A3

INTEGRATING SWIDDEN AGRICULTURAL KNOWLEDGE SYSTEMS

Into sustainable intensification in the Central Mekong region

*Jianchu Xu, Timothy McLellan and Lisa Hiwasaki**

Introduction

Until the second half of the 20th century, swidden cultivation was the dominant agricultural system in much of the tropics. However, since then Southeast Asia – particularly China, Cambodia and Thailand – has experienced a decrease in swidden area at a pace faster than that of the rest of the world (Van Vliet et al., 2012). This has been attributed to market development and population growth, as well as government policies that have encouraged or coerced the conversion of swidden lands into permanent and more intensive agricultural practices. Throughout the region, swidden farmers have been marginalized by laws that criminalize their practices, or land laws that prohibit the use of land for anything other than permanent agriculture or forestry (Dressler and Pulhin, 2010). Much existing swidden cultivation is practised by ethnic minorities and indigenous groups using their own indigenous agricultural knowledge, developed over long histories of interaction with their natural surroundings.

In this chapter we propose a broad view of swidden knowledge; one that encompasses indigenous swidden agriculture and includes the knowledge and practices associated with it. We approach swidden cultivation as an example of 'hitching a ride on a multiplicity of processes observed in nature' (Brookfield, 2007, p12, quoting Paul Richards), or of what Eduardo Kohn recently called 'thinking with and like forests' (Kohn, 2013). That is to say, we want to highlight the ways in which

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swidden farmers recognize and harness various processes, such as forest regeneration and nutrient cycling, that they observe in the forests with which and in which they live. Indigenous knowledge of this kind has inspired the emergent concept in agricultural ecology of farming systems that mimic nature (Xu, 2007). More broadly, the philosophy of swidden agriculture as 'hitching a ride with nature' also complements the scientifically established idea of ecosystem services: the recognition that natural ecological processes often provide the most efficient support for agricultural production, and that these processes can be fostered by appropriate land management. In this respect, the indigenous knowledge of swidden farmers – and the agro-ecological science it has helped to inspire – provides a welcome antithesis to modernist projects such as the Green Revolution and Chinese Maoism. Moreover, such an approach to indigenous knowledge opens up the potential for scientists – as well as policy-makers and other stakeholders – to work with and alongside indigenous peoples as co-theorists, not only of agriculture and ecology, but also of culture and society.

In this chapter, we propose a framework in which swidden agriculture can form a basis for the sustainable intensification of agricultural production. To do this, we start by outlining some of the key challenges facing agriculture in the tropics and in the Central Mekong region in particular – a region that covers parts of Cambodia, southwestern China, Laos, Myanmar, Thailand and Vietnam (Figure A3-1). We then provide some brief examples of existing swidden systems before elaborating on our proposed socio-ecological framework, which comprises 12 dimensions: six ecological and six social. Finally, we describe a research programme that is focused on the humid tropics of the Central Mekong region, which could provide a basis for further agricultural research-for-development that integrates indigenous knowledge. We believe that integration of indigenous agricultural knowledge through participatory research is vital to promoting better livelihoods while conserving natural resources in upland mountainous areas of Central Mekong.

Unsustainable land use and finding innovative solutions to improve livelihoods

Farming systems are changing rapidly around the world due to many factors, including commercial alternatives to swidden agriculture, large-scale land and infrastructure development, increasing regional market integration and agricultural intensification. Across Southeast Asia, swidden cultivation is being replaced by monoculture tree plantations and annual cash crops such as maize, rubber, bananas and cassava, as well as paddy rice (Van Vliet et al., 2012). Increasingly, these crops are being grown for regional and global value chains and for a wide range of uses. Their production often involves trade-offs between subsistence-oriented and market-oriented activities and objectives. Although such commercialization has resulted in increased household incomes, what is less clear is its impact on positive livelihood outcomes, such as improved food and nutrition security. Moreover, equity – in terms of access to

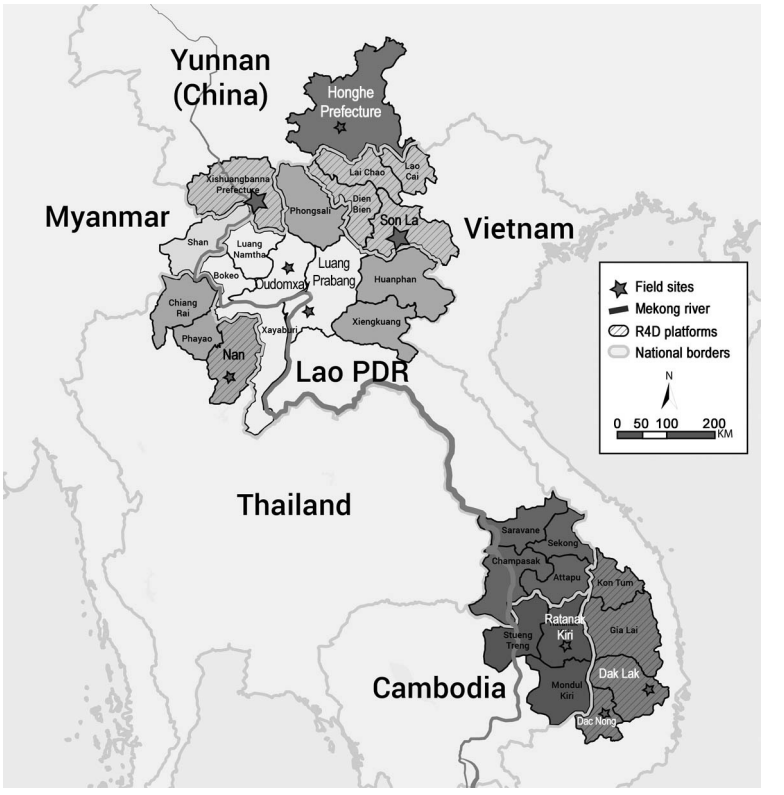
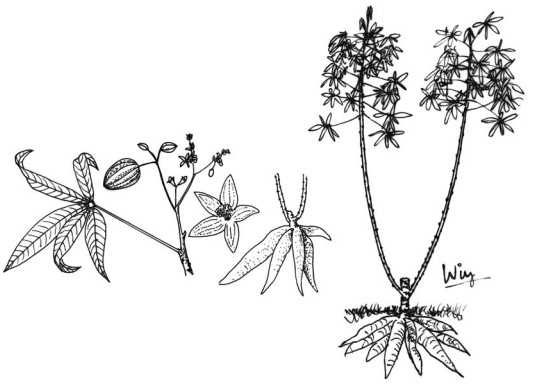


FIGURE A3-1: Humidtropics action sites in the Central Mekong Action Area.

resources and markets and benefits received – is an issue that is often overlooked. Specialization for regional and global markets makes farmers vulnerable to both production and market risks. Monoculture cropping also leaves farmers vulnerable to extreme climatic events, plant diseases and food insecurity. Furthermore, poorly managed single-species production can exacerbate soil and water degradation.

In order to increase livelihood opportunities and equitable agricultural development for smallholder farmers, it is necessary to carefully design interventions based on the biophysical, economic, social and institutional contexts of each site. Moreover, to achieve positive impacts for the poor and the vulnerable, research-for-development needs to be based on integrated agricultural systems research and natural resource management. Integration should also take place among different sectors both horizontally and vertically (Coe et al., 2014).

Humidtropics is a research programme of the Consultative Group for International Agricultural Research (CGIAR). It seeks to transform the lives of the rural poor in tropical America, Asia and Africa, using integrated systems research and unique partnership platforms for impacts on poverty and ecosystems integrity. Humidtropics' theory of change is based on the hypothesis that the region's inherent potential is best realized through an integrated systems approach, built around sustainable



Manihot esculenta Crantz [Euphorbiaceae]

Permanent fields of cassava, often interplanted with bananas, is one of the land-use systems that is replacing shifting cultivation in Southeast Asia.

intensification and diversification and involving participatory action across stakeholder groups. Research-for-development platforms and other multi-stakeholder processes help to identify and prioritize systems problems and opportunities, supported by systems analysis to identify entry points that require social and technical innovations. Innovative options that have been tested in the field include integrated or mixed farming (combining crop-animal-tree technologies, aquaculture and/or vegetable gardens), as well as other practices that raise system productivity and delivery of ecosystem services. Such innovations can improve the ecological performance and sustainability of farming systems and result in landscapes with increased resilience and nutritional capacity. Research-for-development activities began in 2013 in area-based flagships, two of which are in Africa, one in Central America and the Caribbean, and one in Southeast Asia. Although swidden cultivation has been practised in the past or is currently taking place in many of the Humidtropics' area-based flagships, the world's highest concentration of swidden cultivation has been recorded in Southeast Asia and the Pacific (Van Vliet et al., 2012).

Existing swidden systems as foundations for innovation

Swidden agriculture or shifting cultivation is an extremely broad set of practices. Examples of its full diversity can be found elsewhere in *Shifting Cultivation Policies: Balancing Environmental and Social Sustainability*. However, in order to highlight the positive potential of swidden in contemporary agricultural innovation, we provide a brief outline of some existing swidden practices.

The Taungya *system*

The *taungya* system originated in the mountainous borderlands between China and the rest of mainland Southeast Asia. As with many swidden systems, forest land is cleared for the cultivation of annual food crops. An important further feature of *taungya* is the planting of a preferred species of timber tree that develops to maturity in the fallow. In some systems, annual crops are planted for only one or two years, but there are also indigenous systems in which the number of years of food cropping

in the understorey of the growing timber plantation is extended by using a rotation of increasingly shade-tolerant crops. This allows farmers to continue annual crop production while they wait for fallow timber to mature (Menzies, 1988).

In the 19th century, officers of the British colonial administration in Myanmar adapted this system for teak cultivation, coercing indigenous Karen hill farmers to plant their fallows with teak. Subsequent colonial and post-colonial forestry sectors in Myanmar have continued to use various versions of *taungya* teak production (Win and Kumazaki, 1998), while the success of the system in Myanmar led to its adaptation and utilization elsewhere in the tropics (Kalame et al., 2011).

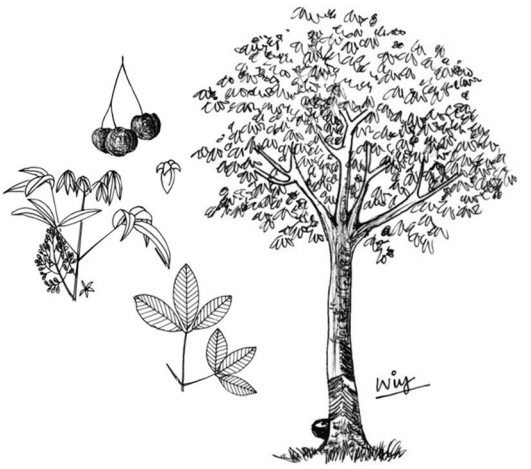
Contemporary studies in Myanmar and elsewhere have demonstrated a variety of advantages to *taungya* and other similar swidden systems, including high labour efficiency, high economic output, potential for forest restoration, enhanced ecosystem services, climate-change mitigation and adaptation and a significant ability to sequester carbon (Kalame et al., 2011; Soto-Pinto and Armijo-Florentino, 2014). Furthermore, increasingly sophisticated research on *taungya* systems promises the potential for further innovations, such as enhanced fire management (Suzuki et al., 2004, 2009), optimized tree-litter management (Suzuki et al., 2007) and improved species selection for rotating inter-crops (Soto-Pinto and Armijo-Florentino, 2014).

Rubber and non-timber forest products in managed fallows and agroforestry

In the early part of the last century, Kantu' swidden farmers in Borneo began cultivating rubber trees in swidden fallows. Michael Dove (1993) later described how rubber cultivation was integrated into swidden agriculture in Borneo, and how it was able to complement the labour demands of the pre-existing system. In the swidden cycle, there are three peaks in demand for labour – planting, weeding and harvesting – that account for about four months of work, leaving eight months of relative labour surplus every year. According to Dove, rubber cultivation was well suited to exploiting this surplus of labour because it could be exploited intermittently, and latex flows could even benefit from pauses in tapping that occurred when labour was required for other swidden work. This integration of new cash crops into the swidden labour cycle pointed to the need to consider the social, as well as the ecological, aspects of swidden systems. As Dove pointed out, the potential of such integration could be seen in other systems where fallows were managed for non-timber forest products, such as the cultivation of rattan in Yunnan, China (Chen et al., 1993; Brookfield, 2007; Burgers, 2007; Xu, 2007).

In recent decades, research into rubber agroforestry has intensified, with priority given to alternatives to rubber monocropping, which is at once ecologically unsustainable and a source of economic instability. One important avenue has been to explore the ecological benefits of existing rubber agroforestry systems, such as those in Borneo, some of which are more than a century old. The potential benefits of such systems over monocrop rubber systems – such as the prevailing systems in Xishuangbanna, China – include biodiversity conservation, watershed protection, enhanced ecosystem

services, carbon sequestration and livelihood diversification (Penot, 2007; Fox et al., 2011; van Noordwijk et al., 2012). Proposals for eco-certification of 'green' or 'environmentally-friendly' rubber also suggest the potential to enhance rubber value chains with higher prices, and the establishment of financial incentives for environmentally-friendly practices (van Noordwijk et al., 2012; Yi, forthcoming).



Hevea brasiliensis (Willd. ex A. Juss.) Müll. Arg [Euphorbiaceae]

Rubber grown in agroforestry systems or managed fallows is under study as an alternative to ecologically unsustainable monocrop plantations.

A framework for swidden agricultural-knowledge systems

If indigenous swidden agricultural-knowledge systems promise a path for humans and nonhumans to flourish together, we must approach them as social as well as ecological knowledge systems. We have therefore adopted a socio-ecological systems approach (see Figure A3-2). Specifically, we propose a framework that focuses on six ecological and six social dimensions to swidden agriculture. Focusing on these dimensions provides a framework not only for understanding existing swidden systems, but also for experimenting with enhanced and intensified swidden systems, and for monitoring, assessing and re-engineering innovations.

Six dimensions of ecological systems

1. **Place (site selection)**: Local climate, hydrologic, edaphic and geomorphologic factors, as well as biotic interactions, strongly affect ecological processes and the abundance and distribution of species at any one place. Appreciating such place-specific factors is important not only for the innovation process, but also for the process of scaling-up. In this respect, the spread of the *taungya* system across the world demonstrates the potential for scaling-up of swidden-based innovations. However, it must be appreciated that this scaling-up has only been successful because each iteration of *taungya* has been adapted to the specific ecological (and also social) conditions of the place in question.
2. **Biomass (protective slashing)**: Many swidden systems involve the deliberate management of biomass through practices such as notching, slashing, felling, trimming and pollarding to promote tree regeneration. As well as having the potential to increase or accelerate the production of exploitable resources,

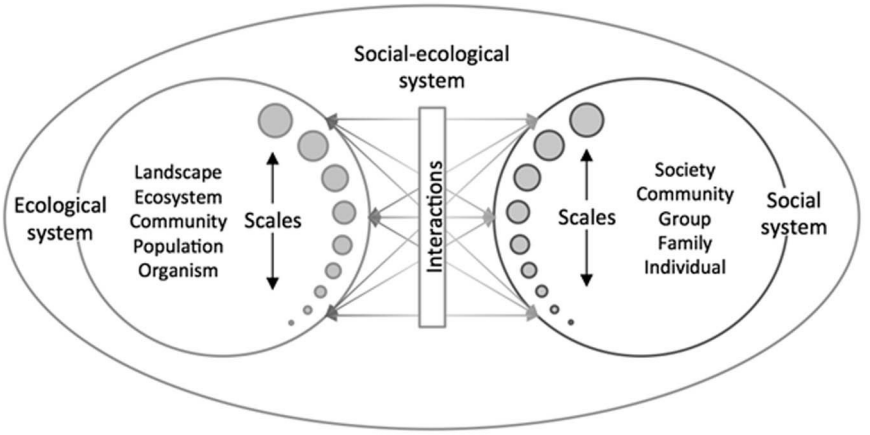


FIGURE A3-2: Diagrammatic representation of a socio-ecological framework for swidden agricultural-knowledge systems.

enhanced biomass production may also enhance the potential for carbon sequestration.

3. **Fire regime (protective burning)**: The use of controlled burning of selected areas is an important part of many, though not all, swidden systems. As well as controlled fire, a further vital dimension to swidden agriculture can be fire prevention, and fallow recovery in particular. Understanding and innovating intensified swidden systems that might maximize, among other things, productivity and carbon sequestration will require analyses of fire regimes across all stages of the swidden system, from clearing to fallow recovery.
4. **Diversity (cropping with diverse mixes of annual and perennial species)**: Most swidden systems incorporate a diverse mix of crops and trees in order to harness positive inter-organism, as well as plant-soil, interactions. Understanding and optimizing these interactions requires an appreciation of the broad-scale ecosystem-level effects that exist between particular perennial species and networks of interacting species.
5. **Fallow succession (tree-crop farming systems and perennial tree cropping)**: Sub-dimensions to fallow succession include the type, intensity and duration of annual cropping, as well as the nature of management of the subsequent fallow. Each of these dimensions shapes the characteristics of the ecological communities fostered by swidden fields.
6. **Landscape (mosaic of swidden and non-swidden areas)**: The size, shape and spatial relationships of land-cover types influence the dynamics of populations, communities and ecosystems. The ecology of swidden systems must therefore be approached at landscape level and include an analysis of surrounding land-cover types. This will involve assessment of non-swidden areas such as water-source forests, stream buffer forests and protected cemeteries or sacred forests.

Six dimensions of social systems

1. **Indigenous cosmovision:** Swidden systems are often intimately tied to broader indigenous values, knowledge systems and spiritual practices. Properly understanding indigenous swidden practices therefore requires an understanding of this broader ethnological context. We cannot take an exclusively economic approach in order to understand motivations for adopting particular practices, and must adopt ethnological and ethnobotanical methods that will allow us to appreciate the broader values and meanings of swidden systems to their practitioners.
2. **Indigenous technical and scientific knowledge:** In order to fully benefit from the lessons of existing swidden systems, we must understand the indigenous knowledge underlying their management. This will include eliciting indigenous taxonomic systems and the relation of these taxonomies to, among other things, the selection of domesticated species for cultivation and the management of naturally occurring species. In many cases, it will also be important to understand and learn from indigenous knowledge of ecological and climatic indicators, for example, naturally occurring species that indicate high- or low-quality soils.
3. **Customary institutions:** This dimension relates to the social organization of technical knowledge, and the collective management of swidden agriculture. Focusing on this dimension will allow us to understand indigenous decision-making patterns and processes, and to appreciate how local people arrive at individual and collective decisions about the management and use of natural resources.
4. **Experiments and innovations:** Swidden farmers constantly search for novel variations and manage a dynamic portfolio of practices and plant varieties. Swidden research should engage this dynamism by identifying not only existing knowledge, but also the ways in which swidden farmers generate further knowledge and refine their existing management of natural and agricultural resources.
5. **Indigenous teaching and learning:** Swidden research should incorporate studies of how long-standing practices, as well as novel innovations, are communicated intra- and inter-generationally. This will allow us to develop an understanding of how people learn from each other and share information about natural and agricultural resources.
6. **Markets and value chains:** A vital part of any agricultural system is the exchange of goods and services. In the contemporary context, research into agricultural transactions will need to consider both global and local value chains and understand existing and potential access to world and local markets.

The socio-ecological systems approach to agricultural research-for-development

If the socio-ecological framework set out above is to have practical impacts, it must be integrated with appropriate participatory methods of research-for-development. All too often in the past, otherwise nobly intended and meticulously designed development programmes have failed because the knowledge and experience of local populations has been ignored. Nowadays, scientists are studying and incorporating the experience-based knowledge and insights of upland swidden cultivators into their research designs. Two realizations have driven this new trend. First, the knowledge of specific micro-environments acquired by local populations over centuries of learning by discovery has intrinsic value and, in fact, it may be the only existing knowledge of some complex micro-environments. Second, knowing and understanding the concepts and language forms of indigenous knowledge enables scientists and technicians to communicate more effectively with local people.

Building on these positive developments, further efforts should be made to encourage the closing of knowledge gaps between scientists and indigenous peoples by encouraging more extensive and intensive interaction in the field. There is also a need to promote effective interaction between agents of government bureaucracies dealing with health, irrigation, natural resources and agriculture and local leaders who hold specialized indigenous knowledge in these areas and are willing to share it. To make this possible, the indigenous knowledge of local specialists must be documented and scientists and government officers trained not only in its use, but also in effective methods of acquiring more indigenous knowledge. The framework described above, which focuses on six ecological and six social dimensions of the swidden socio-ecological system, could help us to carry out this documentation of indigenous swidden knowledge, as well as to identify divergences in government, research and local perspectives. Our socio-ecological systems framework can therefore provide the basis for coordinating focused interactions between stakeholders with differing perspectives, and facilitating innovation processes that engage multiple stakeholders.

Rapid assessment tools like Participatory Rural Appraisal (PRA) and Rapid Rural Appraisal (RRA) might also have a role to play in projects of this kind, but as Rambo (2007, p793) argues, these methods 'are not a magical means by which to obtain reliable information quickly and cheaply'. Indeed, it would also be necessary to carry out extensive (and therefore slow) monitoring of the biophysical characteristics of swidden areas, focusing on the six ecological dimensions already identified. Research-for-development projects should also employ extensive social-science techniques such as long-term participant observation. Researchers employing long-term research methods of this kind (often 12 months or more) can access indigenous perspectives and social phenomena with a depth that is impossible with rapid techniques such as PRA or household surveys. Participant observation (or 'SRA – slow rural appraisal') will therefore be vital to understanding the six social dimensions to swidden socio-ecological systems already set out above. As well as giving us a deeper understanding of swidden socio-ecological systems, the long-term presence of a non-local

researcher – whose research techniques would already necessitate building relations with community members – may help to facilitate interactions between local or indigenous stakeholders and those who are neither local nor indigenous.

Potential research-for-development on swidden in Central Mekong

Having set out our broader framework for swidden as an indigenous knowledge system, we now describe the potential for this approach and possibilities for its application through agricultural research-for-development in the Central Mekong region.

In Southeast Asia, the Humidtropics research programme has focused on upland areas of Central Mekong, encompassing parts of Cambodia, southwestern China, Laos, Myanmar, Thailand and Vietnam. The region is the source of headwaters and major tributaries leading into several major rivers that have an impact on the lives of more than 600 million people. It is an area of extreme diversity in topography, farming systems, ethnic populations, markets and socio-political systems. Recent changes may offer many new economic opportunities, but they also pose threats to ecological sustainability and equitable livelihood development.

Throughout history, the lowlands of Central Mekong have supported large-scale rice farming. Cities have grown on the lowlands that are now the seats of centralized governments. The uplands, on the other hand, have been home to a great diversity of ethnic-minority groups engaged in traditional, small-scale, swidden agriculture. As subsistence farmers, uplands people were little integrated into state decision-making, knowledge mobilization or land-use planning. This pattern began to change about 30 years ago as upland populations increased, cash crops such as rubber, cassava, bio-energy and vegetables spread, and governments sought to better integrate the uplands into nation states. Socialist states in the region classified minority groups according to their perceived level of development and attempted to legitimize the expansion of central government control over remote regions (Harrell, 1995; Fiskesjö, 2006). Traditional farming practices, including swidden cultivation, were considered archaic and environmentally destructive, and policies that promoted cultural integration, economic standardization and abandonment of traditional agriculture were widely implemented (Yin, 2001; Michaud and Forsyth, 2011).

Tectona grandis L. f. [Lamiaceae]

Teak was the basis of the widely adopted *taungya* system of combining swidden crops with trees that grow to maturity in the fallow. It is suggested that research could produce further innovation from *taungya*.

Situational analyses undertaken in northwestern Vietnam and southwestern China demonstrate that ethnic minority groups, particularly those living in upland areas, tend to have less material wealth, lower school-attendance rates, fewer job opportunities and less market access (ILRI, 2014; Hammond et al., 2015). Such realities are also reflected in agricultural development: in northwestern Vietnam, agricultural production is performed predominantly by ethnic-minority farmers, who play a very small role further along the supply chain. Business operators of the Kinh ethnic majority have exclusive control over the collection of products at the district and provincial levels and the use of export agents (ILRI, 2014).

Social inequality is perpetuated in agricultural research and development, leading to further underdevelopment. Agricultural extension services and agricultural research and training organizations typically focus their work on majority ethnic groups. As a result, many upland minority peoples have not been adequately trained in modern agricultural techniques and when they are forced to abandon their traditional agricultural practices the consequences often include environmental degradation and only marginally profitable agriculture, leading to economic and nutritional problems.

Against this backdrop, a cross-cutting research effort focusing on ethnic minorities began in 2015. In late 2014, Humidtropics partners in Central Mekong stressed the importance of ensuring that the benefits of the programme's interventions reached the region's poorest smallholder farmers. To this end, Humidtropics' partners identified as a priority the pursuit of more inclusive rural development from agricultural research.

The swidden farmers of Central Mekong have a wealth of local and indigenous agro-ecological knowledge. However, this knowledge has not often been incorporated into existing agricultural research-for-development, nor is it used in government decision-making. We believe that hybrid combinations of local, market and government actions offer the most effective means of improving the livelihoods of smallholder farmers and supporting long-term food and climate security. One component of future research under the Humidtropics programme in Central Mekong should focus on working with ethnic-minority people to access and assess the indigenous agro-ecological knowledge of swidden landscapes that has accumulated over generations of daily interactions with the land, soil, water, trees, animals and wildlife of the mountains. Such knowledge can be documented, validated and integrated with scientific knowledge: a process in which the socio-ecological systems framework set out above would be invaluable.

The integration of swidden agricultural knowledge with research-for-development can lead to locally relevant, 'bottom-up', innovative solutions to sustainable intensification and diversification in Central Mekong. Such research could build on existing work on hybrid knowledge in swidden cultivation (e.g. Sillitoe, 1998) and on incorporating local knowledge to strengthen agroforesty research and extension (e.g. Walker et al., 1995). In recent years, similar efforts to integrate indigenous knowledge with scientific knowledge have taken place in fields such as disaster-risk reduction (e.g. Mercer et al., 2009; Hiwasaki et al., 2014) and climate change adaptation (e.g. Kelman et al., 2009; Armitage et al., 2011). Such solutions

can then be tested for scaling up, and in close collaboration with government actors, incorporated into practical guidelines for use by local, regional and national decision-makers as they create and implement policies on agriculture, food, and nutritional security issues. Moving forward, Humidtropics plans to emphasize effective ways to communicate new knowledge and build working partnerships with private, civil-society and government actors at local and national levels. The goal is to mainstream integrated knowledge from local, market and government sources into explicit 'new normal' practices with targeted government funding.

Conclusions

Integrating indigenous knowledge with scientific knowledge can help us to better understand swidden agriculture and develop innovative solutions for the sustainable intensification of agriculture in Central Mekong. We propose a socio-ecological systems framework for approaching and understanding indigenous swidden knowledge. This is a framework that emphasizes the dual importance of social and ecological dimensions to agricultural systems. Integrated into participatory multi-stakeholder research-for-development processes, this framework can provide the foundation for innovative new swidden-based or swidden-inspired agricultural systems. The Humidtropics programme in Central Mekong is an example of the kind of multi-stakeholder initiative in which the hybrid swidden knowledge described in this chapter has great potential. Indeed, many of the core issues identified by the Humidtropics programme – especially the marginalization of upland peoples and environmental degradation that has followed the replacement of diverse traditional agricultural and forestry systems with modern monocrop plantations – are issues that can be addressed through greater engagement with indigenous swidden knowledge. In this respect, Humidtropics in the Central Mekong presents a large-scale and concrete programme into which indigenous, scientific and hybrid swidden knowledge can and should contribute to the innovation of sustainable agricultural intensification.

Postscript: Reshaping the Anthropocene with swidden knowledge

The emerging concept of the Anthropocene as a new geological epoch recognizes that humans have become the dominant agents of environmental change. It has provided a focal point for scholars, policy-makers and ordinary citizens to reflect upon and debate the past, present and future of the relationship between humanity and the non-human world. Contemporary debates aiming to define the beginning of the Anthropocene have focused on the Industrial Revolution and the post-1950s 'Great Acceleration', as well as on the unique impacts that humans have had on the environment going back centuries or millennia. Whatever the appropriate demarcation of the Anthropocene, the emergence of modern agriculture represents an important shift in human relationships with the environment. Typified by the

monoculture rubber plantations of Xishuangbanna, China, discussed in this chapter, modern agriculture is a system that relies heavily on mechanical and chemical inputs and provides few opportunities for landscapes to recover.

Going back more than 10,000 years, the development of swidden agriculture represents an earlier agricultural milestone for human influence on the planet (Gorman, 1971). In this case, humans began to use fire to change land cover on a planetary scale. Although it undoubtedly represents a very different relationship with the environment than that of modern agriculture, much controversy surrounds the evaluation of swidden agriculture. For some, swidden reflects the negative potential of humans upon the environment – an example of the 'misanthropocene'. In this view, swidden is seen as a primitive land-use system that contributes to deforestation, soil erosion, biodiversity loss and carbon emissions. To the contrary, in this chapter we have approached swidden as an example of positive human-environment relations: an example of the possibilities for a better Anthropocene. Indeed, the argument we have set out above would suggest that indigenous swidden-knowledge systems can provide a positive path towards '[r]etelling and practising the Anthropocene' (Buck, 2015, p376); a path that can take us closer to conditions under which humans and non-humans can flourish in the Anthropocene.

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