obstacle for the implementation of mechanisms to Reduce Emissions from Deforestation and forest Degradation (REDD+) in Southeast Asia (Mertz 2009).

Swidden agriculture is still the most rational land use for farmers in forests in some instances, from both economic and environmental perspectives (Fox et al. 2009; Padoch & Pinedo-Vasquez 2010). Although conservation policies and market forces will likely continue pushing swidden farmers toward commercial agriculture, we think swiddening should be encouraged in areas where it contributes to the preservation of ecosystem services and cultural identity. Relevant to the current global change debate, we believe REDD+ policies should not preclude maintaining or rehabilitating traditional swidden systems with fallow periods that are sufficiently long to allow regeneration of mature secondary forests.

Acknowledgments

This paper is a result of a 2008 workshop on the demise of swidden agriculture in Southeast Asia. Support was provided by the Ford Foundation, Vietnam and Indonesia, National Aeronautics and Space Administration (grants NNG04GH59G and NNX08AL90G respectively), and Asia Pacifica Network (grants ARCP2007-01CMY and ARCP2008-01CMY). We recognize the contributions of the following people: C. Colfer, A. de Neergaard, W. Dressler, M. Epprecht, Y. Fujita, M. Hardiono, A. Heinimann, P. Laungaramsri, D. Lawrence P. Meserli, E. Mulyoutami, D. Ngidang, L. Nguyen, N. Peluso, C. Pham, L. Potter, L. Quang, V. Phang, K. Rerkasem, N. Sakuntaladewi, D. Schmidt-Vogt, J. Sturgeon, Thiha, D. Thomas, T.Dao, C. Vu, and R. Wadley.

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