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COMMENTARY

Saving Slash-and-Burn to Save Biodiversity

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ABSTRACT

Several prominent articles have recently revived the debate on how to advance and reconcile two pressing global issues: conservation of biodiversity, and food production for an increasing human population. These discussions contrast a 'land-sparing/intensive agriculture' strategy with a 'biodiversity-friendly' agriculture approach. We propose that swidden or shifting cultivation should be an important component of the latter approach in the tropics because many swidden systems maintain very high levels of biodiversity while providing livelihood for populations in tropical forest areas worldwide. We suggest further that when many swidden systems are viewed without prejudice and in broader spatial and longer temporal perspectives, the conservationist aspects of the systems become evident.

Key words: Agrobiodiversity; shifting cultivation; swidden agriculture.

SEVERAL PROMINENT ARTICLES have appeared recently reviving a long-standing debate on the best way to advance and reconcile two pressing global issues: the need to protect and conserve decreasing biodiversity and the imperative to feed, clothe, and shelter an increasing human population (Fischer *et al*. 2008, Scherr & McNeely 2008, Chappell *et al*. 2009, Perfecto & Vandermeer 2010). Most of these recent discussions set up a dichotomy between a 'land-sparing/intensive agriculture' strategy and a 'wildlife-friendly' or 'biodiversity-friendly' agriculture approach. Calling upon both ecological theory and empirical data, they weigh whether we are more apt to attain these two (often seemingly opposed) goals where biodiversity is preserved in well-protected pristine reserves interspersed with highly productive, intensively managed, homogeneous agricultural zones, or are we more sure to reach our objectives where agriculture and biodiversity conservation share a more heterogeneous, less distinctly demarcated matrix. Each approach has its theoretical bases and its proponents, and each presents questions and complications. The first strategy seems like the surefire proposition: pristine forest reserves are known to conserve biodiversity, and intensive agriculture can produce lots of food. The arrangement appears simple, stable, straightforward and easy to replicate and monitor. Where and even whether the combination actually works, both theoretically and empirically, however, is not clear (Angelsen & Kaimowitz 2001, Chappell *et al*. 2009, Perfecto & Vandermeer 2010).

In this brief commentary, we choose not look into the land-sparing approach. Perhaps our principal reason for this decision is that in the humid tropics where we work, the land-sparing approach leaves little room for smallholders. Smallholder farmers, foresters, and agroforesters have been the lifelong focus of our research and include (in MPV's case), our brothers and sisters and many other members of our immediate and more distant families. We largely do not consider land-sparing as an option because smallholders persist in the hundreds of millions in the tropics, and any plan that threatens their livelihoods and hastens their disappearance from the landscape seems unacceptable.

The second, biodiversity-friendly alternative allows for a greater diversity of both land uses and users. When several proponents of this option focus on exactly what kinds of agriculture should make up the matrix, however, their vision narrows. While we echo the calls for greatly increased experimentation and development of biodiversity-friendly agriculture (Scherr & McNeely 2008), we regret that these often leave the impression that production systems combining the conservation of wild biodiversity with agricultural crops still need to be invented, created totally anew, fresh, and original. We do not wish to romanticize existing smallholder farming systems, or the 'noble peasants' nor the 'sage indigenous people' who developed and practice them, any more than we believe that the pristine and ennobling tropical forest needs to be romanticized. We fear, however, that as the search for the fresh and new, scientifically proven, and theoretically rigorous systems that offer more perfect solutions to the biodiversity conservation–agricultural production conundrum gets underway, some pretty good existing answers to that puzzle are being lost. This is not only because of global change, but also because of our inattention and the widespread ignorance, misperception, and prejudice within the scientific and conservation communities.

Can existing smallholder agricultural systems play a role in the new conservation paradigm? Some of the most compelling articles in this debate suggest they can and identify selected traditional production systems as resources (Scherr & McNeely 2008, Perfecto & Vandermeer 2010). Among the systems they highlight are several that we know and endorse as well: diverse, multi-storied

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homegardens, complex and productive agroforests, and ingeniously designed, organically farmed, and apparently sustainable permanent annual cropping systems. There is, however, one conspicuous omission in most of these discussions of biodiversity-friendly traditional agriculture: shifting cultivation, also known as swidden, or—making it obvious why it is not included among the environmental agriculture all-stars—slash-and-burn.

Shifting cultivation is an integral part of many, if not most, tropical forest landscapes that are crucial to biodiversity conservation in all the remaining large tropical forests: Amazonia, Borneo, Central Africa (Ickowitz 2006, Padoch *et al*. 2007, Mertz *et al*. 2009, Schmidt-Vogt *et al*. 2009). Most often, it is a central component in landholdings and livelihoods that also include the agroforests, homegardens, and permanent plots that have gained favor. But swiddening has been criticized, condemned, and criminalized everywhere it exists (Fox *et al*. 2009, Mertz *et al*. 2009). Few of its features seem to fit into any conventional category of sustainable management. Cutting of trees, burning of fields, comparatively low production of staple crops, haphazard weeding, and the apparent abandonment of fields after a year or two of cropping—all highly visible features of many swidden systems—are regarded worldwide as primitive, wasteful, and destructive, and efforts to eliminate slash-and-burn are central to both national and international conservation and development programs (Hecht *et al*. 1998, Cramb *et al*. 2009, Fox *et al*. 2009).

But seeing beyond the smoke and the prejudices inherent in a term like 'slash-and-burn', it becomes clear that many swidden systems could and should be essential components of a tropical forest 'conservation-agriculture matrix'. Including them requires a willingness to reject the lure of simplicity that alternative solutions offer. Swidden is complex on several levels (Hecht *et al*. 1998, Padoch *et al*. 2007). First, there are near-infinite variants of what has been labeled shifting cultivation or slash-and-burn; a simple 'traditional/nontraditional' dichotomy does not really work to distinguish the desirable from the destructive. Second, in swidden fields the number and arrangement of planted crops, and tolerated, encouraged, or transplanted spontaneous plants, and trees left from previous forests and fields, can present an array that is bewildering to map and monitor. Yields of all but the principal crops can be near impossible to measure. Third, the range and types of fallows and old forests, of homegardens, of timber and fruit stands, of intensively cropped plots, small pastures, and the several other production sites that usually make up a swiddener's landholding and livelihood also defy measurement and monitoring. Finally, all of these components constantly change, mostly by design, but rarely on a tightly programed schedule. In our world where the most advanced agriculture is defined by its extreme environmental simplicity, homogeneity, and predictability, swidden is inevitably perceived as backward.

If shifting cultivation belongs in conservation landscapes, it is largely because swidden systems harbor astounding levels of biodiversity. Perhaps the best-known study documenting crop biodiversity in swidden systems is anthropologist Harold Conklin's pioneering work on the Hanunoo of Mindoro Island in the Philippines (Conklin 1957).The large number of crops and crop landraces encountered in Hanunoo swiddens—over 280 types of food crops and 92 recognized rice varieties, with several dozen usually found in any particular field—is often considered as the benchmark of swidden diversity in SE Asia. Crop diversity in swiddens actually varies considerably from region to region, locale to locale, field to field, and year to year (Rerkasem *et al*. 2009), but in any field, a variety of crops coexists with numerous spontaneously occurring species. Our (unpublished) study of swiddening in the Peruvian Amazon showed an average of 37 species of tree seedlings tolerated, even encouraged, in each hectare of swidden plot. Even this species diversity found within actively managed annual crop fields is only a small part of the biodiversity of swidden systems. Shifting cultivation creates and maintains complex mosaics of more and less managed stand types. A great many other species, plant and animal, are found in the young and old fallows that are the result of this management. In one Karen village in northern Thailand, for instance, nearly 370 plant species were found in the swidden fields, homegardens, paddy fields, and surrounding forest patches that made up the village territory (Rerkasem *et al*. 2009). Amazonian swidden landscapes have been known to contain even more diversity.

The greater obstacle to including shifting cultivation within the new conservation paradigm, in the eyes of both development professionals and conservationists, is not, we suspect, the illegibility of its patchy landscapes or the complexity of its management, but its dynamism. Change is what defines the system as shifting cultivation: annual cropping is moved from plot to plot every year or two; as forests regrow in one sector, they are felled in another. Can so much change be tolerated in a conservation landscape? Can swidden be sustainable if it includes slashing and burning? In the 1950s and 1960s researchers diligently measured the carrying capacity of swidden systems (Conklin 1957, Brush 1975) and many, finding that fallow cycles were becoming ever shorter, spread the alarm that the future necessarily was a swidden apocalypse, a total collapse of the systems and its practitioners. That general collapse did not happen. Several swidden systems worldwide adapted to larger populations, to new economic demands, to the demands and directives of anti-swidden policies and conservation prohibitions. Others disappeared, but not in an apocalyptic collapse (Schmidt-Vogt *et al*. 2009). Adaptation took a large number of pathways. More active management of swidden fallows was perhaps the most important. Examples include management of rich mixtures of marketable fruits and fast-growing timbers in Amazonia, and rubber and rattans in SE Asia (Sears & Pinedo-Vasquez 2004, Cairns 2007). Swidden is increasingly revealed as an agroforestry system and a central component of systems that generate the agroforests, forest gardens, and intensive plots that we prefer. These adaptations suggest that sustainability of swidden systems emerges when it is seen in broader spatial and longer temporal scales: swidden is constantly mutable.

Even more than movement and mutability, it is the use of fire that condemns swidden, especially now that climate change concerns are at the forefront. Burning fields undoubtedly release carbon into the atmosphere, and in a particularly dramatic and visible way, but the balance of carbon in swidden systems is still

little understood (Bruun *et al*. 2009). Recent research also questions long-standing assumptions about soil and water degradation tied to shifting cultivation on tropical hillslopes (Hecht *et al*. 1998, Schmidt-Vogt *et al*. 2009, Ziegler *et al*. 2009). Finally, swidden has been criticized for its inability to produce high yields to feed burgeoning tropical populations. The rice yields of swiddens never approach those of double- and triple-cropped paddies, but again the strength of the system is its diversity of products. The capacity to supply dietary variety and quality rather than quantity makes swidden superior to many other production types that would replace it.

Why do we urge that swidden be reconsidered and included in conservation programs here and now? Despite its persistence for millennia, and especially in the last several decades, against great odds, swiddening is disappearing in much of the world at rates never before seen (Padoch *et al*. 2007, Schmidt-Vogt *et al*. 2009). Owing largely to a convergence of disparate factors including a broad range of negative legislation, exclusionary conservation zoning, logging, and large-scale plantation development, swidden is being replaced with new, mostly far less diverse land use systems with ecological and social consequences that we still do not understand (Cramb *et al*. 2009). REDD schemes and biofuel plantations are new and serious threats. These changes endanger much of the diversity, especially the agrobiodiversity that was maintained and developed within swidden systems. We are afraid that few of the scientists who are concerned with the loss of biodiversity appreciate these threats. Most conservationists in their ignorance probably cheer the demise of slash-and-burn. As Van Noordwijk *et al*. (2008) have stated in regard to rapid changes among Indonesia's swiddeners: 'The loss of diversity in crops and the wild component of agroforests is less visible than smoke'.

We hope that the new paradigms of conservation that include food production as a matrix could incorporate more complete livelihood systems, rather than just a few selected and simple land uses approved or designed by those who will not live by them. Swidden is, without doubt, a complex and, in several respects, a problematic management system, difficult to pin down, to categorize, to measure, and to monitor, but it is also an important and proven source of livelihood and a great generator of diversity. Swidden may well not be an ideal solution and it stands very far outside conventional, business-as-usual conservation, that is, the conservation of charismatic animals, landscapes, and 'hotspots'. But we suggest that it could have a place in a new conservation paradigm, with serious scientific research aimed at working with it and not against it. The potential payoffs would be great, including the conservation of much biodiversity with special meaning to human communities, and the conservation and even creation of cultural diversity that has long been part of the diversity, complexity, and dynamism of swidden and smallholders.

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