



DOES CONSERVING BIODIVERSITY WORK TO REDUCE POVERTY?

A State of Knowledge Review

August 2010

PREPARED BY:

Craig Leisher, M. Sanjayan, Jill Blockhus
The Nature Conservancy

Andreas Kontoleon
Cambridge University

S. Neil Larsen
Consultant

Contents

Antecedents	1
Approach	2
Conservation Mechanisms	3
1. Non-Timber Forest Products	3
2. Timber	5
3. Payments for Environmental Services	6
4. Nature-Based Tourism	7
5. Fish Spillover	8
6. Mangrove Conservation and Restoration	9
7. Protected Areas	10
8. Agroforestry	11
9. Grasslands Management	12
10. Agrobiodiversity Conservation	13
Common Challenges to Ensuring the Poor Benefit	15
Knowledge Gaps	17
Conclusions	19
Literature Cited	20

**‘Nature teaches
more than she preaches.’**

—John Burroughs, (1837-1921) naturalist, essayist

This review was produced with the generous support of the Schooner Foundation, the HRH Foundation, The Nature Conservancy, and the International Institution for Environment and Development and its donors Danida (Denmark), DFID (UK), DGIS (the Netherlands), Irish Aid, Norad (Norway), SDC (Switzerland), and Sida (Sweden).



Summary

Can strategies designed to save nature also help reduce rural poverty? Many conservationists would like you to think so. If their actions work to reduce poverty, then a clear win-win situation is created greatly enhancing the viability of conservation efforts. Those in the development community, however, may be apathetic or even hostile to the entire idea, seeing it as a drain on precious resources. Much of the evidence used by supporters and detractors of the notion that conservation and poverty reduction are linked is anecdotal and too site specific to be broadly compelling.

Here we review 400+ documents that focus on the nexus between biodiversity conservation and poverty reduction and specifically seek conservation interventions—or “mechanisms”—for which there is empirical evidence of impacts on poverty. This is the first-ever comprehensive review of what we know empirically about biodiversity conservation as a mechanism for poverty reduction.

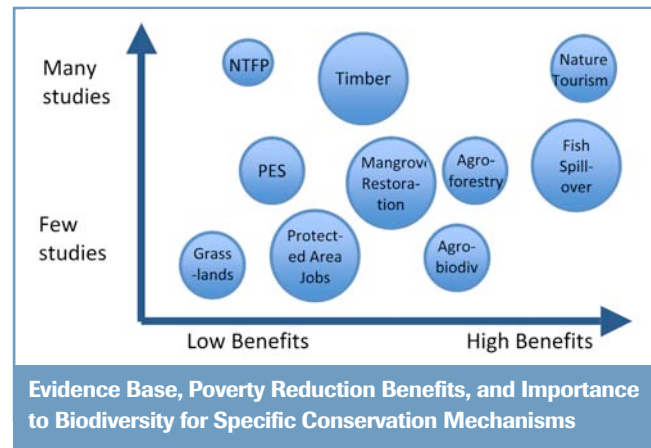
To illuminate the pitfalls and highlight what works, we summarize the conservation mechanisms with empirical evidence of poverty reduction, how they work, who they benefit, which components of biodiversity are important, and what are the uncertainties.

Overall, we found ten conservation mechanisms with empirical evidence of poverty reduction benefits to the rural poor: non-timber forest products (NTFPs), community timber enterprises, payments for environmental services (PES), nature-based tourism, fish spillover, mangrove restoration, protected area jobs, agroforestry, grasslands management, and agrobiodiversity conservation.

Sometimes these mechanisms are a route out of poverty for local people. Sometimes they provide modest poverty reduction benefits or a safety net to keep people from falling deeper into poverty, and sometimes when upended, a few can become poverty traps.

The figure here shows the number of studies with empirical evidence of poverty impacts for a particular conservation mechanism on one axis—i.e., how well studied a mechanism is. The other axis shows the relative strength of the poverty benefits, and the size of the bubbles shows whether the conservation benefits from a mechanism are generally low, moderate or high.

While there are other conservation mechanisms, we found no hard evidence of poverty reduction benefits from any save these ten.





There are also initiatives that might benefit both the rural poor and biodiversity but lack hard evidence of conservation benefits, including trophy hunting, bushmeat harvesting, medicinal plant collection, woodcarving, and bio-prospecting. All of these mechanisms could benefit from evidence-based studies that measure poverty and conservation impacts in a rigorous way.

We had one unexpected finding. In six of the mechanisms, what reduced poverty was not increased biodiversity but increased biomass—the amount harvested rather than the variety. In NTFPs, community timber enterprises, PES, fish spillover, mangrove restoration, and agro-forestry it was greater biomass that resulted in poverty reduction benefits to the poor. To help a poor fisher take the first steps out of poverty, for example, the amount of the fish he catches is far more important than the variety of the fish he catches. In the longer term, biodiversity underpins biomass, but in the near term, increasing particular kinds of biomass is what matters more for the poor in these six widely used mechanisms.

We also looked at over 100 policy evaluation studies to identify the common challenges to ensuring the poor benefit. We found four: households with higher assets and higher levels of social capital are more likely to participate in a conservation initiative;

elites often capture the benefits of an initiative; conservation initiatives may widen income disparities; and there is a need to build in provisions for reducing discrimination against women.

Finally, there are considerable gaps in the existing poverty-conservation knowledge. Overall, the limited number of poverty-conservation studies with hard evidence means the conclusions should be treated with caution.



Antecedents

In 1987, the former prime minister of Norway, [Gro Harlem Brundtland](#), chaired a UN commission that produced a report called *Our Common Future*. The report stated “poverty is a major cause and effect of global environmental problems”. In 1996, [Duraiappah](#), examining new evidence, concluded that the Brundtland Commission’s “causal link is too simplistic, and the nexus is governed by a complex web of factors”. A few years later, [Ekblom and Bojö](#) (1999) untangled some of the complexity. They found that when it came to the environment, potential win-wins that “combine poverty alleviation with environmental management measures” were possible—for example, reducing indoor air pollution from cooking fires, protecting a clean water source, or cleaning up a polluted place where the poor live. After Ekblom and Bojö, experts and governments began to look hard to see if these win-wins also exist in a sub-sector of the environment: biodiversity conservation.

For more than two decades, it has been clear that the rural poor are often highly dependent on the goods and services provided by biological diversity, and that these goods and services are frequently taken for granted, underpriced and overexploited. Twenty years ago, the dominant view was that “the only hope for breaking the destructive patterns of resource use is to reduce rural poverty and improve income levels, nutrition, health care and education” ([Wells and Brandon](#) 1992). Perhaps at some point this will break the destructive usage patterns, but it has not happened in many developing countries. China, Indonesia and Brazil, for example, have greatly reduced rural poverty while continuing to draw down their natural capital. There are two primary reasons why reductions in rural poverty and improvements in incomes, health care and education are unlikely to break the destructive resource-use patterns: natural resource consumption tends to increase with income; and better-off people are often the ones who benefit the most from natural resources use because they have the capital to exploit the resources. Reducing rural poverty by itself is thus unlikely to save imperilled nature. There are good reasons, though, why reducing local poverty in conservation areas matters. Ethically, a conservation initiative should help people and not hurt them. Practically, a conservation initiative needs to provide tangible and lasting benefits to local people or the initiative will not be socially sustainable.

So are there specific interventions that can benefit both the poor in rural areas and biodiversity? As this knowledge review shows, the answer is yes. There are conservation “mechanisms”—meaning a conservation intervention or approach—that can contribute measurably to reducing poverty while conserving biodiversity. Sometimes these mechanisms are a route out of poverty for local people. Sometimes they provide modest poverty reduction benefits or a safety net to keep people from falling deeper into poverty, and sometimes when upended, a few can become poverty traps.

To illuminate the pitfalls and highlight what works, this review summarizes the conservation mechanisms with empirical evidence of poverty reduction, how they work, who they benefit, which components of biodiversity are important, and what are the uncertainties.



Approach

A total of 431 documents were collected from the peer-reviewed publications, books, grey literature, and Poverty Conservation Learning Group members. The list of documents can be downloaded at <http://conserveonline.org/library/conservation-and-poverty-reduction-literature-0/view.html>.

Within this body of knowledge, the review highlights the documents that present multi-site empirical evidence of a conservation mechanism's poverty benefits or have been widely cited by others as per Google Scholar. The knowledge review includes literature up to February 2010 and goes as far back as 1985. To cast a wide net, any definition of poverty was sufficient for inclusion.

This review does not include all conservation mechanisms believed to benefit poverty. We looked at 16 mechanisms but included here only those mechanisms for which there is publicly available empirical evidence that the conservation mechanism contributed to poverty reduction.

Several constraints became increasingly evident as the knowledge review proceeded. The first was the limited number of studies that generated hard evidence of poverty impacts. The second was the generalizations made in this knowledge review miss the individual variations in costs and benefits from a conservation initiative. Finally, there is the lack of uniformity of poverty indicators that are used to measure impacts, so empirical evidence that a mechanism was a route out of poverty depends greatly on how poverty impacts were measured. These constraints mean that the conclusions reached in this review should be treated with caution.



Conservation Mechanisms



1. Non-Timber Forest Products (NTFPs)

What is the NTFP mechanism? The proceedings of a 2007 international conference on “The Role of NTFPs in Poverty Alleviation and Biodiversity Conservation” gave a summation of the potential of non-timber forest products: “...NTFPs can play a critical role in providing both food and income for the poorest households, notably by creating income and employment opportunities for women. However,...there are also concerns about the potential impact of NTFPs collection on biodiversity” (UCN 2008). And these are the NTFP optimists.

NTFP projects have been criticized as at best, a safety net (Wunder 2001), and at worst, a poverty trap (Dove 1993). Much of the difference comes in how NTFPs are defined. Sceptics tend towards a broad definition: “all products other than timber that come from forests” (Belcher 2003). The proponents use a definition that has evolved to recognize that “NTFPs are shifting from forest to agricultural fields to become ‘non-timber farm products’ that are cultivable, desirable, profitable and innovative” (UCN 2008). NTFP are viewed by proponents

as a tool to help the poorest of the poor in rural areas transition to new and more beneficial livelihoods. The benefits to biodiversity from NTFPs, in the proponents’ view, come from reducing pressure on natural forest resources. The sceptics point out there is no empirical evidence of NTFP commercialization benefiting biodiversity.

How does the mechanism work? Classically, this mechanism works via the sustainable gathering of NTFPs from natural forests by poor collectors who then sell the products to buyers thereby earning income, buying assets, creating savings, and reducing poverty. These financial benefits give local people an incentive to protect the natural forest which benefits biodiversity. More recently, this view has been amended such that NTFPs are cultivated outside forests and sold for poverty reducing income, while keeping collectors out of the forest reduces pressure on biodiversity.

Which groups of poor benefit from NTFPs? There is compelling evidence that the poorest of the poor are those who use NTFPs the most (Neumann & Hirsch 2000) and that NTFPs are often the employment of last resort (Angelsen & Wunder 2003). There is also compelling evidence that NTFPs can prevent a decline deeper into poverty but rarely sustainability reduce local poverty

Biodiversity versus Biomass

Conservation efforts almost always focus on preserving biological diversity. Yet for generating direct benefits to poor people, is it biological diversity or biological mass that matters in the near term? Balmford et al. 2008 shows that the direct benefits to people depend more on the abundance of particular species than the number of different species. This suggests that direct benefits to poor people are more about biomass than biodiversity. Of course, in the longer term, biodiversity is the foundation for biomass production.

(Wunder 2001). Dove (1993) notes that there is a history of external powers taking control of NTFPs once it is clear that money can be made. Dove cites the Indonesian examples of latex, gems, minerals and rattan, where historically many poor have fallen into the poverty trap of collecting the NTFPs for powerful bosses who provide them with income and credit sufficient to keep them indentured. The evidence for NTFPs being a poverty trap is old and based on maximum exploitation models. No evidence was found of an NTFP conservation project that made poverty worse.

For NTFPs to reduce poverty, there needs to be local commercialization of one or more NTFP. When this happens, women are often beneficiaries. Marshall et al. (2006) studied 16 NTFP value chains in Mexico and Bolivia and found that “NTFP activities are one of the few cash-generating opportunities for women in marginalized rural communities”. Moreover, among female-headed households, forest resources often contribute significantly more total household income than in male-headed households (Shackleton & Shackleton 2004). Available evidence suggest that NTFP commercialization tends to benefit the poorer people in a community, especially women, unless there is significant money to be made, in which case the powerful and better-off people take control.

Which biodiversity components are most important? For NTFPs to benefit poor people, it is largely about increasing the quantity of an NTFP or the value added. Biological diversity itself has little to do with the direct benefits except by underpinning the habitat that produces the NTFP. The NTFPs that appear to generate significant benefits for the poor include honey, bamboo, fuelwood and mushrooms.

What are the uncertainties? A study of 61 cases of NTFP production and trade in Asia, Africa and Latin America found that NTFPs have not reduced poverty in most cases (Belcher et al. 2005). “The same factors that tend to make NTFPs important in the livelihoods of the poor, also limit the scope of NTFPs to lift people out of poverty” (Sunderlin et al. 2005). Four factors are critical. First, NTFPs are often collected in open-access areas, and thus overexploitation is common. Second, access to NTFP markets tends to be poor for many forest dwellers. Third, fluctuations in the quantity and quality of NTFPs cause an unpredictable income stream, and fourth, middlemen often take the bulk of the added value (Pandey et al. 2007).

Benefits to biodiversity are also uncertain. No quantitative evidence of an NTFP project helping conserve biodiversity was found during the knowledge review. Even anecdotal evidence of biodiversity benefits from NTFP projects is limited (IUCN 2008).

Ros-Toten and Wiersum’s analysis of NTFP projects (2003) gives some specific recommendations for ensuring NTFPs benefit the poor:

- Producers have secure tenure rights.
- Producers combine NTFP production with other rewarding economic activities.
- Products can be harvested efficiently from areas where abundance of NTFP-producing species has increased as a result of tending, enrichment planting, and domestication.
- Products have established markets or potential to reach promising niche markets.
- Producers have the capacity to add value to the products.
- Producers are organized and maintain effective alliances with outsiders who may help identify new markets and potential donors.

Medicinal Plants, Bushmeat and Woodcarving

In various places and at various times, medicinal plants, bushmeat and wood carving have all been shown to produce beneficial impacts on poverty, but could they be a conservation mechanism? For medicinal plants, there is lots of evidence that they are important to the poor but no evidence that better managing their collection in the wild can make the harvests sustainable. Conceivably, commercialization of medicinal plant production could take pressure off natural supplies, but empirical evidence of this happening was not found. For bushmeat, there is evidence for it being a safety net for the poor. The sustainability of most bushmeat sources is questionable, however. For woodcarving, there is empirical evidence of it being a route out of poverty, but the sustainable supply of the woods favoured by carvers is doubtful without the creation of new sources.

Summary conclusion: Overall, non-timber forest products are generally a safety net and only rarely a route out of poverty. Whether or not a project to promote NTFPs can benefit biodiversity is uncertain. Here biomass rather than biodiversity is more significant in determining the poverty reduction potential.



2. Timber

What is the timber mechanism? In 2004, approximately 25 percent of forests in developing countries were owned by communities, and with the current trend, this is likely to double by 2020 (Scherr, White and Kaimowitz 2004). In addition to more secure tenure of forest lands, forest communities are benefiting in some places from decentralization coupled with democratization and anticorruption campaigns, growing demand for forest products, market deregulation, retreat of forest concessionaires, payments for forest environmental services, and new technologies that make small-scale harvesting and processing easier (Sunderlin et al. 2007). This has created a renewed interest in community forestry. (Community forestry initiatives can include NTFPs—covered above—and mangroves—covered below.) It is within community forestry that the evidence of timber benefiting the rural poor is found.

How does the mechanism work? Small-scale wood processing is the most common community forestry mechanism and where most of the timber win-wins are found. These are frequently contractual arrangements between communities and companies to supply fibre, pulp or construction timber. The income generated helps reduce poverty. By harvesting the timber at sustainable levels, communities also help conserve biodiversity.

Which groups of poor benefit from timber? Historically, timber harvesting has rarely benefited the rural poor for several reasons. First, local and national elites capture much of the wealth for themselves. Second, timber “represents a long-term, high-risk investment whereas low-income people generally need short-term income and want to avoid risk” (Sunderlin et al. 2005). Third, there is little ‘trickle-down’ benefit from timber harvesting. Fourth, “tree growing for timber requires secure land tenure and the poor are often landless or only have informal control over the land they use” (Sunderlin et al. 2005). Fifth, dependence on forestry resources can be a poverty trap when access to markets is very limited: Chomitz, et al. (2007) shows how forest poverty correlates strongly to the number of hours to the nearest major market. Finally, forests and trees are rarely the economic mainstay of communities, and forestry needs to be part of a larger economic development framework (Mahanty et al. 2006).

Even with the challenges, however, there is considerable evidence that community-forestry timber enterprises can reduce poverty and conserve biodiversity. A study of 14 community-forestry timber enterprises in developing countries found that they can be quite profitable (Molnar et al. 2007), and in Mexico, community-forestry enterprises have been shown in a rigorous analysis to have reduced poverty (Bray & Tardanico 2005). Sunderlin et al. (2007) write that “community forestry is potentially a key vehicle for lifting rural people out of poverty in forested areas, particularly if it is implemented on the basis of tenure transfer and enhanced marketing opportunities. . .” For biodiversity, community forestry can also be a benefit. There is empirical evidence from Nepal (Gautam et al. 2002, Oli & Kanel 2006), Mexico (Bray et al. 2003) and Vietnam (Nguyen et al. 2009) that community forestry has led to increases in forest cover.

It is not only timber that can benefit poor communities but the forest itself. A meta-analysis of 51 case studies from 17 countries found that forest environmental income represents on average 22 percent of the total household income (Vedeld et al. 2004). Fuelwood, fodder and wild foods are often an integral part of the livelihood strategies of the poor, and simply maintaining an intact forest has benefits to the rural poor that are often overlooked.

Which biodiversity components are most important? As with NTFPs, benefits to the poor from timber come from the abundance of particular tree species (biomass) rather than the number of tree species (biodiversity), and more specifically, the benefits frequently come from the faster-growing commercially valuable tree species.

What are the uncertainties? While the poor can benefit from community-managed forestry, this has not always been the case. Equity issues within communities have hampered the benefit sharing of community-based resource management projects in several countries. Blaikie (2006) makes the point that community management of resources is viewed by many as “progressive and transformative” but it can just as easily be “laggard and traditional”.

Failure rates can be high. A study of small and medium-sized timber enterprises found that on average, 75 percent of enterprises fail in the first three years (Mayers 2006).

Summary conclusion: Overall, timber harvesting in community forests can be a route out of poverty and conserve biodiversity. The challenges are forest tenure, market access, and ensuring the poor benefit. Therefore, removing market and regulatory barriers and ensuring solid benefit-sharing arrangements are crucial to success. Biomass (quantity and size of trees) rather than biodiversity (species diversity) is more significant in determining the poverty reduction potential.



3. Payments for Environmental Services (PES)

What is the PES mechanism? The most widely used definition of a payment for environmental/ecosystem/ecological services is [Wunder's](#) (2005): Payments for environmental services (PES) are voluntary transactions where a well-defined environmental service is bought by an environmental service buyer from an environmental service provider if and only if the environmental service provider secures environmental service provision. PES is one mechanism used many different ways. PES can include bio-prospecting, eco-labelling, conservation easements, conservation concessions, watershed protection, and carbon sequestration or storage ([Richards & Jenkins](#) 2007).

How does the mechanism work?

To date, the evidence of PES benefiting the poor is in payments

for watershed services and in carbon sequestration and storage. In payments for watershed services, downstream water users pay to protect their upstream water supply. It is often cheaper for downstream cities to protect their upstream water sources than increase water treatment. New York City is a classic example ([Pires](#) 2004). In carbon sequestration, CO₂ emitters pay landholders to reforest an area thereby offsetting their CO₂ emissions. In carbon storage, CO₂ emitters pay landholders to not deforest or degrade an area thereby keeping the forest intact. Here the benefits to the poor are linked not to biomass or biodiversity but to payments.

Which groups of poor benefit from PES? This mechanism is almost always linked to how land is used, and because the poorest of the poor rarely own or control land, they rarely benefit from a PES. In fact, if a conservation practice encouraged under a PES is less labour intensive, the poor and landless may be harmed ([Pagiola et al.](#) 2005, [Angelsen & Wunder](#) 2003). It is the moderately poor smallholders and the better-off landowners who generally benefit from a PES. The inclusion of the poor is “more by accident than design” ([Porrás](#) 2008), and most PES initiatives do not explicitly aim at reducing poverty ([Pagiola et al.](#) 2005). Fortunately, “most PES gains are not large enough to really attract the interest of the powerful” ([Wunder](#) 2008).

Even so, PES has been shown to reduce poverty. A payment for watershed services project in Ecuador ([Echavarría et al.](#) 2004) and a forestry PES in the Osa Peninsula of Costa Rica ([Muñoz](#) 2004) both provided greater than 30 percent of household income for poor PES sellers and helped reduce poverty. These examples may be outliers, however. [Porrás et al.](#) (2008) reviewed 50 watershed PES programmes and found that “the cash payments appear to be relatively insignificant, and there is an opinion that they function more like supports or a bonus than a real incentive for land-use change.” [Wunder](#) (2008), [Porrás et al.](#) (2008) and [Bond & Mayers](#) (2010) all cite non-income gains as significant PES benefits. These include strengthening property rights, capacity building, and improvements in social organization. [Bond & Mayers](#) (2010) caution, however, that “these effects are rarely specific to payments for watershed services and could potentially be generated through alternative actions”.

Which biodiversity components are most important? The majority of PES initiatives are not dependent on biodiversity per se. Once again, biomass rather than biodiversity seems to be important in delivering the ecosystem services for which people are prepared to pay (such as watershed services or carbon sequestration in trees). There is evidence, however, that for some PES initiatives, biodiversity is important. Higher levels of plant biodiversity, for example, result in faster and higher concentrations of soil carbon storage.

REDD, Poverty and Conservation

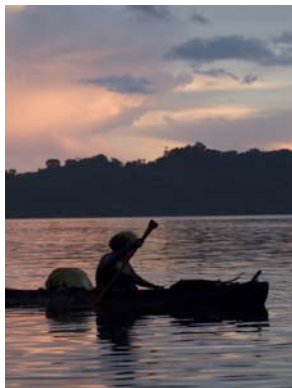
Reduced Emissions from Deforestation and Degradation (REDD) is viewed as one of the most cost-effective means of tackling climate change ([Stern](#) 2007, [Strassburg et al.](#) 2009). It is also expected that REDD will help conserve biodiversity, deliver ancillary environmental benefits, and reduce poverty ([Brown et al.](#) 2008). REDD has the potential to deliver substantial funding to rural, impoverished communities, though it could lead to elite capture of benefits and exacerbate conflict over land tenure (among other potential pitfalls) ([Griffiths](#) 2007, [Peskett et al.](#) 2008). With pilot REDD projects just getting underway in many parts of the world, there is not yet substantial evidence that REDD can deliver poverty-conservation benefits ([Peskett et al.](#) 2008). An older avoided deforestation project in Bolivia has had mixed success in delivering livelihood benefits to local communities ([May et al.](#) 2004). Yet an analysis of current pilot projects shows that many are likely to deliver socioeconomic benefits ([Wertz-Kanounnikoff](#) 2009). Some see the ability of REDD to be a mechanism for reducing poverty as questionable ([Campbell](#) 2009), with any benefits that REDD could provide to poverty alleviation ultimately contingent on both how REDD is structured by the international community ([Peskett et al.](#) 2008, [Boersema et al.](#) 2009) and how the benefits are shared at the national and sub-national levels.

What are the uncertainties? PES is a relatively new mechanism, and the knowledge is rooted as much in the theoretical as in the empirical. There are several factors believed to limit where a PES can work. First, PES sellers need to have the right to exclude people from their land and the ability to do so. This is often not the case for the poor who lack recognized land tenure. Second, there are high transaction costs if there are a large number of landholders (though there are examples of how bundling small PES sellers can lower transaction costs). Third, “PES makes the most sense at the margin of profitability, when small payments to landowners can tip the balance in favour of a desired land use” (Wunder 2005). Fourth, only those who pose a credible threat to an environmental service should be paid. “The ideal environmental service seller is, if not outright environmentally nasty, than at least potentially about to become so” (Wunder 2005). Engel et al. (2008) sum it up: “The scope for application of PES, then, is to a narrow set of problems”.

So long as a PES is voluntary, it is never a poverty trap. But poverty can be made worse off in cases where there is de facto forced participation in a PES, and the payments do not offset the losses from the land-use changes (Wunder 2005).

There are also uncertainties in some cases about whether or not PES initiatives are delivering the environmental services promised. Porras et al. (2008) notes, for example, that “evidence of the delivery of watershed services has proved elusive”, and “research on the Mexican and Costa Rican national programmes suggests that their additionality has been limited”. This may be a systematic problem related to how biodiversity conservation is measured and reported. Often, however, the assumption that a strategy is doing good for nature is just that, an assumption.

Summary conclusion: Overall, PES is rarely a route out of poverty but does have limited poverty reduction benefits. When a PES is not truly voluntary, it can become a poverty trap, though this has rarely been documented. Biodiversity is not a prerequisite for a successful PES initiative, but it can enhance the delivery of some ecosystem services and hence make the initiative more attractive.



4. Nature-Based Tourism

What is the nature-based tourism mechanism? The nature-based tourism mechanism includes community-based operations on one end, and at the other end, all-inclusive international eco-lodges and safari operations. Tourism is often a lucrative enterprise for wildlife-rich areas.

How does the mechanism work? Nature-based tourism offers a number of opportunities for reducing poverty. These include jobs in the formal tourism sector such as accommodation and guiding, and in new markets for local services and products including sales of crafts, cultural services, food and drinks. Tourism also often brings infrastructure development, including roads, telecommunications and healthcare facilities that, while provided for the benefit of tourists, can also benefit poor people.

Which groups of poor benefit from nature-based tourism? A meta-review of 27 tourism case studies in Asia found income gains for all economic levels but with those already better off gaining most (Shah 2000). In Zambia, a World Bank study (2007) found that nature-based tourism had reduced poverty, but those with most assets (the less poor) benefit more than the very poor by up to 50 percent. The indirect benefits may be important to the poor, however. There is the multiplier effect whereby tourism “creates opportunities and downstream effects for... more people besides the wage earners, such as casual labourers, crafters and small businesses” (Ashley & Roe 2002). A study of global tourism (Markandya et al. 2003) found that the typical tourism multiplier is between 2 and 3, meaning each dollar spent by a tourist generates 2 to 3 more in the national economy. Many of these economic benefits flow to women. Hemmati (1999) reviewed a decade of global tourism data and found that tourism is a particularly important sector for women and that women comprise a higher percentage in the tourism sector than in the general workforce (46 versus 34 percent). This is not surprising given the service nature of the industry. The industry also has need for a high proportion of low-skill domestic type work, something often accessible to women (Ashley et al. 2000). There are also indirect benefits such as the roads, communication infrastructure, clinics and schools, often in remote areas, created to support a tourism venture (Shackleton 2007). Where tourism operators commit to hire and train local people, the poverty reduction benefits are much greater. In Indonesia’s Bunaken National Marine Park, for example, a study found that the commitment by local tourism operators to hire 80 percent of staff from local communities resulted in approximately 1,000 new jobs in tourism over five years (Davis 2005).

Which biodiversity components are most important? Nature-based tourism depends on both the existence (and likelihood of viewing) certain key species and on the overall attractiveness of the landscape. Wunder (1999) notes: “the

tourism appeal of a natural site (and hence its income-generating potential) tends to be closely related to its conservation level". Thus, biodiversity is important in terms of maintaining an intact ecosystem. Terrestrially, evidence suggests that it is large, charismatic animals, such as mountain gorillas, tigers and pandas, which attract tourists. In the marine realm, the tourism draws include corals, dolphins, stingrays, whales, turtles and reef fish.

What are the uncertainties? There are several uncertainties about nature-based tourism as a poverty-conservation mechanism. First, tourism can be a fickle business. A terrorist event (think the bombings in Kenya, Tanzania and Bali in recent years), an economic downturn, spillover from civil war, or a SARS-like outbreak can cause a sudden drop in visitors. Decades of conservation success can be wiped out as tourism-dependent local people are forced to use tourist-attracting natural resources like wildlife and forests just to survive. Second, when skilled staff and luxury items are imported for a tourism operation and profits exported, there are fewer poverty-reducing benefits from tourism. This is called 'leakage'. Concerns about leakage, however, may be overrated as a [World Bank](#) (2007) Zambia tourism study notes: "Although overseas services constitute over 70 percent of the total [tourist] package price, they are not a leakage from the Zambian economy. Rather, they are payments for services in the source markets, including representation, marketing, insurance and flights; services that are used to sell the Zambian product, without which there would be no benefit at all to Zambia". Third, tourism's ecological impact can exceed the limits of acceptable change in a location and jeopardize both biodiversity and tourism, though [Wunder](#) (2000) notes that tourism's negative environmental impacts are often more aesthetic than systemic.

Summary conclusion: Overall, nature-based tourism can be a route out of poverty provided there are natural attractions people will pay to see, reasonably easy access, and systems to ensure local people benefit directly. Yet unlike most of the other mechanisms in this review, this mechanism is less about restoring degraded ecosystems in order to generate greater benefits to poor people and more about keeping ecosystems intact to generate the benefits. Biodiversity matters for this mechanism. It is, however, a mechanism whose reliance on visitors makes it vulnerable to global events unrelated to local conditions.



5. Fish Spillover

What is the fish spillover mechanism? Protecting a key area of marine habitat from fishing can allow fish stocks to replenish, and as stocks increase, some fish will spill over into adjacent areas where they can be caught by fishers.

How does the mechanism work? Creating a no-fishing area gives space for fish to grow bigger, and bigger fish generally have exponentially more offspring than smaller fish ([PISCO](#) 2007). After three to five years of protection, the fish begin to spill over into the area outside what is commonly called the 'no-take zone' ([Gell & Roberts](#) 2003). The greater fish catches generate more income for fishers and hence help reduce poverty, while the no-take zone provides protected habitat for marine biodiversity.

There is evidence that the spillover mechanism works better where there is active participation of local communities in the resource management ([McClanahan et al.](#) 2006). There is also evidence that size matters. If a no-take zone is too large, spillover will not offset the losses to fishers from closing sections of the fishing grounds ([PISCO](#) 2007). "From the perspective of fisheries, networks consisting of many smaller marine protected areas may be preferable to a few very large marine protected areas" ([UCN](#) 2008a).

Which groups of poor benefit from fish spillover? The poorest of the poor can benefit from spillover because the barriers to collecting marine resources are often low. In places where many people are poor, and fishing is in crisis, the medium-term poverty reduction benefits can be significant. [WRI](#) (2005) and [Leisher et al.](#) (2007) found that spillover from two community-managed marine areas in Fiji roughly doubled local incomes within five years of establishing the no-take zone compared to control sites, and women were the primary beneficiaries. Successful sites are also usually within the community's line of sight ([UCN](#) 2008a).

The indirect benefits to the poor are also important. Organizing a community to manage a no-take zone often strengthens the social fabric of the community, giving them a ready decision-making body and a more unified voice to solve other community issues ([Leisher et al.](#) 2007). The stronger social cohesion also improves local security and empowers local decision-making, two key elements of poverty reduction ([World Bank](#) 2001).

Which components of biodiversity are important? It is the near-shore fish biomass that is critical, and this biomass in turn is affected by the levels of biodiversity. There is empirical evidence that greater biological diversity creates greater fish biomass in marine ecosystems (Worm et al. 2006).

What are the uncertainties? There is a growing body of empirical evidence of the fisheries benefits of no-take zones. Gell & Roberts (2003) cite 14 marine protected areas where biomass was greater inside the no-take zone than outside and where spillover of fish or larva has been empirically documented. The uncertainty here is about spillover's potential contribution to poverty reduction. Abesamis et al. (2006), cautions that "advocates of reserves are sometimes overly optimistic about the potential benefits of spillover". They found that spillover in a site studied for more than 20 years (Apo Island, Philippines) contributed less than 10 percent of the total fish catch. Harmelin-Vivien et al. (2008) studied six Mediterranean no-take areas and found "fish spillover beneficial to local fisheries occurred mostly at a small spatial scale (100s of metres)". The differences between advocates and sceptics of spillover's poverty reduction benefits come from, inter alia, differences between no-take area size and connectivity. Nakeke (2008) shows that if the no-take zone is too small, fish learn that when they leave the no-take zone, they are caught, so they stay. Tupper (2007) notes, "marine protected areas that are physically connected by contiguous reef structures will likely provide more spillover to adjacent fished sites than those that are separated by habitat barriers". Rules of thumb for marine protected area network design currently recommend that no-take zones should be a minimum size of 10 km² and that they should be separated by a distance of less than 15 km² (Friedlander et al. 2003, Fernandes et al. 2005, Mora et al. 2006, reviewed in McLeod et al. 2008).

Pollnac and Crawford's 2001 study of community-based marine protected areas in the Philippines collected data from 45 sites with no-take zones. This study found that the most likely predictors of poverty-conservation benefits from a community-based no-take zone were: "if the community in our sample 1) has a relatively small population, 2) a perceived crisis in terms of reduced fish populations before the marine protected area project, 3) has successful alternative income projects, 4) manifests a relatively high level of community participation in decision making (high on the democracy scale), and 5) has continuing advice from the implementing organization".

Summary conclusion: Overall, fish spillover has been a route out of poverty, but it needs specific conditions to work (noted above). This mechanism depends more on biomass (how much fish) than biodiversity per se (the specific kinds of fish).



6. Mangrove Conservation and Restoration

What is the mangrove conservation and restoration mechanism? There is ample literature on the benefits mangroves provide to people and nature (see Walters et al. 2008 for a review). Mangroves have been shown to increase the biomass of commercially important species on nearby coral reefs in the Caribbean (Mumby et al. 2004). Fisheries landings in the Gulf of California are positively correlated to areas of nearby mangrove forest (Aburto-Oropeza et al. 2009). Mangroves also are a source of valuable wood products and serve as storm barriers (Sathirathai & Barbier 2001) that can save lives (Das & Vincent 2009).

How does the mechanism work? This mechanism works by restoring or conserving mangroves, which improves the productivity of the mangrove and adjacent ecosystems, thereby benefiting local livelihoods. In three mangrove areas in India, the most intact mangrove area yielded approximately four times as much income from shellfish and finfish per day as the

less robust mangrove areas (Kathiresan & Rajendran 2002). The mechanism also works by mitigating the impact of storms on the coastal poor.

Recent work suggests that the length of mangrove forest fringe is more important than total mangrove area for fisheries benefits (Aburto-Oropeza et al. 2009).

Which groups of poor benefit from mangroves? Mangroves can benefit the poor through associated fisheries that provide income and food (Rönnbäck 1999, Magalhaes et al. 2007), and there is evidence that mangroves can be a route out of poverty. A community-based mangrove project in Thailand, for example, increased income from crab harvesting for poor, landless families while boosting the abundance of other marine products (Soontornwong 2006). More often, however, mangroves provide only modest poverty reduction benefits as they do in Bangladesh where small-scale and mostly poor fishers in the Sundarban mangroves produce 95 percent of the total marine catch in the country (Islam & Haque 2004).

Women may also benefit from mangrove restoration if they are involved in collecting or processing mangrove products. Processing crabs harvested from mangroves in Brazil, for example, provides an important supplemental source of income for women (Magalhaes et al. 2007).

Which components of biodiversity are important? Replanted mangroves often contain trees with high value for people such as various species of Rhizophora. Though these stands are less diverse, they provide much of the same structural functionality as native mangroves and have been shown to hold equivalent populations of commercial crab species (Walton et al. 2007). One review concluded that fish and crustacean communities can have a “remarkable recovery of biodiversity in restored mangroves” (Bosire et al. 2008). This evidence suggests that the benefits to the poor from mangroves are more dependent on the biomass than the biological diversity of the mangroves.

What are the uncertainties? There are several scientific uncertainties. It is difficult to show a direct relationship between fish catches and specific mangrove habitats (Manson et al. 2005). The value of mangroves for coastal storm protection is well established (Barbier 2007), but there is an ongoing debate as to whether mangroves serve a similar role for larger wave events, such as the 2004 Indian Ocean tsunami (Alongi 2008, Walters et al. 2008).

Summary conclusion: Overall, the benefits vary widely, but restoration of mangroves can provide at least moderate benefits to the poor by generating natural resources and providing protection from storms. Here it is biomass rather than biodiversity that is most important to the poor.



7. Protected Areas

What is the protected area mechanism? This conservation mechanism is focused on the poverty reduction benefits that flow directly from protected areas themselves. Thus, it does not include mechanisms like NTFPs, tourism and PES which may depend on a protected area but are not exclusive to protected areas. There are multiple benefits provided by protected areas, but only one direct benefit from protected areas can show empirical evidence of having reduced poverty: employment generation.

How does the mechanism work? When a protected area is established, the management often hires local people to help operate the protected area. A study by WWF (2004) surveyed more than 200 protected areas across 37 countries and found the average protected area has 40 permanent staff. In South Africa, for example, the 21 national parks employed 3,776 people in 2006 and had a payroll of US\$ 375 million equivalent (Urban-Econ 2008). The average wage for a South African national park employee in 2006 was four times greater than the minimum wage in the forestry sector of South Africa. Local jobs provided by a protected area can reduce poverty, and the protected areas can help conserve biodiversity. While the number of protected area jobs and the pay may be modest, the multiplier effect of the new jobs in the local rural economy can be significant (Versa 2004, Fortin & Gagnon 1999).

Which groups of poor benefit from protected areas? Those hired by protected areas tend to be the moderately poor to the better off. The poorest of the poor rarely have the basic skills or the connections needed to secure protected area jobs.

Which components of biodiversity are important? It is the biodiversity itself that is important here because this is most protected areas' reason for being.

What are the uncertainties? There is a lot of anecdotal evidence of the employment benefits from protected areas but very little hard evidence showing that working for a protected area can be a route out of poverty. Moreover, many protected area jobs do not go to local people, and positions that require a knowledge of the local area, such as guides and guards, often pay too little to lift a local person out of poverty. There is also the uncertainty about the net benefits to local people from a protected area. Establishing a new protected area may generate new local jobs, but it can also negatively impact the livelihoods of other local people by restricting access to natural resources inside the protected area or involuntarily resettling people living inside the protected area (Brockington 2006).

Summary conclusion: Many poverty reducing benefits ascribed to protected areas can also be standalone activities such as tourism, PES and NTFP collection and hence are covered separately in this review. Of the poverty reduction benefits that flow directly from protected areas themselves, only employment by the protected area management authority has some empirical evidence of reducing poverty, scanty though it is. Here it is biodiversity that matters more than biomass for the poverty reduction benefits.



8. Agroforestry

What is the agroforestry mechanism? Agroforestry is the practice of integrating domesticated trees into agricultural landscapes. The poverty reduction benefits include: improved soil fertility from “fertilizer trees” that can increase the productivity of existing crops (Garrity 2004, Sileshi et al. 2009, Jose 2009); diversification of food production for both commercial and subsistence needs (Schreckenberg et al. 2006); and non-timber tree products such as oils and medicines (Leakey et al. 2005).

In addition to providing livelihood enhancement, agroforestry has benefits for biodiversity by providing structurally similar habitat for forest species, serving as biological corridors, and reducing human pressure on natural forests (Schroth 2004, Perfecto et al. 2007, Bhagwat 2008). While agroforestry landscapes do not contain the same level of biodiversity as natural forests, they generally play host to significantly more species compared with monoculture

agriculture (Harvey et al. 2006).

How does the mechanism work? Trees are incorporated into the agricultural landscape in order to obtain economic and ecological benefits. Agroforestry can diversify and improve income through the harvest of tree products or by providing enhanced soil and hydrological functions for existing crops. Agroforestry also encompasses the culturing of specific trees, such as cacao or coffee, in natural forest settings.

Which groups of poor benefit from agroforestry? Agroforestry can provide benefits to many different economic levels, though it is often targeted at the poor as a means to reduce poverty. Evidence from West Africa suggests that indigenous domesticated fruit trees can improve the livelihoods of poor households, especially women (Leakey et al. 2005, Schreckenberg et al. 2006). In one study, women perceived greater livelihood benefits from agroforestry tree products than men (Akpabio 2009). In India, agroforestry was found to augment income from rice monocultures by 2–3 times compared with non-agroforestry households (Pandey 2007). The income was also distributed throughout the year and thus helped even out household income fluctuations. As the cultivation of trees requires a multi-year investment, those without secure property rights are less likely to participate in agroforestry initiatives (Garrity 2004).

Which components of biodiversity are important? In many areas where agroforestry is promoted, native trees are sought out and bred to enhance farm productivity. The World Agroforestry Centre lists 670 species in its “agroforestree database”. Among the species with proven poverty reduction benefits are trees that produce fruit, fuel, fodder or fertilizer, including *Garcinia kola*, *Dacryodes edulis*, *Tephrosia candida*, *T. vogelli*, and *Sesbania sesban*.

What are the uncertainties? Agroforestry in theory has much to contribute to both poverty reduction and biodiversity conservation goals (Garrity 2004). Experiences in three sub-Saharan African countries, however, illustrate how uncertain and conflicting legal environments governing the use of trees and tree products (even on private land) can undermine potential benefits from agroforestry (Ashley et al. 2006). Furthermore, without access to markets, households are not able to capture many of the benefits that agroforestry tree products could provide (Leakey et al. 2005). Also by some estimates, up to 10 percent of tree species used in agroforestry systems are non-native, potentially negatively affecting local biodiversity (McNeely 2004).

Trade-offs exist when deciding to maximize either the biodiversity or economic benefits in agroforestry systems—typically when deciding how much natural tree cover to maintain. Many agroforestry systems maintain a significant portion of biodiversity found in natural forests, though specialized species (often of high conservation value) are frequently less able to adapt to agricultural landscapes (Steffan-Dewenter et al. 2007).

Summary conclusion: Overall, agroforestry can be as a route out of poverty, and for biodiversity, some trees are generally better than none. For near-term benefits to the poor, biomass matters more than biodiversity.



9. Grasslands Management

What is the grasslands management mechanism? There is evidence that some grassland types have greater grass productivity with grazing than without grazing (Guo 2007). In fact, many types of grassland are ecologically dependent on grazing to maintain their biodiversity (Fratkin & Mearns 2003). Livestock is also the primary form of wealth for a number of often poor, nomadic communities in grasslands (Eriksen & Watson 2009). These three facts underpin grasslands management as a poverty-conservation mechanism.

Evidence for this mechanism is found primarily in dryland grass habitats. Dryland pastoralism is “a successful adaptation to the high uncertainty of dryland environments” and is one of the “few production systems that is genuinely compatible with ‘formal’ nature conservation” (WISP 2008). The ability of livestock to be mobile is an essential element in effective semi-arid grasslands management.

How does the mechanism work? A study in the Mongolian Gobi grasslands gives an example of how the mechanism works (Schmidt 2006). The study compared five years of data from pastoralist communities who practiced rotational grazing with control communities that did not. The rotational grazing communities were significantly better off, and “the number of poor households was reduced to half between 2002 to 2005” (Schmidt 2006). The communities organized themselves to increase mobility and thus access better grazing lands. There were also benefits to the communities from becoming better organized, such as enhanced education and alternative income activities.

Which groups of poor benefit from grasslands management? Despite grasslands being used by poor people on nearly all continents, hard data for better grasslands management lifting people out of poverty is limited to the Mongolia example. Campbell et al. (2002) found that there are many restrictions on the expansion of natural capital in dryland areas of Zimbabwe, but the better off people are generally the ones who have the assets to capitalize on the rapidly changing opportunities in dryland habitats. There is some scope, however, for animal husbandry in grasslands benefiting the poorest of the poor. This group often does not own livestock, but if they can acquire animals, it can be a pathway out of poverty (Peden et al. 2003).

Which components of biodiversity are important? There is evidence that in many grasslands, the grazers, the grass productivity, and the biodiversity are interdependent. Increased productivity of the grasslands (biomass) depends on the biological diversity of the grasses which in turn is dependent on the grazing of animals.

What are the uncertainties? There are considerable challenges to better grasslands management and pastoralist livelihoods in general. Expanding agriculture, private ownership of land and water resources, fencing of rangelands, commercialisation of livestock production, global competition in the livestock market, expanding protected areas, and climate change have all been shown to push poor people out of pastoral livelihoods (Eriksen & Watson 2009). For the Maasai in Kenya and Tanzania, Homewood et al. (2009) presents evidence that the current land-use policies in the two countries are unlikely to benefit biodiversity conservation or poor pastoralists who depend on the grasslands. “Above all, there is the political structure that favours agricultural communities over pastoral” (Homewood et al. 2009). Finally, wild animals are often actively harassed by pastoralists keen to protect their stock, such as lions, wolves or landscape modifiers like elephants. The loss of such keystone animals can have a ripple impact on the integrity of the ecosystem.

Summary conclusion: Overall, grasslands management has a theoretical potential to help reduce poverty at least marginally, but there have been almost no studies demonstrating this in practice. Both biomass and biodiversity matter here because they are interdependent in grassland ecosystems.



10. Agrobiodiversity Conservation

What is the agrobiodiversity mechanism? Agrobiodiversity encompasses all the variety and variability of animals, plants and micro-organisms that are used directly or indirectly for food and agriculture (FAO 1999). Initiatives for in-situ agrobiodiversity conservation generally help poor farmers diversify the types of crops they raise either within a particular crop (such as different varieties of plantains) or among crops (such as adding native varieties of beans to maize fields). There is a strong gender component to agrobiodiversity conservation because it is often women who grow native species as companion crops to the household's cash crops.

How does the mechanism work? There is some evidence that promoting agrobiodiversity can benefit poor farmers through better nutrition and more stable food production (Frison et al. 2004). Conserving traditional landraces can also help poor farmers address local challenges like droughts, floods and pests and thus help with food security (Scherr & McNeely 2007).

The conservation benefits come from conserving native varieties of plants and animals and thereby making an agricultural landscape more species diverse. This in turn helps wild pollinators, birds and some mammals.

Which groups of poor benefit from agrobiodiversity? The poorest of the poor rarely benefit because they rarely own land. Poor farmers can benefit directly from an agrobiodiversity conservation initiative if a farming household is malnourished from a local diet that lacks diversity and critical micronutrients like Vitamin A and iron (Johns & Eyzaguirre 2006).

Which components of biodiversity are important? The most important agrobiodiversity elements are traditional landraces that are uniquely adapted to local conditions such as soil characteristics, rainfall, diseases and pests. Here genetic biodiversity is what matters.

What are the uncertainties? In agrobiodiversity, the “agro” comes first—the primary focus is on agriculture, and it's biodiversity conservation for the benefit of agriculture. The direct benefits to conservation are largely about the preservation of genetic material and tend to be small and incremental at the local level but can be quite important at the global level. Moreover, the expansion of agriculture has historically been the number one driver of natural habitat loss. Thus, agrobiodiversity generally lacks a constituency within conservation organizations.

Agrobiodiversity is crucial to increasing global crop yields because it can provide the genetic material to ward off new pests and diseases, help speed adaptation to climate change, and increase yields of staple crops. The local cost-benefit ratio, however, may be highly dependent on local conditions. An agrobiodiversity initiative to conserve traditional landraces, for example, may provide a small benefit to local farmers but at a large opportunity cost when compared with planting non-native high-yield varieties.

For low-input agriculture in marginal lands, promoting agrobiodiversity has been shown to benefit poor farmers (Scherr & McNeely 2007). There is, however, scant empirical evidence of an agrobiodiversity conservation project directly reducing local poverty (Kontoleon et al. 2008). The International Plant Genetic Resources Institute (now known as Biodiversity International) has extensively documented a project that focused on poverty reduction in coconut growing communities (Batugal & Oliver 2005). In several countries, the project increased the varieties of coconuts grown in a community and found evidence that poverty had been reduced. Yet in most of the project areas, the poverty reductions came not from greater agrobiodiversity but from alternative income generating activities funded by micro-credit. One of the challenges with measuring the local impact of an agrobiodiversity conservation initiative is showing a causal link between a local increase in agrobiodiversity and a reduction in poverty.

Summary conclusion: Overall, agrobiodiversity conservation has the potential for strong global benefits for poor farmers but evidence of local poverty reduction from a project to increase agrobiodiversity is scarce. Genetic biodiversity matters most here.

Summary of Poverty Reduction Evidence for Conservation Mechanisms

Mechanism	Number of studies?	Poverty reduction benefits?	Which groups benefit?	Other benefits?	Is it biodiversity or biomass that's important to the poor?
NTFPs	Many	Low	Very poor and better off	Nutritional benefits and medicinal properties	Biomass
Community Timber Enterprises	Many	Medium	Very poor, moderately poor, and better off	Stronger community organization	Biomass
PES	Moderate	Low	Landowners	Stronger property rights, capacity building, social organization	Biomass
Nature-based Tourism	Moderate	High	Moderately poor and better off	Infrastructure and social services	Biodiversity
Fish Spillover	Moderate	High	Very poor, moderately poor and better off	Stronger social cohesion	Biomass
Mangroves	Moderate	Medium	Very poor, moderately poor	Storm protection, fish stocks	Biomass
Protected Area Jobs	Few	Low	Moderately poor and better off		Biodiversity
Agro-forestry	Moderate	Medium	Moderately poor and better-off landowners	Helps even-out income fluctuations	Biomass
Grasslands	Few	Low	Not enough evidence	Stronger social cohesion	Both
Agro-biodiversity	Few	Medium	Moderately poor and better off farmers	Indirect global benefits to agriculture	Biodiversity



Common Challenges to Ensuring the Poor Benefit

Over 100 policy evaluation studies were examined to identify common challenges faced by conservation projects with poverty impacts. From these studies, four largely interrelated challenges were common and are illustrated by case-study evidence below:

- Better-off households with higher social capital were more likely to participate in a conservation initiative.
- Not only were elites more likely to participate, but they were often times the main recipients of conservation-induced livelihood benefits.
- Conservation projects sometimes led to a widening of income disparities.
- There was some evidence that women could have realized greater livelihood gains from projects but were excluded due to discrimination.

1. Households with higher assets and higher levels of social capital are more likely to participate in a conservation initiative. [Weber et al.](#) (2009) undertook a policy evaluation study on the livelihood impacts of a forest microenterprise programme as part of an integrated conservation and development project in the Brazilian Amazon. Individuals who participated in the scheme could earn a flat fee as local trail guides in ecotourism operations or a daily wage if they worked in the community enterprise that made and sold NTFPs. They found that participation in the programme increased cash income by approximately 30 percent and hence the programme has clear impacts on welfare (at least in the short term). But the authors concluded that households with higher assets and with higher levels of social capital were more likely to participate in the programme.

[Groom et al.](#) (2010) evaluated the livelihood impacts on Chinese farmers participating in a PES-type reforestation programme. Their study focused on the programme's impact on both income and off-farm labour supply and found that households with higher assets and higher levels of social capital were more likely to participate in a conservation initiative. The results imply that in order to improve the cost effectiveness of such programmes, subsidies should target constrained households. Moreover, they concluded that the programme should focus not only on households with large land endowments, as is currently the case, but should also consider the education level, household structure, and institutional environment of recipient households.

2. Elites often capture the benefits of an initiative. A study by [Jagger](#) (2008) focused on the impact of governance reforms (in the context of community forest management) on the income of forest-edge communities in Uganda. For households living adjacent to one of the community forest study sites, the study found significant gains in average annual household income from forest activities, though these were confined to households in the highest income quartile and were primarily attributed to the sale of illegally harvested timber. Here the elites captured the benefits from the timber. This signals a policy failure, as the main objectives of the programme were to promote non-timber related activities and increase incomes in the poorer segments of the population.

[Bandyopadhyay & Tembo](#) (2009) examined the impacts of introducing a game management policy in Zambia. They found that poverty does not affect the probability of a household participating in this programme. Yet they also found that the positive welfare impacts on households living in a game area and participating in ecotourism activities only apply to the non-poor

households. Hence, though the poor have good access to the programme, they did not derive many welfare gains from it. The study also explored whether the game parks may have provided other benefits to the poor in the form of improved infrastructure, but the presence of a game management park showed no such positive effect. The programme thus appears to have led to elite capture of benefits.

[Jumbe & Angelsen](#) (2006) collected data from 404 randomly selected households to explore the impacts on total income from participation in a community forest management programme in Malawi that focused on the production of NTFPs. Analysis showed that wealthier participants captured most benefits from the programmes due to discrimination and differences in capital endowments.

3. Widening income disparities. [Vyamana](#) (2009) used quasi-experimental data to explore poverty impacts of a participatory forest management programme in Tanzania. Vyamana found that the programme had provided new (albeit small) sources of community-level income that improved community physical capital. The incomes of households from villages included in the programme increased only slightly for most income groups. Technical and administrative obstacles prevented the poorest from benefiting from programme income generating activities. Thus, the programme sometimes led to a widening of local income disparities.

A study by [Maharjan et al.](#) (2009) undertaken in Nepal found the poorer people not benefiting from the programme and an increase in income disparities.

4. Discrimination against women. [Jumbe & Angelsen](#) (2006) found a positive overall impact on income (increases of 13 percent to 65 percent) for women participants in a community forest management programme in Malawi. Yet further disaggregation of the results suggests the programme would contribute even more to the livelihoods of female-headed households if the women were afforded the same opportunities as the men.



Knowledge Gaps

The knowledge review found the major constraint in assessing the link between biodiversity conservation and poverty reduction is the lack of hard evidence. Despite a wealth of case studies, the vast majority of the existing body of work does not use the analytical and empirical methods required to make reliable inferences about the actual impact of a conservation intervention on measurable poverty indicators (Wilshusen et al. 2002, Barret & Arcese 2005, Weber 2009). Overviews and meta-analyses that have been carried out (e.g., Naughton-Treves et al. 2005, Schreckenberg & Luttrell 2009) are largely inconclusive or unsubstantiated by hard evidence of statistically rigorous analysis. In general, the poverty-conservation literature suffers from conjectural and anecdotal assertions.

Fully understanding the link between biodiversity conservation and poverty reduction in any given context requires the ability to make causal inferences about a counterfactual. What would have been the changes, for instance, in household income in the absence of the conservation initiative? To appropriately answer these types of impact-assessment questions, there is a need for greater use of counterfactual cases. Before and after assessments of a conservation initiative are not sufficient.

Case studies that reach conclusions about poverty-conservation mechanisms without reference to a counterfactual have to be treated cautiously because income (or any other welfare related measures) may have been affected by other confounding effects. Such effects include historical trends as well as environmental and social characteristics. For example, Pandey (2007) presents case-study evidence from India that suggests communities engaged in agroforestry increased their income from rice by two to three times compared with non-agroforestry communities. Yet this type of analysis does not account for other confounding effects such as differences in levels of social capital that may have been the cause of this income effect. Without applying appropriate evaluation methods, we simply cannot know what causes what.

Overall, far fewer studies than anticipated could provide some reliable assessment of poverty impacts. Even here, the livelihood outcome indicators that these studies focus on are mainly forms of income, assets and labour-allocation decisions. Work that focuses on other forms of well-being such as social capital development is lacking.

There are at least four main reasons for this lack of hard evidence (see Ferraro & Pattanayak 2006 for a detailed discussion):

- There is a lack of political will among government and policy organisations involved in policy design and intervention.
- A multiplicity of objectives across donor and implementing agencies makes undertaking a structured and focused policy evaluation difficult.
- There is a lack of knowledge of policy evaluation methods among many conservation practitioners and policy makers.
- There is a misconception that policy evaluation is expensive, is not “value for money”, and diverts scarce conservation funds to nonessential “academic” activities.

There are also initiatives that might benefit both the rural poor and biodiversity but lack hard evidence of conservation benefits, including trophy hunting, bushmeat harvesting, medicinal plant collection, woodcarving, and bio-prospecting. All of these mechanisms could benefit from evidence-based studies that measure poverty and conservation impacts in a rigorous way.

In addition to the general lack of hard-evidence studies with counterfactuals, there are some knowledge gaps specific to individual mechanisms summarized in the table below.

Knowledge Gaps within Individual Mechanism	
Mechanism	Knowledge Gap
NTFPs	<p>Ros-Toten and Wiersum (2003) call for:</p> <ul style="list-style-type: none"> Identifying forest laws and regulations that hinder or facilitate the commercialization of NTFPs. Developing optimized [NTFP] production systems in human modified and man-made vegetation types. Developing processing techniques which add value to NTFPs.
Community Timber Enterprises	<p>Sunderlin et al. 2005 calls for:</p> <ul style="list-style-type: none"> “Detailed GIS and field analysis...to better understand how many of the world’s rural poor do in fact live in or nearby forests, and to what extent they depend on them”. More studies of small-scale, wood-based processing enterprises. Greater study of tree planting partnerships between communities and private enterprises.
PES	<p>More study is needed “because of the rapid recent growth of such initiatives, divided viewpoints on their utility, and a clear need for guidance on how to better include the poor in such programs” (Sunderlin et al. 2005). With payments for watershed services in particular, “better evidence is needed of the beneficial impacts of sustainable land-management practices on water flow and quality and on the ability of payments to influence the behaviour of landholders” (Porras 2008).</p>
Nature-based Tourism	<p>More research is need on how to ensure tourism operations benefit local poor people. In other words, what are the replicable approaches used by forest and marine tourism projects that have helped reduce local poverty?</p>
Fish Spillover	<p>Evidence from more sites is needed on the magnitude of the benefit to fisheries from spillover. There is also a need to better understand what factors, such as size, management and location, most influence fish spillover.</p>
Mangroves	<p>A better understanding of the relationship between fish catches and specific mangrove habitats would help to make a stronger case for conserving mangroves and the benefits they provide to the poor.</p>
Protected Area Jobs	<p>Empirical evidence from more sites on the impact of new protected area jobs on the local economy.</p>
Agroforestry	<p>Poverty-conservation initiatives would benefit from evidence showing how agroforestry can measurably decrease pressure on natural forests.</p>
Grasslands	<p>There is a need to understand the details of how intensive rangeland management regimes can be organized in the absence of clear tenure rights, and in some cases, the rule of law.</p>
Agrobiodiversity	<p>There is a general lack of hard evidence of how conserving local agrobiodiversity can benefit the poor and conservation.</p>



Conclusions

Overall, there is empirical evidence that at least six conservation mechanisms have been a route out of poverty for some people in some places: community timber enterprises, nature-based tourism, fish spillover, protected area jobs, agroforestry and agrobiodiversity conservation.

There is also evidence that four conservation mechanisms may not have been a route out of poverty but at least contributed to reducing poverty or provided a safety net in times of need: non-timber forest products (NTFPs), payments for environmental services, mangroves restoration, and grasslands management.

Reviewing more than 400 poverty-conservation documents had the benefit of giving a sense of where poverty-conservation thinking is overall. In general, optimism has waned. Optimism waned because, from ICDPs (integrated conservation development projects) to NTFPs, we know a lot about what does not work. Yet we know too little about what does work. As [K. MacKinnon \(2008\)](#)—an author with a lifetime of experience in the field—states, we need to “identify the key interventions which promote biodiversity conservation and effective poverty alleviation, and highlight conditions for success”.

Finally, for conservation to survive in a world headed to 9 billion people by 2050, a shift in focus is needed. Over the past two decades, natural scientists have focused on identifying the global areas of maximal biodiversity. Conservationists now know where they need to work, but much less about how they should work. It is the local people that make or break most conservation initiatives—especially in the long run. Conservation needs to ensure local people—many of whom are poor—benefit tangibly from biodiversity. For conservation to be relevant in the 21st century, this has to be a primary focus.

“Overuse of biodiversity
will only be reduced
when tangible livelihood gains
are derived from
its sustainable use”.

– DFID



Literature Cited

Abesamis, R.A., Alcala, A.C., and G.R. Russ (2006) "How much does the fishery at Apo Island benefit from spillover of adult fish from the adjacent marine reserve?" *Fishery Bulletin* 104(3): 360-375.

Aburto-Oropeza, O., Ezcurra, E., Danemann, G., et al. (2008) "Mangroves in the Gulf of California increase fishery yields", *PNAS* 105(30): 10456-10459.

Akpabio, I. and I. Ibok (2009) "Agroforestry practices among male and female farmers in South-South, Nigeria", *Small-scale Forestry* 8: 63-76.

Agrawal, A. and K.H. Redford (2006), development, and biodiversity conservation: Shooting in the dark? *WCS Working Paper No. 26*. Wildlife Conservation Society, New York.

Alongi, D.M. (2008) "Mangrove forests: Resilience, protection from tsunamis, and responses to global climate change", *Estuarine, Coastal and Shelf Science* 76(1): 1-13.

Angelsen, A. and S. Wunder (2003) Exploring the poverty-forestry link: key concepts, issues and research implications. *CIFOR Occasional Papers No. 40*. CIFOR, Bogor, Indonesia.

Ashley, C., Boyd, C. and H. Goodwin (2000) Pro-Poor Tourism: Putting Poverty at the Heart of the Tourism Agenda. *Natural Resource Perspectives*, Number 51, March. ODI, London.

Ashley, C. and D. Roe (2002) "Making tourism work for the poor: strategies and challenges in southern Africa", *Development Southern Africa* 19(1): 61-82.

Ashley, R., Russell, D., and B. Swallow (2006) "The policy terrain in protected area landscapes: challenges for agroforestry in integrated landscape conservation", *Biodiversity and Conservation* 15: 663-689.

Balmford, A., Rodrigues, A.S.L., Walpole, M., Ten Brink, P., Kettunen, M., Braat, L. and R. de Groot (2008) *The Economics of Ecosystems and Biodiversity: Scoping the Science*, European Commission. Cambridge, UK.

Bandyopadhyay, S. and G. Tembo (2009) Household Welfare and Natural Resource Management around National Parks in Zambia. *Policy Research Working Paper No. 4932*. The World Bank Environment Department, Washington, DC.

Barbier, E.B. (2007) "Valuing ecosystem services as productive inputs", *Economic Policy* 22: 177-229.

Barrett, C. B., Lee, D.R. and J.G. McPeak (2005) "Institutional Arrangements for Rural Poverty Reduction and Resource Conservation", *World Development* 33(2): 193-197.

Batugal, P. and J. Oliver, eds. (2005) Poverty reduction in coconut growing communities, Volume III: Project achievements and impact. *International Plant Genetic Resources Institute - Regional Office for Asia, the Pacific and Oceania (IPGRI-APO)*, Serdang, Selangor Darul Ehsan, Malaysia.

Belcher, B., Ruiz-Perez, M. and R. Achdiawan (2005) "Global Patterns and Trends in the Use and Management of Commercial NTFPs: Implications for Livelihoods and Conservation", *World Development* 33(9): 1435-1452.

- Belcher, B.M. (2003) "What isn't an NTFP?", *International Forestry Review* 5(2): 161-168.
- Bhagwat, S.A., Willis, K.J., Birks, H.J.B. and R.J. Whittaker (2008) "Agroforestry: a refuge for tropical biodiversity?", *Trends in Ecology and Evolution* 23 (5): 261-267.
- Blaikie, P. (2006) "Is Small Really Beautiful? Community-based Natural Resource Management in Malawi and Botswana", *World Development* 34 (11): 1942-1957.
- Boersema, J., Blowers, A., and Martin, A. (2009) "Biodiversity loss, poverty and climate change: can one solution fit all?", *Journal of Integrative Environmental Sciences* 6: 239-245.
- Bond, I. and J. Mayers (2010) Fair deals for watershed services: Lessons from a multi-country action-learning project. *Natural Resource Issues* No. 13. IIED, London.
- Bosire, J., Dahdouh-Guebas, F., Walton, M., Crona, B.I., Lewis III, R.R., Field, C., Kairo, J.G. and N. Koedam (2008) "Functionality of restored mangroves: a review", *Aquatic Botany* 89(2): 251-259.
- Bray, D.B., Merino-Pérez, L., Negreros-Castillo, P., Segura-Warnholtz, G., Torres-Rojo, J.M. and H.F.M. Vester (2003) "Mexico's Community-Managed Forests as a Global Model for Sustainable Landscapes", *Conservation Biology* 17(3): 672-677.
- Bray, D.B. and R. Tardanico (2005) Can community forest management for timber production alleviate poverty and conserve forests? Presentation to 6th Open Meeting of the Human Dimensions of Global Environmental Change Research Community, 9-13 October. University of Bonn (in Sunderlin 2007).
- Brockington, D., Igoe, J., and K. Schmidt-Soltau (2006) "Conservation, Human Rights, and Poverty Reduction", *Conservation Biology* 20(1): 250-252.
- Brown, D., Seymour, F. and L. Peskett (2008) "How do we achieve REDD co-benefits and avoid doing harm?" In Angelsen, A. (ed.) (2008) *Moving ahead with REDD: Issues, options and implications*. CIFOR, Bogor, Indonesia.
- Brundtland, G. (ed.) (1987) *Our common future: The World Commission on Environment and Development*. Oxford University Press, Oxford, UK.
- Campbell, B. (2009) "Beyond Copenhagen: REDD+, agriculture, adaptation strategies and poverty", *Global Environmental Change* 19: 397-399.
- Campbell, B., Jeffrey, S., Kozanayi, W., Luckert, M., Mutamba, M. and C. Zindi (2002) *Household Livelihoods in Semi-Arid Regions: Options and Constraints*. CIFOR, Bogor, Indonesia.
- Cavendish, W. (2000) "Empirical regularities in the poverty-environment relationship of rural households: evidence from Zimbabwe", *World Development* 28(11): 1979-2003.
- Chomitz, K. with Buys, P., de Luca, G., Thomas, T.S. and S. Wertz-Kanounnikoff (2007) *At Loggerheads? Agricultural Expansion, Poverty Reduction, and Environment in Tropical Forests*. The World Bank, Washington, DC.
- Das, S. and J.R. Vincent (2009) "Mangroves protected villages and reduced death toll during Indian super cyclone", *PNAS* 106(18): 7357-7360.
- Davis, T. (2005) *Local and Semi-Local Economic Impacts of Dive Tourism in Bunaken National Park, North Sulawesi, Indonesia*. Master's thesis. University of Washington, School of Marine Affairs, Seattle.
- Dove, M.R. (1993) "A Revisionist View of Tropical Deforestation and Development", *Environmental Conservation* 20(1): 17-24.
- Duraiappah, A. (1996) *Poverty and Environmental Degradation: a Literature Review and Analysis*. CREED Working Paper Series No 8. International Institute for Environment and Development and Institute for Environmental Studies, London and Amsterdam.
- Echavarría, M., Vogel, J., Alban, M. and F. Meneses (2004) *The impacts of payments for watershed services in Ecuador*. International Institute for Environment and Development, London.
- Ekbom, A. and J. Bojö (1999) *Poverty and Environment: Evidence of Links and Integration into the Country Assistance Strategy Process*. Environment Group, Africa Region, The World Bank, Washington, DC.
- Emerton, L. (2005) *Making the Economic Links Between Biodiversity and Poverty Reduction: The Case of Lao PDR*. The World Conservation Union, Ecosystems and Livelihoods Group Asia, IUCN, Colombo, Sri Lanka.
- Engel, S., Pagiola, S. and S. Wunder (2008) "Designing payments for environmental services in theory and practice: An overview of the issues". *Ecological Economics* 65: 663-674.
- Eriksen, S.E.H., and H.K. Watson (2009) "The dynamic context of southern African savannas: investigating emerging threats and opportunities to sustainability". *Environmental Science and Policy* 12: 5-22.

- FAO (1999) *Agricultural Biodiversity, Multifunctional Character of Agriculture and Land Conference. Background Paper 1*. Maastricht, Netherlands.
- Ferraro P.J. and S.K. Pattanayak (2006) "Money for Nothing? A Call for Empirical Evaluation of Biodiversity Conservation Investments", *PLoS Biol* 4(4): e105.
- Fratkin, E. and R. Mearns (2003) "Sustainability and Pastoral Livelihoods: Lessons from East African Maasai and Mongolia". *Human Organization* 62(2): 112-122.
- Frison, E.A., Cherfas, J., Eyzaguirre, P.B. and T. Johns (2004) *Biodiversity, nutrition and health: making a difference to hunger and conservation in the developing world*. International Plant Genetic Resources Institute, Rome.
- Garrity, D.P. (2004) "Agroforestry and the achievement of the Millennium Development Goals", *Agroforestry Systems* 61: 5-17.
- Gautam, A.P., Webb, E.L. and A. Eiumnoh (2002) "GIS Assessment of Land Use/Land Cover Changes Associated with Community Forestry Implementation in the Middle Hills of Nepal", *Mountain Research and Development* 22(1): 63-69.
- Gell, F.R. and C.M. Roberts (2003). "Benefits beyond boundaries: the fishery effects of marine reserves and fishery closures", *Trends in Ecology and Evolution* 18: 448-455.
- Griffiths, T. (2007) *Seeing 'RED'?: 'Avoided deforestation' and the rights of Indigenous Peoples and local communities*. Forest Peoples Programme, UK.
- Groom, B., Grosjean, P., Kontoleon, A., Swanson, T. and S. Zhang (2010) "Relaxing rural constraints: a 'win-win' policy for poverty and environment in China?" *Oxford Economic Papers* 62(1): 132-156.
- Guo, Q. (2007) "The diversity-biomass-productivity relationship in grasslands management and restoration", *Basic and Applied Ecology* 8: 199-208.
- Hannah, J. (ed.) (2007) *Women pastoralists: preserving traditional knowledge, facing modern challenges*. Secretariat of the United Nations Convention to Combat Desertification, Bonn, Germany.
- Harmelin-Vivien, M., Le Diréach, L. Bayle-Sempere, J., Charbonnel, E., García-Charton, J.A., Ody, D., Pérez-Ruzafa, A., Reñones, O., Sánchez-Jerez, P. and C. Valle (2008) "Gradients of abundance and biomass across reserve boundaries in six Mediterranean marine protected areas: Evidence of fish spillover?" *Biological Conservation* 141(7): 1829-1839.
- Harvey, C.A., Gonzalez, J. and E. Somarriba (2006) "Dung beetle and terrestrial mammal diversity in forests, indigenous agroforestry systems and plantain monocultures in Talamanca, Costa Rica", *Biodiversity and Conservation* 15: 555-585.
- Hemmati, M. (ed.) (1999) *Gender and Tourism: Women's Employment and Participation in Tourism*. Summary of UNED UK's Project Report. UNED forum, UK, London.
- Homewood, K., Kristjanson, P. and P. Chenevix Trench (2009) *Staying Maasai? Livelihoods, Conservation and Development in East African Rangeland*. Springer, New York.
- Islam, M.S., and M. Haque (2004) "The mangrove-based coastal and nearshore fisheries of Bangladesh: ecology, exploitation and management", *Reviews in Fish Biology and Fisheries* 14: 153-180.
- IUCN (2008) *The Role of NTFPs in Poverty Alleviation and Biodiversity Conservation*. International Conference Proceedings, IUCN, Ha Noi, Viet Nam.
- IUCN World Commission on Protected Areas (2008a) *Establishing Marine Protected Area Networks—Making It Happen*. IUCN-WCPA, National Oceanic and Atmospheric Administration and The Nature Conservancy, Washington, DC.
- Jagger, P. (2008) *Forest Incomes After Uganda's Forest Sector Reform: Are the Rural Poor Gaining? CAPRI Working Paper No. 92*. International Food Policy Research Institute, Washington, DC.
- Johns, T. and P. B. Eyzaguirre (2006) "Linking biodiversity, diet and health in policy and practice", *Proceedings of the Nutrition Society* 65: 182-189.
- Jose, S. (2009) "Agroforestry for ecosystem services and environmental benefits: an overview", *Agroforestry Systems* 76: 1-10.
- Jumbe, C. and A. Angelsen (2006) "Do the Poor Benefit from Devolution Policies? Evidence from Malawi's Forest Co-Management Program", *Land Economics* 82(4): 562-581.
- Kathiresan, K. and N. Rajendran (2002) "Fishery resources and economic gain in three mangrove areas on the south-east coast of India", *Fisheries Management and Ecology* 9: 277-283.
- Kaimowitz, D. and D. Sheil (2006) "Conserving What and for Whom? Why Conservation Should Help Meet Basic Human Needs in the Tropics", *Biotropica* 39(5): 567-574.

- Kontoleon, A., Pascual U., and M. Smale (Eds) (2008) *Agrobiodiversity Conservation and Economic Development*. Routledge, Oxon, UK.
- Leakey, R.R.B., Tchoundjeu, Z., Schreckenberg, K., Shackleton, S.E. and C.M. Shackleton (2005) "Agroforestry tree products (AFTPs): targeting poverty reduction and enhanced livelihoods", *International Journal of Agricultural Sustainability* 3(1): 1-23.
- Leisher, C., Van Beukering, P. and L.M. Scherl (2007) *Nature's investment bank: How marine protected areas contribute to poverty reduction*. The Nature Conservancy, Arlington, VA.
- MacKinnon, K. (2008) *Linkages between Biodiversity Conservation and Poverty Alleviation: Lessons from the World Bank Portfolio*. Poverty Conservation Learning Group website, The World Bank, Washington, DC.
- Magalhaes, A., Marinho da Costa, R., da Silva, R. and L. Pereira (2007) "The role of women in the mangrove crab (*Ucides cordatus*, Ocypodidae) production process in North Brazil (Amazon region, Para)", *Ecological Economics* 61: 559-565.
- Mahanty, S., Gronow, J., Nurse, M. and Y. Malla (2006) "Reducing Poverty through Community Based Forest Management in Asia", *Journal of Forest and Livelihood* 5(1): 78-89.
- Maharjan, M.R., Dhakal, T.R., Suresh, K., Schreckenberg, K. and C. Luttrell (2009) "Improving the benefits to the poor from community forestry in the Churia region of Nepal", *International Forestry Review* 11(2): 254-267.
- Manson, F.J., Loneragan, N.R., Harch, B.D., Skilleter, G.A. and L. Williams (2005) "A broad-scale analysis of links between coastal fisheries production and mangrove extent: A case-study for north-eastern Australia", *Fisheries Research* 74: 69-85.
- Markandya, A., Talyor, T., and S. Pedrosa (2003) *Tourism and Sustainable Development: Lessons from Recent World Bank Experience*. The World Bank, Washington, DC.
- Marshall, E., Schreckenberg, K. and A.C. Newton (eds.) (2006) *Commercialization of Non-timber Forest Products: Factors Influencing Success. Lessons Learned from Mexico and Bolivia and Policy Implications for Decision-makers*. UNEP World Conservation Monitoring Centre, Cambridge, UK.
- May, P.H., E. Boyd, F. Veiga and M. Chang (2004) *Local sustainable development effects of forest carbon projects in Brazil and Bolivia: A view from the field*. International Institute for Environment and Development, London.
- Mayers, J. (2006) *Poverty Reduction through Commercial Forestry: What evidence? What prospects? The Forests Dialogue Research Publication Series No. 2*. Yale University School of Forestry and Environment Studies, New Haven, CT.
- McClanahan, T., Marnane, M., Cinner, J. and W. Kiene (2006) "A Comparison of Marine Protected Areas and Alternative Approaches to Coral-Reef Management", *Current Biology* 16: 1408-1413.
- McLeod, E. and R. Salm (2006) *Managing mangroves for resilience to climate change*. Working Paper Series No 2. IUCN Resilience Science Group, Gland, Switzerland.
- McNeely, J.A. (2004) "Nature vs. Nurture: managing relationships between forests, agroforestry, and biodiversity", *Agroforestry Systems* 61: 155-165.
- Millennium Ecosystem Assessment (2005) *Ecosystems and Human Well-being: General Synthesis*, WRI/Island Press.
- Molnar, A., Liddle, M., Bracer, C., Khare, A., White, A. and J. Bull (2007) *Community-based forest enterprises in tropical forest countries: status and potential*. International Timber Trade Organization, Yokohama, Japan (in Sunderlin 2007).
- Mumby, P.J., Edwards, A.J., Arlias-Gonzalez, J.E., et al. (2004) "Mangroves enhance the biomass of coral reef fish communities in the Caribbean", *Nature* 427: 533-536.
- Muñoz, R. (2004) *Efectos del programa de servicios ambientales en las condiciones de vida de los campesinos de la Península de Osa*. (thesis), Evaluación de Programas y Proyectos de Desarrollo, Universidad de Costa Rica, San José (in Wunder 2005).
- Neumann, R.P. and E. Hirsch (2000) *Commercialisation of Non-timber Forest Products: Review and Analysis of Research*. CIFOR, Bogor, Indonesia.
- Nakeke, A. (2008) *Fish tags determine catch*. University of the South Pacific, Institute of Applied Science, Fiji.
- Naughton-Treves, L., Holland, M.B. and K. Brandon (2005) "The Role of Protected Areas in Conserving Biodiversity and Sustaining Local Livelihoods", *Annual Review of Environment and Resources* 30: 219-252
- Nguyen, Q.T., Tran N.T., Hoang H.T., Yasmi, Y. and T. Enters (2009) *Red Books for Greener Trees: Strengthening Community Forestry in Vietnam*. Policy brief, August. Forest Governance Learning Group (FGLG), Vietnam.

- Oli, K. P. and K. Kanel (2006) "Community-based forest management in Nepal: Reversing environmental degradation and improving livelihoods", In Steele, P., Oviedo, G. and McCauley, D. (eds.) *Poverty, Health and Ecosystems: Experience from Asia*. IUCN, Gland, Switzerland and Asian Development Bank, Manila, Philippines.
- Ostrom, E. (2009) "A General Framework for Analyzing Sustainability of Social-Ecological Systems", *Science* 325(5939): 419-422.
- Pagiola, S., Arcenas, A. and G. Platais (2005) "Can Payments for Environmental Services Help Reduce Poverty? An Exploration of the Issues and the Evidence to Date from Latin America", *World Development* 33(2): 237-253.
- Pandey, D.N. (2007) "Multifunctional agroforestry systems in India: a review", *Current Science* 92(4): 455-463.
- Pandey, N., Garg, A.K., Malhotra, R. and D.N. Pandey (2007) *Linking Local Knowledge to Global Markets: Livelihoods Improvement through Woodcarving in India*. Working paper, Agricultural Financing Corporation, India.
- Peden, D., Tadesse, G. and M. Mammo (2003) *Improving the water productivity of livestock: An opportunity for poverty reduction*. International Livestock Research Institute (ILRI), Addis Ababa, Ethiopia.
- Perfecto, I., Ambrecht, I., Philpott, S.M., Soto-Pinto, L. and T.V. Dietsch (2007) "Shaded coffee and the stability of rainforest margins in Latin America", In Tschardtke, T., Leuschner, C., Zeller, M., Guhadja, E. and A. Bidin (eds.) *The stability of tropical rainforest margins, linking ecological, economic, and social constraints of land use and conservation*. Springer, New York.
- Peskett, L., Huberman, D., Bowen-Jones, E., Edwards, G., and J. Brown (2008) *Making REDD work for the poor*. Poverty Environment Partnership (PEP).
- Pires, M. (2004) "Watershed protection for a world city: the case of New York", *Land Use Policy* 21(2): 161-175.
- PISCO (2007) *Science of Marine Reserves, second edition*. Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO).
- Pollnac, R.B., Crawford, B.R. and M.L.G. Gorospe (2001) "Discovering factors that influence the success of community-based marine protected areas in the Visayas, Philippines", *Ocean & Coastal Management* 44: 683-710.
- Porrás, I., Grieg-Gran, M. and N. Neveset (2008) *All that glitters: A review of payments for watershed services in developing countries*. Natural Resource Issues No. 11. International Institute for Environment and Development, London.
- Richards, M and M. Jenkins (2007) *Potential and Challenges of Payments for Ecosystem Services from Tropical Forests*. Forestry Briefing 16, December. ODI, London.
- Rönnbäck, P. (1999) "The ecological basis for economic value of seafood production supported by mangrove ecosystems", *Ecological Economics* 29: 235-252.
- Ros-Toten, M.A.F. and K.F. Wiersum (2003) *The Importance of Non-Timber Forest Products for Forest-Based Rural Livelihoods: an Evolving Research Agenda*. AGIDS/UvA, Amsterdam.
- Sathirathai, S. and E.B. Barbier (2001) "Valuing mangrove conservation in southern Thailand", *Contemporary Economic Policy* 19(2): 109-122.
- Scherr, S. and J. McNeely eds. (2007) *Farming with Nature: the Science and Practice of Ecoagriculture*. Island Press, Washington, DC.
- Scherr, S., White, A. and D. Kaimowitz (2004) *A New Agenda for Forest Conservation and Poverty Reduction: Making Markets Work for Low-income Producers*. Forest Trends, Washington, DC.
- Schmidt, S. (2006) *Conservation and Sustainable Management of Natural Resources in the Gobi: People Centred Conservation and Community-Driven Poverty Reduction*. Unpublished draft report, January. New Zealand Nature Institute Initiative for People Centred Conservation.
- Schreckenberg, K., Awono, A., Degrande, A., Mboosso, C., Ndoye, O. and Z. Tchoundjeu (2006) "Domesticating indigenous fruit trees as a contribution to poverty reduction", *Forests, Trees and Livelihoods* 16: 35-51.
- Schreckenberg, K. and C. Luttrell (2009) "Participatory forest management: a route to poverty reduction?" *International Forestry Review* 11(2): 221-238.
- Schroth, G., Da Fonseca, G.A.B., Harvey, C.A., Gascon, C., Vasconcelos, H.L. and A-M.N. Izac (2004) *Agroforestry and biodiversity conservation in Tropical Landscapes*. Island Press, Washington, DC.
- Shackleton, C. and S. Shackleton (2004) "The importance of non-timber forest products in rural livelihood security and as safety nets: a review of evidence from South Africa", *South African Journal of Science* 100: 658-664.

- Shackleton, C.M., Shackleton, S.E., Buitenb, E. and N. Bird (2007) "The importance of dry woodlands and forests in rural livelihoods and poverty alleviation in South Africa", *Forest Policy and Economics* 5: 558-577.
- Shah, K. and V. Gupta (2000) *Tourism, the Poor and Other Stakeholders: Experience in Asia*. Fair Trade in Tourism Project, ODI, London.
- Sileshi, G., Akinnifesi, F.K., Ajayi, O.C. and F. Place. (2009) Evidence for impact of green fertilizers on maize production in sub-Saharan Africa: a meta-analysis. ICRAF Occasional Paper No. 10. World Agroforestry Centre, Nairobi.
- Soontornwong, S. (2006) "Improving Rural Livelihood Through CBNRM: A Case of Self-organization in Community Mangrove Management in Thailand", in Mahanty, S. et al. (eds.) *Hanging in the Balance: Equity in Community-Based Natural Resources Management in Asia*. RECOFTC and East-West Centre, Bangkok.
- Steffan-Dewenter, I., Kessler, M., Barkmann, J., et al. (2007) "Tradeoffs between income, biodiversity, and ecosystem functioning during tropical rainforest conversion and agroforestry intensification", *PNAS* 104(12): 4973-4978.
- Stern, N. (2007) *Stern Review on the Economics of Climate Change*. Cambridge University Press, Cambridge.
- Strassburg, B., Turner, R.K., Fisher, B., Schaeffer, R., and A. Lovett (2009) "Reducing emissions from deforestation—the "combined incentives" mechanism and empirical simulations", *Global Environmental Change* 19: 265-278.
- Sunderland, T. C. H., Ehringhaus, C. and B.M. Campbell (2008) "Conservation and development in tropical forest landscapes: a time to face the trade-offs?" *Environmental Conservation* 34: 276-279.
- Sunderlin, W.D., Angelsen, A., Belcher, B., Burgers, P., Nasi, R., Santoso, L. and S. Wunder (2005) "Livelihoods, Forests, and Conservation in Developing Countries: An Overview", *World Development* 33(9): 1383-1402.
- Sunderlin, W.D., Dewi, S.D. and A. Puntodewo (2007) *Poverty and forests: multicountry analysis of spatial association and proposed policy solutions*. CIFOR Occasional Paper No. 47. CIFOR, Bogor, Indonesia.
- Tupper, M.H. (2007) "Spillover of commercially valuable reef fishes from marine protected areas in Guam, Micronesia", *Fishery Bulletin* 105(4): 527-537.
- Urban-Econ (2008) *SANPARKS: Economic Impact Assessment*, March. South African National Parks and Urban-Econ Development Economists.
- Vedeld, P., Angelsen, A., Sjaastad, E. and G. Kobugabe Berg (2004) *Counting on the Environment: Forest Incomes for the Rural Poor*. Environmental Economics Series No. 98. The World Bank, Washington, D.C.
- Vyamana, V.G. (2009) "Participatory forest management in the Eastern Arc Mountains of Tanzania: who benefits?" *International Forestry Review* 11(2): 239-253.
- Walters, B.B., Ronnback, P., Kovacs, J.M., et al. (2008) "Ethnobiology, socio-economics and management of mangrove forests: A review", *Aquatic Botany* 89: 220-236.
- Walton, M.E.M., Le Vay, L., Lebata, J.H., Binas, J. and J.H. Primavera (2007) "Assessment of the effectiveness of mangrove rehabilitation using exploited and non-exploited indicator species", *Biological Conservation* 138: 180-188.
- Weber, J., Sills, E., Bauch, S., and S. Pattanayak (2010) "Do ICDPs work? An empirical evaluation of forest-based microenterprises in the Brazilian Amazon", *Unpublished work*.
- Wells, M. and K. Brandon (1992) *People and parks: linking protected area management with local communities*. The World Bank, Washington, DC.
- Wertz-Kanounnikoff, S. and M. Kongphan-apirak (2009) *Emerging REDD+: A preliminary survey of demonstration and readiness activities*. CIFOR Working Paper 46. CIFOR, Bogor, Indonesia.
- Wilshusen, P.R., Brechin, S.R., Fortwangler, C.L. and P.C. West (2002) "Reinventing a Square Wheel: Critique of a Resurgent "Protection Paradigm" in International Biodiversity Conservation", *Society and Natural Resources* 15(1): 17-40.
- World Initiative for Sustainable Pastoralism (2008) *Policies that Work for Pastoral Environments: A Six-Country Review of Positive Policy Impacts on Pastoral Environments*. WISP, Nairobi.
- World Bank (2001) *Attacking Poverty*, World Report 2000/2001. Oxford University Press, Oxford and New York.
- World Bank (2007) *Zambia Economic and Poverty Impact of Nature-based Tourism*. Report No. 43373-ZM. The World Bank, Washington, DC.
- Worm, B., Barbier, E.B., Beaumont, N., Duffy, J.E., Folke, C., Halpern, B.S., Jackson, J.B.C., Lotze, H.K., Micheli, F., Palumbi, S.R., Sala, E., Selkoe, K.A., Stachowicz, J.J. and R. Watson (2006) "Impacts of Biodiversity Loss on Ocean Ecosystem Services", *Science* 314(5800): 787-790.

WRI (2005) *The World Resources 2005 - The Wealth of the Poor*, Chapter 5. World Resources Institute, Washington, DC.

Wunder, S. (2008) "Payments for environmental services and the poor: concepts and preliminary evidence", *Environment and Development Economics* 13: 279-297.

Wunder, S. (2005) *Payments for environmental services: some nuts and bolts*, CIFOR Occasional Paper No. 42. CIFOR, Bogor, Indonesia.

Wunder, S. (2001) "Poverty alleviation and tropical forests—what scope for synergies?", *World Development* 29(11): 1817-1833.

Wunder, S. (2000) *Big island, green forests and backpackers. Land-use and development options on Ilha Grande, Rio de Janeiro state, Brazil*. CDR Working Paper No. 00.4. Centre for Development Research (CDR), Copenhagen, Denmark.

Wunder, S. (1999) *Forest conservation through ecotourism income? A case study from the Ecuadorian Amazon region*. CIFOR Occasional Paper No. 21. CIFOR, Bogor, Indonesia.

WWF (2004) *Are protected areas working? An analysis of forest protected areas by WWF*. WWF International, Gland, Switzerland.



Photo Credits

Cover: © Djuna Ivereigh/indonesiawild.com

Inside Cover: © Djuna Ivereigh/indonesiawild.com

Page i: © Djuna Ivereigh/indonesiawild.com

Page ii: © Rumi Naito

Page 1: © Judith Kaine

Page 2: © S. Neil Larsen

Page 3: © Rumi Naito (above), Paul Youn (below)

Page 5: © Bridget Besaw

Page 6: © Paul Holthus

Page 7: © Djuna Ivereigh/indonesiawild.com

Page 8: © Carolyn Drake

Page 9: © Ami Vitale

Page 10: © Hugo Arnal/TNC

Page 11: © Suzi Eszterhas

Page 12: © Douglas Steakley

Page 13: © Ami Vitale

Page 15: © Paul Holthus/TNC

Page 17: © Paige Olm

Page 19: © Suzi Eszterhas

Page 20: © David Wachenfeld/Triggerfish Images

DOES CONSERVING BIODIVERSITY WORK TO REDUCE POVERTY?

A STATE OF KNOWLEDGE REVIEW