Chapter 18

Research Partnerships

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Introduction

The development of ecoagriculture landscapes is essential to addressing the dual challenge of enhancing wild biodiversity in critical habitats and improving rural livelihoods of agriculture-dependent people. As illustrated by the many examples in this volume, there is considerable scope for local innovations through collective action and local trial and error. But in many landscapes, there is no clear pathway to ecoagriculture solutions, and developing them will require integrating the efforts of scientists with a range of disciplinary expertise, interacting closely with land users. There remain major gaps in knowledge to overcome major tradeoffs and achieve real synergies between biodiversity and agricultural livelihoods.

There is thus a need for large-scale research initiatives in major ecozones to understand how agroecosystems function and to identify opportunities and constraints for ecoagriculture under diverse conditions. But conventional research approaches are inadequate. Few existing research methods are adapted for application in complex and dynamic landscape mosaics. The agricultural and conservation research communities are weakly linked, and their research frameworks are often incompatible. Disciplinary research priorities often fail to address the major constraints of field practitioners (Rhodes and Scherr 2005).

The challenge for ecoagriculture is particularly evident in the practice of fallow-based (slash-and-burn) agriculture now practiced in the tropical forest margins, where over a billion chronically poor people depend on forest resources, and globally important biodiversity is threatened. These systems are found across
the humid tropics. Working in collaboration since 1994, a large group of research partners have developed and tested an institutional model for research in the tropical forest margins using a collaborative, participatory, multiscale, integrated natural resource management approach and research methods.

This organizational model for collaborative research on integrated natural resource management is the ASB Partnership for the Tropical Forest Margins (formerly known as the Alternatives to Slash-and-Burn program). The partnership focuses on landscape mosaics (comprising both forests and agriculture) where global environmental problems and local poverty converge at the margins of remaining tropical forests. This chapter describes the ASB partnership, its approach to assessment of ecosystem services in the tropical forest margins and the trade-offs and synergies among these services, and the tools ASB partners developed to support landscape-scale assessment and action. Through participatory action research, ASB partners have identified promising ways to achieve an equitable balance between biodiversity conservation and agricultural livelihood options for poor, rural communities. This organizational model potentially has broad applicability for the development of ecoagriculture landscapes in other biomes.

### Key Features of the ASB Partnership for the Tropical Forest Margins

The ASB Partnership for the Tropical Forest Margins is a systemwide program of the Consultative Group on International Agricultural Research (CGIAR) that was born out of recommendations agreed upon at the 1992 Rio Earth Summit (*Agenda 21*, Chapter 11, on Combating Deforestation) (Sanchez et al. 2005). It is a global consortium of more than 80 local, national, and international partners, including research institutes, nongovernmental organizations (NGOs), universities, community organizations, and farmers’ groups. Key features of the partnership include an ecoregional focus, a growing emphasis on landscape mosaics within its multiscale design, an integrated natural resource management approach, and a multisite, multidisciplinary, multipartner network.

#### Ecoregional Focus

ASB benchmark sites have been established in the Amazon of Brazil and Peru, the Congo Basin forest of Cameroon, the island of Sumatra in Indonesia, the mountains of Northern Thailand, and the island of Mindanao in the Philippines. These are landscapes of roughly 100 to 1000 square kilometers for long-term study and engagement by ASB partners with households, communities, and policymakers at various levels.
All the ASB benchmark sites are in the humid tropical and subtropical broadleaf forest biome as mapped by the World Wide Fund for Nature (WWF). The most biologically diverse terrestrial biome by far, conversion of these forests leads to the greatest species loss per unit area of any land cover change. Current estimates by ASB indicate that of the more than 1.8 billion people within this tropical forest biome, 1.2 billion are rural. Most are poor households that depend directly on forest resources and agriculture for their livelihoods. Other poor households suffer indirectly from activities such as commercial logging that can lead to resource wastage and environmental degradation. Tropical deforestation has no single cause but is the outcome of a complex web of factors whose mix varies greatly in time and space. Understanding the nexus of these factors in a given situation is a crucial first step if policymakers are to introduce effective measures to curb deforestation, and to do so in ways that reduce poverty (http://www.asb.cgiar.org/PDFwebdocs/PolicyBrief6.pdf).

Across the benchmark sites, deforestation is often blamed on the slash-and-burn practices of migratory smallholders, millions of whom do clear and cultivate small areas of forest by this method. However, plantation owners, other medium- and large-scale farmers, ranchers, loggers, and state-run enterprises and projects clear much larger areas, leading to conflict, often with smallholders, who in many cases have longstanding prior claims that are rarely officially recognized.

Growing Emphasis on Landscape Mosaics

Although clearing forests for pasture development is readily visible through remote sensing, much of the change at the forest margin is more gradual and defies accurate classification by current remote sensing techniques. The combined land-use systems, with portions of fields, farms, and landscapes in annual crops, pastures, agroforestry, and forests are classified as agriculture and forest mosaics and are now recognized as quite extensive in area and importance in terms of their impact on ecosystem functions. However, the mapping legends used in studies of land cover change do not in general do justice to these landscape mosaics. Furthermore, some of the processes by which these complex landscapes function in terms of providing ecosystem services are not yet understood. These questions have become the focus of ASB’s ongoing work.

Integrated Natural Resource Management Approach

ASB operates as a multidisciplinary research and development consortium that aims to implement integrated natural resource management (iNRM) through long-term engagement with local communities and policymakers at various
levels. As shown in Figure 18.1, iNRM begins with problem analysis. An integrated analysis of a broad range of land-use alternatives is used to quantify the local, national, and global benefits they entail as well as the institutional realities that may favor or hinder their further development in three distinct dimensions: (1) enhanced productivity, (2) enhanced ecosystem integrity and resilience, and (3) enhanced human well-being. These three elements correspond closely to the three legs of the ecoagriculture “stool”: agricultural productivity, biodiversity conservation, and contributions to human well-being (livelihood support, poverty reduction, and rural vitality) (Buck et al. 2004; McNeely and Scherr 2003).

Figure 18.1. The integrated applied natural resource management (iNRM) paradigm (adapted from a figure by A.M. Izac)
Multisite, Multidisciplinary, Multipartner Network

ASB’s multisite network helps to ensure that analyses of local and national perspectives and the search for alternatives are grounded in reality. ASB partners work with households to understand their problems and opportunities. Similarly, consultations with local and national policymakers bring in their distinctive insights. In this way, participatory research and policy consultations guide the iterative process necessary to identify, develop, and implement workable and relevant combinations of policy, institutional, and technological options.

By bringing together local knowledge, policy perspectives, and science, ASB partners work to understand the trade-offs among development and conservation goals and to identify and develop innovative policies and practices that work for both people and nature. The global consortium seeks to:

• Strengthen partner institutions and build capacity in developing countries to participate fully in the global search for solutions
• Accelerate the participatory assessment, development, adaptation, and spread of technologies and land-use practices that conserve biodiversity, store carbon, and maintain (or restore) local ecosystem services while providing attractive opportunities for poor rural households in the humid tropics to increase their income and food security
• Facilitate global sharing of information on these innovative practices and policies
• Generate knowledge, methods, tools, and data sets on natural resource management in the tropical forest margins

ASB Approach to Assessment of Ecosystem Goods and Services

This section covers how the ways to provision, regulate, and support ecosystem services are studied and incorporated within the ASB approach.

Assessment Approach

Ecosystem services provided by tropical forests and forest-derived land-use systems range from the plot to the global level, making cross-scale assessment a vital necessity. As part of the Millennium Ecosystem Assessment (MA), ASB partners have undertaken a multiscale assessment of forest and agroecosystem tradeoffs in the humid tropics, attempting to synthesize findings across ASB sites. Over the past decade, ASB partners have undertaken research, evaluated development experience, and built capacity at the benchmark sites and else-
where. These have resulted in proven methods and new databases for plot-level indicators. Methods for landscape and watershed scale assessment are under development, as well as a pantropic analysis of the nexus among tropical hydrology, biodiversity, and poverty. Stakeholder consultations to identify user needs have provided the basis for developing questions to guide assessment teams for specific topics.

For each of the assessment topics, indicators reflect user needs and concerns regarding specific outcomes, focusing on land use, land cover change, and resource management. These include protocols for the following:

- Benchmark site characterization and multiscale assessment (Palm et al. 2000)
- Assessment of global environmental services, specifically carbon stocks and greenhouse gas fluxes. The ASB report can be viewed at http://www.asb.cgiar.org/publications/wgreports/wg_climatechange
- Assessment of below-ground biodiversity (Bignell et al. 2005) and agronomic sustainability at the plot level (Hairiah et al. 2005). The ASB report can be viewed at http://www.asb.cgiar.org/publications/wgreports/wg_biodiversity.asp
- Assessment of social and economic issues, including smallholder farmers’ concerns and national policymakers’ concerns. The ASB report can be viewed at http://www.asb.cgiar.org/publications/wgreports/wg_socioecon.asp

These include measures of output and profitability, valued at both private and socially adjusted costs and benefits; labor requirements, including the establishment and operational phases for various land uses; means of meeting household food security; and institutional capacities, such as existence and functioning of markets for purchased inputs and outputs, labor, and capital; access to technological information; property rights and resource access; equity issues; and degree of social cooperation.

These plot-level indicators have been measured for locally significant land uses at ASB benchmark sites (http://www.asb.cgiar.org/publications/countryreports/). The underlying data on plot-level indicators for the specific land uses are compiled in a format referred to as the ASB matrix (Table 18.1), available at http://www.asb.cgiar.org/gallery/ASB_matrix.ppt, which facilitates assessment of trade-offs across land uses (Tomich et al. 1999, 2005b).

To conduct cross-site (and intercontinental) comparisons within the biome, land uses for benchmark site assessments were also selected with reference to a set of “meta land uses” http://www.asb.cgiar.org/gallery/ASBmetalanduse.ppt. Similar indicators have been developed for landscape mosaics in Northern Thailand (Thomas et al. 2005). Indicators for output of ecosystem goods (provisioning services) underpin the profitability indicators described earlier and will be derived from those existing databases and other secondary data for
which work is ongoing (see later discussion). In 2002 and 2003, assessment activities were extended to include hydrological functions and their coincidence with biologically significant habitats at various scales, from the local/landscape scale to medium-sized river basins (the Mekong) to the pantropic scale.

Natural or undisturbed forests were considered as the reference or baseline condition against which other tropical forest-derived systems could be compared. ASB assessed subsets of conditions and trends at the global, benchmark, landscape, and land-use (plot) level. The ASB assessment “priority list” includes ecosystem goods (of which food supply received particular emphasis from some users); the regulating services of carbon sequestration and air quality; water supply; and nutrient supply; and the resource base and supporting services such as soil, soil formation and biological diversity. The full discussion is available in Tomich et al. (2005a). Two categories of clear importance—regulation of pests and diseases (of humans, plants, and animals) and cultural and spiritual values—were not covered in detail because of limited capacity and data within the consortium and limited time and other resources to develop new partnerships in these areas.

**Table 18.1. The alternatives to slash-and-burn (ASB) matrix**

<table>
<thead>
<tr>
<th>Meta land uses</th>
<th>Global environmental concerns</th>
<th>Agronomic sustainability</th>
<th>Smallholders’ socioeconomic concerns</th>
<th>Policy and institutional issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural forest</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forest extraction</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complex, multistrata agroforestry systems</td>
<td></td>
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<tr>
<td>Simple tree-crop systems</td>
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<tr>
<td>Crop/fallow systems</td>
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<tr>
<td>Continuous annual cropping systems</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Grasslands/pasture</td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: completed matrices for the forest margins of Cameroon, Northern Thailand, the Peruvian Amazon, Sumatra in Indonesia, the western Amazon of Brazil are available at http://www.asb.cgiar.org/data/dataset/
“Provisioning” Ecosystem Services

Building on the synthesis of users’ needs, a protocol was developed to assess food, fiber (including timber and fuelwood), feed for livestock, and a host of other major products that are obtained from forests and the diverse forest-derived land-use systems found at the tropical forest margins. The main products differ greatly by land-use system, between and within regions, and also with changes over time (e.g., during droughts). But regardless of their location, rural people in these regions typically rank these goods, especially food and timber, as their primary concerns among all ecosystem services. After synthesizing data collected on users’ needs, the ASB-MA ecosystem goods (provisioning services) assessment intends to “scale up” the goods analyses from benchmark sites to states/provinces and other larger units.

“Regulating” Ecosystem Services

The ASB paradigm works in conjunction with ecosystem services, supporting their functions while attempting to maximize production in a sustainable way. Measures to quantify the effectiveness of management approaches allows land stewards to most effectively utilize natural controls on climate change, air quality, water, nutrient supply, crop pests, and disease.

Carbon Sequestration and Climate Change Mitigation

Carbon stored in tropical forests is vital to maintaining and reducing the level of greenhouse gases in the atmosphere. There is considerable uncertainty in the carbon dioxide flux and storage from the tropics due to inadequate estimates for rates of different land-use transitions, the biomass of the vegetation that is cleared, the rates of regrowth, and levels of biomass recovery of the subsequent land-use systems. In particular, little information is available on the carbon stored and the potential to sequester carbon in many of the land-use systems of the humid tropics, other than for continuous cropping and pasture systems, both of which have low carbon storage potential. However, significant tree cover on deforested, agricultural, and abandoned land in the rain-fed, or humid, tropics could provide a potentially large sink for carbon. Carbon storage in soils is essential for maintaining many ecosystem services, including nutrient availability, water infiltration, and detoxification of certain minerals and chemicals. A database developed by ASB from the carbon stock measurements taken in each of the major land-use types at each site was used for assessing the condition of carbon sequestration in forests and agroecosystems. (See the ASB Climate Change working group report at http://www.asb.cgiar.org/publications/wgreports/wg_climatechange.asp.) Because many of the land-use systems (agroforests and tree plantations) in the humid forest margins are cyclic, the
carbon stored in these systems at the end of a rotation cycle is the maximum carbon stored and is thus an overestimate of the carbon stock of those systems over their full rotation period. To account for the changes in carbon stocks from the harvest, clearing, and regrowth phases, a time-averaged carbon index was calculated to indicate the average carbon stocks stored in each land-use system over the rotation time of the system (Palm et al. 2005b).

**Air Quality and Mitigation of Smoke Pollution**

Smoke pollution from burning of forest, grassland, and agricultural fields is a serious public health problem and disrupts livelihoods in large areas of the humid tropics. ASB research has emphasized options to manage smoke from land clearing activities (Byron 2004; Tomich et al. 2004). Fires are not intrinsically harmful and if well managed can be a legitimate, low-cost technique for clearing unwanted vegetation. The challenge for policymakers is to minimize the adverse effects of fire and smoke, not to stamp out the use of fire (http://www.asb.cgiar.org/PDFwebdocs/ASBPolicyBriefs4.pdf).

**Water Supply and Buffering Lowland Flooding**

Hydrological integrity is extremely important in providing sustainable water yields, reducing flood hazard, and controlling erosion. Habitat conservation and integrated watershed management are intimately connected to the water cycle of humid tropical ecosystems. A recent assessment of available evidence for the humid tropics (Bruijnzeel 2004) indicates that the role of natural forest cover in providing reliable water supplies to humans and their agroecosystems may be significantly overstated in this biome.

**Nutrient Supply**

The continued productivity of land-use systems depends on the supply of nutrients through either external inputs or internal cycling, the latter being an ecosystem service upon which many tropical agroecosystems depend. Depletion of nutrient stocks through the repeated harvest and removal of goods without replenishment of those nutrients will also result in a decline in the provisioning services of the agroecosystem. Two indicators were developed to assess whether the nutrient balance was (or could potentially be) maintained in the different land-use systems: (1) net nutrient export (which equals nutrient input minus nutrients harvested), and (2) relative nutrient replacement cost (which equals the costs, in the form of chemical fertilizer, of replacing nutrients “exported” from the agroecosystem in harvested products).

**Regulation of Crop Pests and Diseases**

Many pests and diseases of domesticated crops can be controlled “biologically” through natural parasites and predators that occur within the same agroecosys-
tem or within patches of vegetation in the landscape. As agroecosystems are intensified they are frequently simplified with accompanying losses of biodiversity. In such cases pests and diseases can occur at levels that negatively affect the provisioning service of the system (crop and tree productivity and yields). Continued production of the same crops without rotation may also lead to increased pest problems. Similarly, as landscapes become more homogeneous with forest clearance and land-use intensification, forest refugia for natural predators disappear, and pest and disease outbreaks may become more common. Overall, there are few immediate answers for the practical questions regarding biodiversity function at the landscape scale (Swift et al. 2004; Tomich et al. 2004). One obvious priority for further work is to examine whether the risk of pests and diseases increases as biodiversity richness declines within these changing landscapes (Naylor and Ehrlich 1997). Although farmers in the humid tropics typically rank crop pests and diseases (including weeds) as their paramount resource management concern, with few exceptions (collective action for pig hunting in Sumatra, locust control, synchrony in rice planting to reduce opportunities for rats), interventions beyond the plot/household scale seem rare.

Resource Base and “Supporting” Ecosystem Services

This section deals with key resources underpinning ecosystem services: soil and biodiversity above and below ground.

Soils

The physical, chemical, and biological properties of soils determine their capacity for overall supporting services, and are affected by deforestation and land-use change. The role of soils and the interaction with above- and below-ground biodiversity is a central theme to the sustainability of land-use systems in the tropics and has been investigated at several scales. The work by Ziegler et al. (2004) illustrates what can be accomplished through informed scientific efforts to measure lateral flows. They provide evidence that unpaved roads produce as much sediment as agricultural land in an upper catchment in Northern Thailand, despite the fact that these roads occupy less than one-tenth of the area occupied by agriculture.

Biological Diversity, Above and Below Ground

Although biological diversity is not necessarily an ecosystem service per se, it provides a reservoir of biota that can and does provide a regulatory service, such as regulation of pests and diseases. Considerable ecological debate surrounds the issue of whether (and how) high biological diversity enhances ecosystem resilience and stability, although most empirical information suggests this is the case in tropical moist broadleaf forests.
It is clear that in addition to cultural, aesthetic, and spiritual values, natural biological diversity is vital for providing many local livelihood needs in terms of foods, medicines, and cash. Agrobiodiversity (in its broadest interpretation) also can help regulate pests and diseases and provides a diverse set of crops to reduce risk to climatic or economic fluctuations and to provide nutritional diversity.

ASB researchers have developed a highly cost-effective method for rapid appraisal of vascular plant biodiversity, which was tested at all benchmark sites. The method was originally designed to quantify changes in species composition, functional types, and vegetation structure along land-use intensity gradients from primary forest to degraded cropland in ASB sites. Multidisciplinary surveys in Indonesia and Thailand (Gillison 2000; Gillison et al. 2003) and the Brazilian Amazon (Gillison et al. 2003) have also shown that the method provides a robust statistical basis for using vegetation features as indicators of above-ground carbon, certain faunal groups, and potential agricultural productivity. These ASB rapid survey methods have led to major progress on biodiversity conservation in Indonesia, most tangibly playing a key role in designation of a new national park in Sumatra, currently covering 33,000 ha and planned to be expanded by another 120,000 ha. The methods were also influential in declaration of Tessio Nilo as a conservation priority area and national park in October 2003.

A global database currently held by the Center for Biodiversity Management contains uniformly collected data from more than 1600 sites, including all ASB biodiversity sample sites. The rapid survey protocol developed in association with ASB makes possible rapid assessment and comparison of data across all global scales, and this is facilitated by the hierarchical nature of the variables sampled, from local species to generic plant functional types (PFTs) and vegetation structure. Data collected using this approach in Sumatra and Thailand (Gillison and Liswanti 2004; Gillison et al. 2004) have shown useful predictive correlates between land use and biodiversity at a landscape scale.

ASB researchers have also been pioneers in the study of the functional values of below-ground biological diversity (BGBD) to better assess the potential uses of soil biodiversity in ecosystem management. A project coordinated by an ASB partner, the Tropical Soil Biology and Fertility Institute of the International Center for Tropical Agriculture (CIAT), is developing internationally accepted standards for characterizing and evaluating BGBD. These include indicators of BGBD loss, inventories of BGBD at sites representing a broad range of globally significant ecosystems and land-use types, and a global network to exchange that information.

**Ecological Knowledge**

The research program included assessment and comparison of local, public/policy, and scientists’/modelers’ ecological knowledge. Initial findings suggest
that understanding the differences among these "ways of knowing" can help to reduce conflict and find practical solutions. Local ecological knowledge on, for example, watershed functions is process-based and well articulated for observable phenomena such as overland flow, erosion, sedimentation, and filter effects. It does not depend on strict land-use categories. By contrast, policy knowledge is based on established categories, for example, the attributes that are supposed to go along with forest and nonforest land cover. Science can potentially help bridge between these process- and category-based types of understanding and can usefully interact in both arenas. Progress in actual stakeholder negotiations can come from developing a shared articulation of the underlying cause–effect relations and the criteria and indicators that reflect the various concerns. Breaking through existing categories at the policy level, and especially recognizing the intermediate systems and forest mosaics as the focus of interest in natural resource management, requires a change to evidence-based discourse (Joshi et al. 2004).

Analyses of Tradeoffs and Synergies

Poverty reduction in most of the tropics depends on finding ways to raise productivity of labor and land through intensification of smallholder production systems. Although there may be opportunities to alleviate poverty while conserving tropical rainforests, it is naive to expect that productivity increases necessarily slow forest conversion or improve the environment.

Balancing Biodiversity, Carbon Storage, and Production

Provisioning ecosystem services are often produced at the expense of some regulatory or support services. Yet some land-use combinations appear to minimize these trade-offs or even achieve synergies, producing both additional globally valued ecosystem services and provisions for local livelihoods and national economic development. For example, complex agroforestry systems provide food, including nutritionally diverse fruits, products sold locally for cash, timber, and international commodity crops such as rubber, cacao, and coffee. These systems can also maintain 25 to 50% of the carbon of the natural forest, often contain high levels of biodiversity, and also effectively sustain the main hydrological functions and soil-supporting functions. These tree-based systems at current levels of production appear to be sustainable in terms of their provisioning and regulating services. But not all agroforestry or tree-based systems maintain carbon and biodiversity. As an example from Cameroon, most of the tree-based systems contain similar amounts of carbon but have very different
levels of biodiversity. And efforts to intensify annual food crop production in
the rainfed uplands of the humid tropics frequently are unable to maintain suf-
ficient inputs to sustain production.

Given that forest-derived farming systems cannot match the biological di-
versity and carbon storage of old-growth forests, it can be difficult to strike a
balance between the legitimate interests of pro-poor development, on the one
hand, and concerns over the environmental consequences of tropical deforesta-
tion, on the other. However, ASB research in Southeast Asia and West Africa has
found that agroforests (complex, multistrata systems) that harbor high levels of
biodiversity often represent the next best option to natural forest for conserving
biodiversity and storing atmospheric carbon, while also providing attractive
livelihood opportunities for poor people.

Moreover, it is often the direction of change (degradation vs. restoration)
that determines whether the environment benefits. If farmers replace unsus-
tainable cassava production, for example, with an improved rubber agroforest,
they help restore habitats and carbon stocks while raising their incomes. Tree-
based restoration activities (agroforestry), in which both the environment and
poor people can benefit from a change in land use, constitute some of the ma-
jor win–win opportunities in the humid tropics. Such tree-based restoration
activities can increase carbon storage and be profitable (privately and socially).
But planting trees does not necessarily quickly restore all the ecosystem services
of old-growth natural forests. In particular, the hydrological values of such res-
oration remain uncertain, and we know very little about ecological functions
in tropical landscape mosaics.

**Landscape-Level Responses to Balance Tradeoffs**

The forest margins of the humid tropics tend to be relatively isolated and also
lie at the margins of formal administrative influence. Human activities are gen-
erally the result of private initiative, spatially dispersed and uncoordinated by
central administrative authorities. Attempts to impose coordinated responses
(e.g., government interventions such as land-use planning or zoning) will face
difficult prospects and risk perverse results if these interventions ignore the in-
terests “on the ground,” which produce a vast number of private responses that
dominate decisions about land use and land cover change. Ecosystem assess-
ment and management in the tropics need to evolve from a focus on simplistic
management categories to an acknowledgment of the chaotic reality, where a
large number of actors make their own decisions, disregarding official plans,
maps, rules, and “academic” categories and typologies. Often, the best contribu-
tion outside actors (research and development agencies) can make will be to fa-
cilitate and support a process of negotiation among these stakeholders, who
usually have conflicting interests among various ecosystem goods and services
Assessment of responses and response options needs to include both the imbalanced political economy and the weak organizational capacity of public institutions.

Tools for Landscape Assessment and Action

Despite these challenges, ASB experience shows it is possible to achieve a better balance between people’s needs and nature conservation. The following paragraphs describe tools developed through research partnerships to support landscape assessment and action, and “success stories” associated with their application.

Standardized methodologies, co-located measurements, and a set of sites and land uses that represent the extremes of land use at the humid forest margins provide ASB with unique yet comparable datasets. These have been used successfully to investigate the site specificity or generalities in the trade-offs and synergies among services.

Participatory Scenarios

Building scenarios about the future can help people making decisions about dynamic landscapes to gain a better understanding of the potential impacts of land-use change. National and regional partners of the ASB consortium have underlined their need for such decision-making tools to deal with the uncertainties they face. In response, ASB, the World Agroforestry Centre (ICRAF), and the Millenium Ecosystem Assessment (MA) conducted a global training workshop on scenarios development for facilitators who, subsequently, have both applied these skills themselves and trained others in their use (Lopez et al. 2006; Prieto et al. 2005; Rao and Velarde 2005; Thongbai et al. 2006; Ugarte et al. 2005). Participatory scenario formulation and use are key elements of ASB’s efforts to develop consensus and manage conflicts at the local, national, and regional levels.

Simulation Models

In Cameroon, the ASB team built models to simulate land use decisions at the tropical forest margins. Participatory social and agroecological mapping exercises were undertaken at a sample village to identify indicators of changes at the village landscape level. Using global positioning system (GPS) tools as well as supplementary socioeconomic information, models of land-use change were developed and calibrated for each mosaic of land uses. ASB modeling efforts in Brazil helped Embrapa (Brazil’s national agricultural research organization) an-
alyze the potential contributions of increased rice yields to reducing deforestation, which ran well below their previous expectations.

**Strategic Stakeholder Analysis**

ASB developed questions and categories that frame strategic research on social and political dynamics associated with forest margin areas. At a national level, applying this protocol will increase the practical understanding of challenges at specific sites. Engaging in dialogue with local and national policymakers, smallholder farmers, and private sector and other stakeholders to explore their perceptions of information, technical, and policy needs helps ensure that researchers are addressing issues of real concern to the major stakeholder groups. Such dialogue also facilitates participation by key local and national stakeholders in seeking solutions when there are conflicting interests regarding forests, land, and ecosystem services.

**Innovative Technologies and Resource Management Practices**

ASB research (particularly in Indonesia and Cameroon) has revealed the feasibility of a “middle path” of development involving smallholder agroforests and community forest management for timber and other products. Such a path could deliver an attractive balance between environmental benefits and equitable economic growth. “Could” is the operative word, however, because whether this balance is struck in practice will depend on these countries’ ability to deliver the necessary policy and institutional innovations. Indeed, one of the main lessons of ASB experience is that workable iNRM interventions involve combinations of technological, institutional, and policy innovations. A number of site-specific alternatives to slash-and-burn agriculture, such as sustainable forest management, smallholder agroforestry, improved pastures, and *Imperata cylindrica* grassland reclamation, are assessed in depth by Palm et al. (2005a).

**Recognition of Indigenous Systems**

ASB results have improved official understanding and supported government decisions to promote rubber agroforests in Indonesia. ASB research showed that it was beneficial to maintain rubber agroforests, as well as highlighting opportunities to increase productivity and smallholder income through improvements in rubber germplasm. As a result, the government implemented a national program on smallholder rubber agroforests, called Integrated Rubber Forest Management, and reformed trade and marketing policies for rubber wood. The program has the potential to directly improve livelihoods of many of
the estimated 7 million people in Sumatra and Kalimantan who make their liv-
ing from rubber agroforests.

A major outcome of ASB activities has been a contribution to policy dia-
logues at the local and national level on the ways forest functions can be main-
tained in the context of development. For example, official recognition of the
valuable role of agroforests and other sustainable land-use systems at a national
and local level provides a first step toward empowering the farmers that manage
these systems.

**Empowerment through Measurement**

In ongoing work in the Mae Chaem watershed in Northern Thailand, scientists
are working with communities to develop and validate methods that the com-
munities themselves then use to monitor their watershed functions and the en-
attention to local environmental knowledge also improves scientists’ under-
standing of environmental problems and widens the range of local livelihood
options and appropriate interventions considered by researchers. Early experi-
ences with monitoring suggest that scientists can greatly strengthen communi-
ties’ positions in negotiations to resolve environmental problems with neigh-
boring communities and with the Thai Royal Forest Department. One of the
communities won a national award for its environmental efforts.

These communities in Thailand are working to scale up the knowledge ac-
quired through watershed monitoring by establishing watershed management
networks. The importance and potential role of such networks is being recog-
nized by local leaders elsewhere in Mae Chaem, as well as by high-priority na-
tional efforts coordinated by Thailand’s new Ministry of Natural Resources and
Environment to develop river basin and subbasin management approaches.
Subcatchment management networks are seen as the basic building block for
larger-scale watershed management. Approaches developed by villagers in pilot
subcatchments of Mae Chaem are expected to be a major example for other
parts of the larger Ping River Basin. Moreover, efforts in the Ping basin are
serving as a pilot project for further efforts in the other 24 designated river
basins in Thailand.

**Recognition of Local Rights**

The Krui case in southwest Sumatra shows how scientists helped win the argu-
ment for community management by documenting the environmental and so-
cial benefits of the Krui agroforests. The Krui agroforests were threatened with
conversion to large oil palm plantations, and the people were threatened with
eviction from their land and the loss of their livelihoods. This work produced
immediate benefits from increased security for at least 7000 families in the 32,000 ha of reclassified Krui lands. These communities won the national environmental award, Kalpataru. This principle of local management could be extended to benefit hundreds of thousands of rural Indonesians in similar areas. Indonesian NGOs have identified at least 50 other communities across the archipelago that have developed production systems comparable to the Krui case (http://www.asb.cgiar.org/PDFwebdocs/PolicyBrief2.pdf).

**Conflict Management**

In hopes of securing rights to contested land in Sumber Jaya, Lampung Province, Indonesia, groups have formed to apply for stewardship contracts through the community forestry program (HKM). ASB researchers are working with several of these groups, local government, and the forestry department to facilitate negotiation for HKM status. The overarching goal is to develop a process by which the government can meet its environmental objectives to protect watersheds and park boundaries, while also enabling established settlers to make a living by managing their coffee systems in ways that are environmentally sound.

**Rewards for Ecosystem Services**

ASB research has shown that certain land uses that follow forest conversion maintain some key ecosystem services. The analysis of tradeoffs between the profitability and ecosystem services showed that these systems are really very useful from a broad social perspective, yet they are under threat because options like oil palm may be slightly more profitable from a private perspective. Mechanisms designed to reward the upland poor for these ecosystem services may be able to tip the balance in favor of the broader social and environmental concerns.

**Evolving Research Partnerships**

Together with WWF, the World Conservation Union (IUCN), and the Center for International Forestry Research (CIFOR), ASB is a founding partner in the Rainforest Challenge Partnership (RCP). RCP adds a protected area component lacking in ASB and involves a broader range of conservation, development, and research partners to share and adapt concrete strategies for poverty reduction with conservation of unique tropical forest ecosystems (Box 18.1). It is envisioned that RCP will integrate ASB activities into a much broader network of ongoing conservation and development initiatives, taking advantage
of complementarities among sites to tackle conservation and development issues of both local and global significance. This proposed global network of “learning landscapes” is expected to extend lessons learned so far about developing ecoagriculture in the tropical forest margins, and accelerate the learning process (ASB et al. 2003; http://www.asb.cgiar.org/about_us/future.asp).

The ecoregion- and landscape-focused partnership model of ASB offers a promising institutional approach for research on ecoagriculture systems in other ecosystems. Suitable combinations of agricultural and natural area management systems to achieve joint production, biodiversity, and livelihood goals will likely be landscape specific. But strategic, cross-site action research, in close collaboration with farmers and conservationists, can be a cost-effective means to develop, learn from successful practice, and disseminate ecoagriculture components and principles relevant to many landscapes.

References


