



Policybriefs

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STRIKING AN EQUITABLE BALANCE between the legitimate interests of development and equally legitimate global concerns over the environmental consequences of tropical deforestation is one of the greatest challenges of our generation.

HIGHLIGHTS

Many concerns,
conflicting interests

Lining up the facts

Understanding the
tradeoffs

The balancing act

Paying the price

Occasionally it is possible to conserve tropical forests while reducing poverty, but more often these two objectives conflict. Without action to resolve this conflict, tropical forests will continue to disappear.



J Lewis

Colonists in
Rondônia, Brazil.

Many concerns, conflicting interests

Everyone in the world wants something from tropical forests. Forest dwellers wish to continue their traditional way of life based on hunting and gathering. They are losing their land to migrant smallholders, who clear small amounts of forest to earn a living by raising crops and livestock. Both these groups tend to lose out to larger, more powerful interests—ranchers, plantation owners, large-scale farmers or logging concerns—whose aim is to convert large areas of forest into big money. Outside the forests is the international community, who wishes to see forests preserved for the carbon they store, that would otherwise contribute to global warming, and for the wealth of biological diversity they harbour.

Deforestation continues because converting forests to other uses is almost always profitable for the individual. However, society as a whole bears the costs

of lost biodiversity, global warming, smoke pollution and the degradation of water resources.

Every year the world loses about 10 million hectares of tropical forest—an area more than three times the size of Belgium. None of the land-use systems that replace this natural forest can match it in terms of biodiversity richness and carbon storage. However, these systems do vary greatly in the degree to which they combine at least some environmental benefits with their contributions to economic growth and poor peoples' livelihoods. It is, therefore, always worth asking what will replace forest (and for how long), both under the current mix of policies, institutions and technologies and compared to possible alternatives. In other words, what can be done to secure the best balance among the conflicting interests of different groups?

The ASB matrix: lining up the facts

Faced with such questions, policy makers need accurate, objective information on which to base their inevitably controversial decisions. To help them weigh up the difficult choices they must make, ASB researchers have developed a new tool known as the ASB matrix (see figure below).

In the ASB matrix, natural forest and the land-use systems that replace it are scored against different criteria reflecting the objectives of different interest groups. To enable results to be compared across locations, the systems specific to each are grouped according to broad categories, ranging from agroforests to grasslands and pastures.

The criteria may be fine-tuned for specific locations, but the matrix always comprises indicators for:

- Two major global environmental concerns: carbon storage and biodiversity
- Agronomic sustainability, assessed according to a range of soil characteristics, including trends in nutrients and organic matter over time
- Policy objectives: economic growth and employment opportunities
- Smallholders' concerns: their workload, returns to their labour, food security for

their family, and start-up costs of new systems or techniques

- Policy and institutional barriers to adoption by smallholders, including the availability of credit, markets and improved technology.

Over the past 8 years, ASB researchers have filled in this matrix for representative benchmark sites dotted across the humid tropics (see *ASB Policybrief 1*). The social, political and economic factors at work at these sites vary greatly, as also does their current resource endowment: from the densely populated lowlands of the Indonesian island of Sumatra, through a region of varying population density and access to markets south of Yaoundé in Cameroon, to the remote forests of Acre State in the far west of the Brazilian Amazon, where settlement by small-scale farmers is relatively recent and forest is still plentiful.

At each site, ASB researchers have evaluated land-use systems both as they are currently practised and in the alternative forms that could be possible through policy, institutional and technological innovations. A key question addressed was whether the intensification of land use through technological innovation could reduce both poverty and deforestation.

Understanding the tradeoffs

The matrix allows researchers, policymakers, environmentalists and others to identify and discuss tradeoffs among the various objectives of different interest groups.

The studies in Indonesia and Cameroon have 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, since whether or not this balance is struck in practice will depend on the ability of these countries to deliver the necessary policy and institutional innovations (see *ASB Policybriefs 2 and 3*).

Take the examples of Sumatran rubber agroforests and their cocoa and fruit counterparts in Cameroon. These systems offer levels of biodiversity which, though not as high as those found in natural forest, are nevertheless far higher than those in monocrop tree plantations or annual cropping systems. Like any tree-based system, they also offer substantial levels of carbon storage. Crucially, technological innovations have the potential to increase the yields of the key commodities in these systems, thereby raising farmers' incomes substantially, to levels that either

ASB Summary Matrix: Forest Margins of Sumatra

Land-use	Global environment		Agronomic sustainability	National policymakers' concerns		Adoptability by smallholders
	Carbon sequestration	Biodiversity	Plot-level production sustainability	Potential profitability (at social prices)	Employment	Production incentives (at private prices)
	Aboveground, Time-averaged (tonnes/ha)	Aboveground, Plant species/standard plot	Overall rating	Returns to land (US\$/ha)	Average labour input (days/ha/yr)	Returns to labour (US\$/day)
Natural forest	306	120	1	0	0	0
Community-based forest management	136	100	1	11	0.2	4.77
Commercial logging	93	90	0.5	1080	31	0.78
Rubber agroforest	89	90	0.5	506	111	2.86
Oil palm monoculture	54	25	0.5	1653	108	4.74
Upland rice/bush fallow rotation	7	45	0.5	(117)	25	1.23
Continuous cassava degrading to <i>Imperata</i>	2	15	0	28	98	1.78

TP Tomich

outperform or at least compete well with virtually all other systems. However, to realise this potential, it will be vital to find ways of delivering improved planting material—the key input needed.

The Brazilian Amazon, in contrast, presents much starker tradeoffs between global environmental benefits and the returns to smallholders' labour. Here the most commonly practised pasture–livestock system, which occupies the vast majority of converted forest land, is profitable for smallholders but entails huge carbon emissions and biodiversity loss. Systems that are preferable to this one from an environmental point of view, such as coffee combined with *bandarra* (a fast-growing timber tree), can pay better, but have prohibitively high start-up costs and labour requirements and are riskier for farmers. An alternative pasture–livestock system, in which farmers are expressing interest, offers even higher returns to land and labour but only slightly improves biodiversity and carbon storage (see below). In other words, the land use alternatives that are attractive privately are at odds with global environmental interests. Only a radical overhaul of the incentives facing land users—including smallholders—could change things.

Just how radical would the overhaul have to be? Very radical—even for a small effect—according to ASB research. Consider the gathering of wild Brazil nuts, one of the most environmentally benign uses of the Amazon's forests. At current prices offered to smallholders, Brazil nut harvesting pays well below the going rate for wage labour. To persuade smallholders merely to slow the pace of deforestation, the price of nuts would have to rise more than fourfold (see box).

Research by ASB scientists of the Empresa Brasileira de Pesquisa Agropecuária (Embrapa) on the pasture–livestock system in the western Amazon of Brazil shows that, with a combination of legumes to enrich pastures and solar-powered electric fences to control the pattern of grazing by their cattle, smallholders could double milk production per cow and triple the carrying capacity of their land, bringing a marked increase in profitability. And since this pasture system is sustainable without annual burning to control weeds, seasonal smoke pollution would be reduced (see *ASB Policybrief 4*).

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The Brazil nut case

Settlers in Brazil's Acre State clear forest gradually over the years, with pasture for cattle becoming the dominant land use (see *ASB Voices 3*). In addition, around 50% of farm families harvest nuts from the part of their farms that remains forested.

Using a specially developed bioeconomic model, ASB researchers explored how labour, capital and land would be allocated to different on-farm activities over a 25-year period under different price and market scenarios. When they applied the model to Brazil nuts, the researchers found that doubling the farmgate price of nuts would not decrease and might even increase the rate of deforestation,

because farmers probably would re-invest the extra cash they earned in clearing forest faster. This would be a sensible response from the farmers' perspective because, even at the higher price, cattle production would remain by far the more profitable activity. Only in the unlikely event that prices quadrupled over their current level might the rate of deforestation slow—and even then the braking effect would be slight and the modest saving in forest would probably be short-lived.

The researchers concluded that subsidising the price of Brazil nuts would not by itself be an effective policy measure for conserving forests.

So why haven't these practices been adopted widely already? First, the vast majority of smallholders cannot get access to the necessary credit, seeds or hired labour and are too far from markets to be able to sell the increased milk supplies. Second, aiming for these higher profits entails increased risk, in part because of the higher initial investment costs. But even if these barriers were eliminated, widespread adoption of such improvements would likely increase—not decrease—the pressure on neighbouring forests. The reason is that the greater profitability of the improved system would make the agricultural frontier more attractive to new settlers. Thus, under the present mix of policies and institutions, and the incentives they create, the forests in Brazil's western Amazon will continue to fall whether the smallholder succeeds or fails.

The balancing act

Based on these results, what can be done to balance the objectives of forest conservation and poverty reduction in these tricky settings?

Some assert the best opportunities for meeting both objectives lie in the harvest of various products from community-managed forests. In practice, such extensive systems require low population densities plus effective mechanisms for keeping other groups out if they are to prove sustainable.

Where forests are converted, agroforests often represent the 'next best' option for conserving biodiversity and storing carbon, while also providing attractive livelihood opportunities for smallholders. However, for both economic and ecological reasons, no single land use system should predominate at the expense of all others. Mixes of land uses increase biodiversity at a landscape level, if not within individual systems, and also can enhance economic

and ecological resilience. A mixed 'landscape mosaic' represents an especially attractive option in cases such as Brazil, where no single system offers a reasonable compromise between different objectives.

Where productivity of the natural resource base has already sunk to very low levels, concentrating development efforts on the simultaneous environmental and economic restoration of degraded landscapes is an option that is well worth exploring.

The precise mix of interventions needed—hence the benefits and costs of restoration—varies from place to place. In Cameroon, improved cocoa and fruit tree systems could be a win-win proposition in place of unsustainably short fallow rotations. In Indonesia, millions of hectares of *Imperata* grasslands are the obvious starting point.

The direction of change in land-use systems determines the environmental

consequences. For example, if farmers replace unsustainable cassava production with an improved rubber agroforest, they help restore habitats and carbon stocks. But if such a system replaces natural forest, the environment loses.

Intensification of land use through technological change is a two-edged sword. It has great potential to increase the productivity and sustainability of existing forest-derived systems, thereby raising incomes. By the same token, however, these higher incomes attract more landless people to the agricultural frontier in search of a better living. Therefore, technological innovation to intensify land use will not be enough to stop deforestation. Indeed, it often will accelerate it. If both objectives are to be met, policy measures intended to encourage intensification will need to be accompanied by measures to protect those forest areas that harbour globally significant biodiversity.

Paying the price of rainforest conservation

The main point for policy makers is that, without tangible incentives linked to the supply of global environmental benefits, people will continue to cut down tropical rainforests. Results from ASB research at all the benchmark sites show that it is futile to attempt to conserve forests in developing countries without addressing the needs of poor local people. But how can the necessary incentives to conserve be put in place? Only a limited number of policy instruments have so far been tried and there is still much to learn about what does and does not work.

Part of the answer lies in the developing countries themselves, where such measures as securing land tenure and use rights can be taken. But should these countries have to shoulder the entire financial burden of forest conservation when all face urgent development imperatives, such as educating and vaccinating rural children?

The bottom line is that, if the international community wants the global benefits of rainforest preservation, it is going to have to stump up some of the costs.

For more information:

ASB summary reports on Brazil, Cameroon and Indonesia and working group reports on climate change, biodiversity and socio-economic indicators are available from: <http://www.asb.cgiar.org/publications.shtml>

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