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Social Equity Matters in Payments for Ecosystem Services

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Although conservation efforts have sometimes succeeded in meeting environmental goals at the expense of equity considerations, the changing context of conservation and a growing body of evidence increasingly suggest that equity considerations should be integrated into conservation planning and implementation. However, this approach is often perceived to be at odds with the prevailing focus on economic efficiency that characterizes many payment for ecosystem services (PES) schemes. Drawing from examples across the literature, we show how the equity impacts of PES can create positive and negative feedbacks that influence ecological outcomes. We caution against equity-blind PES, which overlooks these relationships as a result of a primary and narrow focus on economic efficiency. We call for further analysis and better engagement between the social and ecological science communities to understand the relationships and trade-offs among efficiency, equity, and ecological outcomes.

Keywords: efficiency, conservation, behavior, poverty, policy

Designing instruments capable of protecting the biodiversity and ecosystem services on which human societies fundamentally depend represents one of the greatest policy challenges of the Anthropocene. Among traditional conservation strategies such as protected areas and community conservation, innovative instruments such as payment for ecosystem services (PES) schemes have been increasingly promoted to incentivize conservation and sustainable resource management. PES programs are at the center of the contemporary conservation agenda, supported by donors (e.g., Norwegian government, World Bank), intergovernmental policy bodies (e.g., Convention on Biological Diversity), governments (e.g., Costa Rica, Mexico, Ecuador, South Africa, Vietnam, China), the private sector (e.g., Danone water, Ecotourism Kenya), and nongovernmental conservation organizations (e.g., Conservation International, the World Wildlife Fund).

Whereas existing markets and regulatory frameworks have largely failed to account for the public values of ecosystems, such as carbon sequestration and water regulation, PES schemes create new mechanisms to incorporate these values in decisionmaking (Ferraro and Kiss 2002). They do this by creating new relationships between the beneficiaries of ecosystem services and the service providers responsible for on-the-ground conservation actions. Notably, PES schemes often draw on service beneficiaries to fund new incentives (payments and nonfinancial benefits) to compensate land managers for the cost of ecosystem service provision.

The resulting market logic behind these efforts to save ecosystem services by selling them (McAfee 1999) is commonly heralded for its potential to recruit and sustain high levels of conservation funding. For example, the United Nations' Reducing Emissions from Deforestation and Forest Degradation (REDD+) program has proposed to channel hundreds of millions of dollars through PES schemes for forest emissions reductions. PES is also often portrayed as superior to traditional conservation approaches on the basis of claims that they can be more economically efficient (Pattanayak et al. 2010, Kinzig et al. 2011). However, this view of the efficiency of PES is at odds with a more comprehensive understanding of how conservation happens in practice—including the interaction with a range of social equity considerations.

We highlight the increasingly multidimensional view of social equity for conservation and argue that these factors must be taken seriously—not least because there are important causal links between equity and ecological outcomes. Although experience shows that seemingly inequitable approaches to conservation can sometimes meet environmental objectives, the contexts for conservation are changing, and we increasingly appreciate the complexities of social–ecological systems. Where incentive schemes overlook this complexity and the associated feedbacks, they not only fail to notice everyday realities but also ignore the vast body of conservation experience (Hirsch et al. 2010, Miller et al. 2011, Ban et al 2013). We highlight the instrumental roles that equity can play in shaping conservation outcomes

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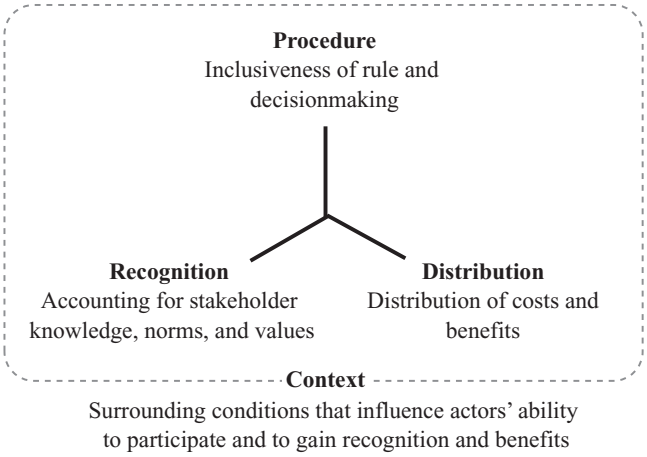

Figure 1. The four dimensions of social equity: (1) Procedure: the degree of involvement and inclusiveness in rulemaking and decisions around land management or conservation programs. (2) Distribution: the distribution of costs, benefits, burdens, and rights derived from land management or conservation actions or programs. (3) Recognition: the respect for knowledge systems, values, social norms, and the rights of all stakeholders in the design and implemention of conservation programs. (e) Context: the surrounding social conditions (e.g., power dynamics, gender, education) that influence the actors' ability to gain recognition, participate in decisionmaking, and lobby for fair distribution. These dimensions are based on those in McDermot and colleagues (2013).

and argue that there is a need to better explore the relationships between social equity and the economic efficiency and ecological effectiveness of PES schemes.

Multiple dimensions of social equity

Although many conservation interventions have approached equity primarily in terms of the distribution of income or benefits (Pascual et al 2010), understanding of the social equity dimensions of conservation has become increasingly sophisticated with the recognition that equity is multidimensional (figure 1). For example, equity dimensions also include the distribution of burdens, including both direct management costs and passive costs, such as reduced resource access (Balmford and Whitten 2003). Equity dimensions also involve a range of interrelated nonmaterial values (see Chan et al. 2012), including procedural dimensions that encompass how and who makes decisions and the recognition of differentiated social actors' rights, cultural identities, values, and knowledge systems. These facets are underpinned by a social and political context in which the existing conditions (e.g., power dynamics, gender, education) that influence stakeholders' ability to gain recognition, to participate in decisionmaking, and to lobby for fair distribution of benefits and burdens are considered (figure 1; McDermott et al. 2013). The relative importance of these interrelated equity dimensions is context dependent. Nevertheless, these types of factors are well-known determinants of people's motivations and behavior (e.g., Fehr and Falk 2002, Wright et al. 2012), and there is broadening recognition that they therefore also influence conservation (Pascual et al. 2010, Miller et al. 2011, Halpern et al. 2013). However, the potential for integrating these considerations into conservation planning is obscured when conservation instruments specifically prioritize economic efficiency.

The prevailing focus on economic efficiency

In the face of urgent needs and limited resources, incentive-based conservation schemes (including PES, biodiversity banking programs, and tradable permits) are often proposed as instruments through which to increase the economic efficiency of conservation. Based on idealized models, these schemes are often envisioned as flexible, market-like conservation mechanisms (Ferraro and Kiss 2002), in which ecosystem services (e.g., water, carbon, biodiversity) are sold and traded to incentivize voluntary, economically efficient conservation (Engel et al. 2008). This view has been embodied, for example, by widespread proposals for trading carbon emissions credits from tropical forest conservation (e.g., REDD+ policies).

In fact, the efficiency of conservation outcomes through PES is rarely evaluated, because it requires complex ecological and economic valuations across scales and beyond business-as-usual baselines. Instead, efficiency is often proxied by cost effectiveness, with managers seeking to maximize ecological outcomes, given a limited budget (Pascual et al. 2010). To this end, a project's focus should be on targeting the most effective ecosystem services providers at the lowest cost (Wunder 2006, Engel et al. 2008, Kroeger 2013). Such an approach might, for example, prioritize targeting large landholders as recipients of PES while excluding conservation agreements with smallholders that would be more costly or that would yield relatively lower returns. Similarly, such PES might also value individual services that are more marketable (e.g., carbon, water). As in other sectors (e.g., health, education), letting the market decide is often considered a more efficient governance approach than either regulation or public spending (see Stiglitz 2012).

However, there is growing concern that the prevailing focus on economic efficiency is at the expense of other important dimensions of PES design, including accounting for broader ecological function (e.g., Palmer and Filoso 2009) and social equity dimensions (Petheram and Campbell 2010, Corbera and Pascual 2012, Muradian et al. 2013), including nonmaterial values (Chan et al. 2012) and the complexities of human–environment interactions that shape ecosystem service provision (Raymond et al. 2013). Some proponents have argued that environmental goals must not be conflated with social objectives that might compromise economic efficiency or distract from the environmental aims of PES schemes (Wunder et al. 2008, Kinzig et al. 2011). The resulting conservation schemes should either adopt a *do not harm*

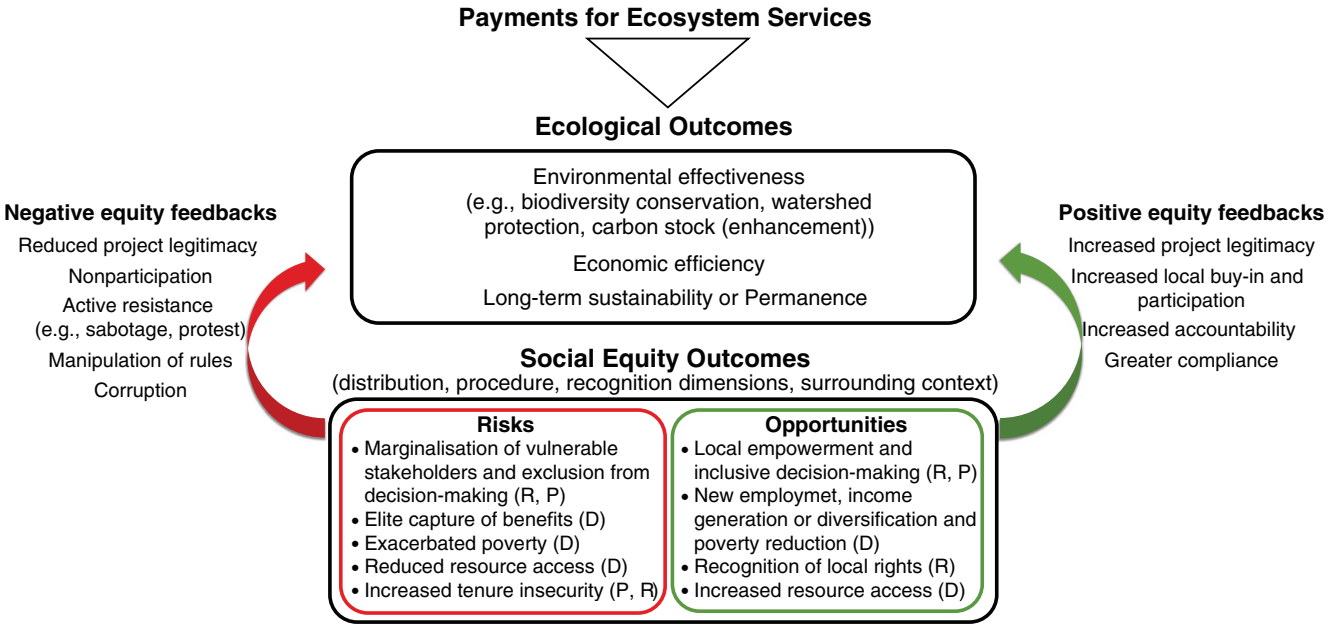

Figure 2. Payment for ecosystem services schemes affect a range of distributional (D), procedural (P), and recognitional (R) dimensions of social equity, mediated by the surrounding context (see figure 1). These dimensions represent both risks and opportunities of conservation, because equity impacts have the potential to feedback on ecological outcomes.

approach in which conservation is sought without a decrease in equity (Barrett et al. 2011) or in which the equity considerations to be addressed are externalized through separate policy instruments (Kinzig et al. 2011).

This efficiency framing of PES remains mainstream within many conservation institutions and in many popular portrayals of PES, and it conditions how scientists and decision-makers view and understand PES. Moreover, the approach is representative of a broader view in which market-like instruments take an ever-increasing prominence in environmental management (McAfee 1999, Muradian et al. 2013).

Contested role of equity in PES framings

However, the exact relationships between equity and the outcomes of environmental management and conservation programs remain unclear (Miller et al. 2011, Halpern et al. 2013). This is especially true in the context of PES (Pascual et al. 2010), in which most schemes are relatively recent and have not been subject to long-term evaluations. Nor is there robust evidence that a market-based approach to conservation yields a comparative advantage for sustaining ecological outcomes in a cost-effective way (Miteva et al. 2012). Nevertheless, narrow efficiency-focused PES designs are potentially at odds with lessons from past conservation experiences. It is increasingly accepted that integrating social considerations into environmental management planning is instrumental to achieving more-robust ecological outcomes (e.g., Chan et al. 2012, Ban et al. 2013, Kinzig et al. 2013, Redpath et al. 2013). As we illustrate below, divorcing equity considerations from PES risks the oversimplification of conservation challenges. Framing resource management in purely economic terms neglects the fact that PES efforts are embedded in complex systems in which other social and political processes interact (Hirsch et al. 2010).

Not surprisingly, as PES schemes have evolved, efforts have also increased to incorporate equity dimensions into their design and implementation. This has emerged in response to realities on the ground, public pressure, and as part of ad hoc, learning-by-doing processes. For example, REDD+ policies under debate through the United Nations Framework Convention on Climate Change—originally driven by a focus on low-cost carbon emissions mitigation—have evolved to integrate social safeguards (box 1).

Likewise, Costa Rica's pioneer forest conservation PES scheme has increasingly integrated equity dimensions into planning. This program, established in the 1990s to engage private landowners in forest conservation and regeneration and in improved management of unprotected forests, is now directed toward redressing inequities that originated because larger landowners and corporations dominated the scheme (Porras 2010). For example, through the state agency responsible for payments, the formal land title requirements that excluded many poor farmers have been eliminated, and participation in areas with low social development index rankings has begun to be prioritized.

Ecuador's SocioPáramo incentive program is another clear example of the shift toward an explicit equity-focused PES approach. Established in 2009, the scheme prioritizes sites on the basis of the threat of deforestation and their relative importance in terms of carbon storage, hydrological regulation, and biodiversity conservation, targeting areas such as the Tropical Andes and Tumebes-Chocó-Magdalena

Box 1. Equity impacts feedback on REDD+ scheme function.

As dozens of projects of the United Nations' Reducing Emissions from Deforestation and Forest Degradation program (REDD+) have emerged across the tropics, policies to leverage financial incentives to reduce tropical deforestation and the associated greenhouse gas emissions remain under debate through the United Nations Framework Convention on Climate Change (UNFCCC). REDD+ policies have been developed for their potential to yield low-cost, efficient emissions abatement through which industrialized nations can offset their domestic emissions. The associated policies also promise to yield broader cobenefits for biodiversity and other ecosystem services, primarily where these geographically overlap with high carbon density forests.

However, REDD+ policies have also been cited for neglecting the complex social–ecological interactions that can ultimately determine ecological functioning and the trade-offs that can emerge among carbon sequestration, other ecosystem services (e.g., biodiversity, water provision), and human development priorities (e.g., resource access). Because of a lack of adequate social and environmental safeguards and equity-conscious design, there has been widespread concern that REDD+ policies that are focused on low-cost carbon emission abatement could have numerous unintended consequences for both broader forest ecology and forest-dependent human communities because of changes in the provision of ecosystem services; shifts in conservation funding; and restrictions to community rights, resource access, and territorial claims. These prospective negative equity effects have prompted a strong precautionary response and mobilization of forest-dependent and indigenous communities to call for social safeguards via active policy engagement and protests (Chhatre et al. 2012) (figure 3). As a result, many REDD+ policies and projects are evolving to integrate social safeguards into their design. This was exemplified during the UNFCCC's nineteenth Conference of Parties in 2013, where, after 7 years of debate, the parties resolved that participating countries would be required to report on social safeguards prior to accessing payments for ecosystem services.

However, disagreements over these types of equity considerations have yielded feedbacks on early REDD+ implementation: Tensions and debates have delayed policy development, postponed pilot projects, compromised trust, and introduced or rekindled conflicts.

In Ecuador, for example, REDD+ policies now face strong opposition from indigenous peoples. Although the opposition is multifaceted, much of it has arisen as a result of a lack of coordinated communication about REDD+ to the indigenous communities, a lack of these peoples' participation in the decisionmaking processes, and their general distrust of government agencies (Reed 2011). The risks of indigenous noncooperation or nonparticipation are substantial: Approximately 60% of the remaining forests are on indigenous lands. Similar tensions with indigenous and forest-dependent communities have complicated REDD+ implementation in other tropical countries, including Indonesia and Panama (see the supplemental material).

hotspots. However, the scheme also uses rural poverty levels to define priority areas, favoring resource allocation among indigenous communities and diminishing payments as a participant's land size increases, to reduce strategic rent seeking by powerful and large landholders (Bremer et al. 2014). There is therefore a tension between the original theoretical underpinning of PES as intended to maximize value for money and the realities on the ground, which underlines the need to include social equity considerations.

The extent to which these equity dimensions undermine conservation objectives constitutes an important part of the vigorous debate—among practitioners and academics—over the scope, optimal design, and implementation of PES (Kinzig et al. 2011, Corbera and Pascual 2012, Muradian et al 2013, Wunder 2013). Among the ongoing contests over the role of equity in PES, we provide a framework to help structure these debates, future research, and project design.

Equity as instrumental to conservation

PES schemes can influence public behavior, values, and social norms (Kinzig et al. 2013) and can yield a range of social equity impacts—both positive and negative (Porras 2010, Bremer et al. 2014). Many of these equity impacts potentially influence ecological outcomes, which creates equity–efficiency trade-offs and synergies (Pascual et al. 2010). Drawing on the literature about PES, other longer-established conservation instruments (e.g., protected areas, integrated conservation and development programs), and field experience in tropical developing countries, we illustrate the key pathways (distributional, recognition, and participation) by which social equity may effect PES schemes' function to shape ecological outcomes (figure 2). The supplemental material further highlights a wider range of cases from the literature (including non-PES examples) to further illustrate these relationships.

There are cases in which PES schemes have yielded revenue distribution that prioritized the poor (Bremer et al. 2014), promoted inclusive decisionmaking, and strengthened local resource governance (see box 2). However, there are also instances in which PES schemes have had negative effects on equity (Porras 2010), associated with a failure to recognize and engage key stakeholders, such as indigenous peoples and forest-dependent communities (box 1), or restrictions on subsistence resource access (figure 2; Ibarra et al. 2011). These negative equity effects are aggravated when the risks are perceived as irreversible or irreparable, such as the loss of rights to ancestral lands and intracommunity conflicts, for which there may not be adequate mitigation or compensation (see Chan et al. 2012). In other

Figure 3. (a) Indigenous peoples and allies from Chiapas and the Amazon protest REDD+ in front of the Sacramento, California, capital building in October 2012, following a California Air Resources Board hearing in which they testified on the adverse impacts that REDD+ is already having on communities. Photograph: Jeff Conant, Friends of the Earth. (b) Recent initiatives to develop social impact assessment methods with local communities for a REDD+ pilot in Kilwa, Tanzania. Photograph: Adrian Martin.

cases, such as in Mexico's Scolel Té carbon forestry project (box 3), PES has yielded mixed positive and negative equity impacts. The program has helped to improve rural livelihoods through income-generating forestry but has excluded landless residents and women, with a resultant uneven distribution of PES benefits (Corbera et al. 2007).

Crucially, there is mounting evidence from diverse conservation initiatives that these impacts on equity can have important feedbacks in terms of how PES schemes function (figure 2, supplemental material). For example, greater local autonomy over conservation monitoring and enforcement have been linked to enhanced project legitimacy (Kanowski et al. 2011), stronger accountability and improved compliance, which yield positive ecological outcomes (figure 2, supplemental material). Participatory approaches and deliberative conflict management strategies may also improve ecological outcomes (see Redpath et al. 2013, Raymond et al. 2013). Similarly, local perceptions of fairness in the distribution of PES benefits have been linked to greater scheme credibility and effectiveness and may be even more important to a scheme's success than the actual amount paid through PES (box 2; Gross-Camp et al. 2012).

Conversely, PES that negatively affect equity can create equity risks that undermine conservation goals (figure 2, supplemental material). They can trigger negative feedbacks that erode the scheme's legitimacy, reduce stakeholder participation, and result in a range of conservation conflicts that can undermine ecological outcomes (see Kinzig et al. 2013, Redpath et al. 2013), such as through rule breaking, sabotage, and protest (Brockington and Igoe 2006); the cancellation of PES contracts (Ibarra et al. 2011); and corruption and manipulation of conservation rules (supplemental material; cf. Scott 1985). These negative equity feedbacks may ultimately undermine a PES scheme's viability and may require ex post enforcement, mitigation, outreach, and compensation. This can significantly add to operational costs and therefore erode the economic efficiency associated with PES. There are, for example, prominent examples of how the equity risks (both actual and perceived) associated with recent REDD+ schemes have delayed the projects' implementation, required mitigation, and prompted local resistance (box 1, supplemental material).

Perceptions of equity and fairness, and feedbacks on conservation are deeply context dependent and are shaped by place-specific social norms, by the institutions that mediate how interventions play out in practice, and the overall conservation and human development objectives. Just as it is difficult to generalize across cases, it is also hard to generalize across social actors, because what may be an opportunity for one stakeholder may represent a risk for another. For example, instances of elite capture in the Scolel Té carbon project represented significant new economic opportunities for the local elites, even if they excluded large parts of the community (box 3).

Moreover, equity impacts and feedbacks have to be considered at different spatial and temporal scales, because these are important in defining who experiences benefits and burdens and how they do so. For example, the time frames over which equity impacts feedback to influence ecological outcomes may be beyond the time horizon of a specific conservation project. As a result, although equity blindness may be deemed adequately efficient in the short-term, the

Box 2. Considering equity within payments for conservation services in Rwanda.

Nyungwe National Park covers more than 900 square kilometers; is part of one of the largest continuous lower montane forests in Africa; and hosts a number of threatened and endemic species, including the owl-faced monkey (*Cercopithecus hamlyni*). However, the region is also densely populated, and the park is subject to various forms of human activity. In the past few decades, the forest has lost its apex grazers—buffalo (*Syncerus caffer*) and elephants (*Loxodonta africana*)—and has probably lost its apex carnivore, the leopard (*Panthera pardus*). Ecological functions will almost certainly be effected as these losses cascade down through trophic levels. From 2009 to 2012, a trial payment for ecosystem services (PES) scheme in Rwanda provided financial incentives for local people to reduce hunting with snares, tree cutting, and mining within Nyungwe National Park (figure 4).

Concerns about social equity were largely addressed by detailed community consultation over key aspects of the PES's design, such that the specific conservation indicators, performance targets, and payment distribution methods varied from site to site. For example, at one site, the community chose for the majority of the payment to be managed communally for the public good, whereas, in others, they felt it fairer for most of the payment to be distributed equally among all households.

One key finding from this trial was that where PES schemes are designed to resonate with local conceptions of social equity, this might bestow the single greatest advantage over traditional fines-and-fences approaches to conservation. The short-term ecological outcomes from the scheme were an improvement in the performance of the rest of the park, indicated by reduced hunting and tree cutting. However, there was little difference compared with matched locations in which traditional park monitoring was increased but with no payments. This confirms that a fortress conservation approach can also achieve ecological outcomes in the short term, at least in contexts such as Rwanda, where a combination of high deterrents (including the fear of death) and enforcement work in tandem with modernizing political discourses to turn people away from the forest.

There was, however, an important difference: In the PES trial areas, local attitudes toward both the park and its authorities improved significantly compared with those in the matched areas, which suggests that the conservation gains would be more robust in the long term. This suggests that the main comparative advantage of the PES scheme came from its legitimacy, a prospective positive equity feedback. Although a more efficient PES scheme might have been achieved by differentiating household payments according to household opportunity costs, in practice, this would have been considered inequitable and illegitimate (Gross-Camp et al. 2012, Martin et al 2013). Any efficiency gains would likely be short lived if they are not considered fair by the participants.

Box 3. Positive and negative equity outcomes in the Scolel Té carbon forestry project, Mexico.

The Scolel Té carbon forestry project in the states of Chiapas and Oaxaca, Mexico, is the first farmer-driven forest carbon offset project in the world (*http://ambio.org.mx/scolelte*). It creates financial incentives to encourage farmers and community groups to design 20-year land-use management plans that incorporate forest mitigation activities, such as tree plantations, agroforestry systems, and live fences. A focus on community engagement and the livelihood dimensions of payment for ecosystem services (PES) has facilitated the project's expansion to now cover 2400 households in 50 communities across more than 9600 hectares within temperate coniferous, temperate broadleaf, and tropical moist forest areas (figure 5).

However, this focus on farmers' priorities has impinged on some desired ecological outcomes. Farmers tend to focus on timber species and monoculture plantations (e.g., *Pinus* spp., *Cedrela* spp.), and live fences (e.g., *Juniperus lusitanica, Cedrela odorata*). This potentially feeds back to shape ecological outcomes, because these species often have greater income-generating potential and lower labor costs and involve easier maintenance than more-complex and biologically rich agroforestry systems.

Despite attention to many important equity dimensions, in an effort to reduce management costs and increase efficiency, the project progressively abandoned an early emphasis on gender equity, originally promoted through the provision of cleaner cook stoves and fruit tree seedlings for home gardens. There is also evidence that a failure to address the underlying tenure claims and power dynamics within the participating communities resulted in elite capture of the PES scheme. Local elites, whose status is largely determined by their local political affiliation and the size of their land holding, largely control the project information, decisionmaking, and access, which results in uneven benefit sharing, conflicts among participants and nonparticipants, and limited project up-take (Corbera et al. 2007). The ecological implications of this skewed participation remains uncalculated but potentially represent a negative equity feedback associated with lost conservation opportunities as a result of nonparticipation.

assessment may change if longer time frames are analyzed. Likewise, reducing forest carbon emissions by protecting a large tropical forest area and excluding forest-dependent communities would likely be deemed unfair to the local stakeholders but might be considered positive at other spatiotemporal scales, when the implications of global climate change on future generations are considered. Such social spatiotemporal tradeoffs are therefore highly dependent on what and whose fairness criteria are counted (Pascual et al. 2010).

Figure 4. (a) Nyungwe National Park, Rwanda. (b) Collecting bamboo (*Yushania alpina*) from the park is strictly illegal, in part because it forms part of the diet of the threatened endemic owl-faced monkey (*Cercopithecus hamlynii*). This man's family says that they still rely on bamboo crafts, partly because they never received compensation for land taken from them when the park was gazetted in 2005. Photographs Adrian Martin.

Rescuing equity in an era of efficiency

Governing ecosystem service provision through idealized, efficiency-led PES schemes runs the risk of failure as a result of the application of single-objective tools to complex social ecological phenomena (Ostrom 2007). In contrast, an approach in which equity risks are seriously considered, and in which positive equity feedbacks are capitalized on, may identify synergies and may achieve more-robust outcomes that can be sustained over time. However, a broadened PES approach must contend with the complex social–ecological relationships that mediate ecosystem services provision and human well-being (Hirsch et al. 2010).

Such a PES approach necessitates the recognition of the multiple dimensions of equity as explicit, intermediate targets. A PES scheme focused on optimizing environmental effectiveness while aware of both equity considerations and financial budgetary constraints will likely involve social and environmental safeguards to avoid unintended impacts. However, safeguards must be binding, enforceable, and subject to evaluation (Chhatre et al. 2012). Experiences to date clearly demonstrate the need to move beyond generic, voluntary guidelines and *do no harm* approaches toward an approach that explicitly allows equity considerations to shape PES design (Ribot and Larson 2012).

This necessitates that conservation efforts better recognize and engage the multiple stakeholders that use and benefit from ecosystem services and the ways in which they conceive and construct claims around different equity dimensions. For example, efficiency-focused PES design might exclusively favor contractual agreements with legal large-land titleholders and resource managers. In contrast, an equity-conscious approach would also map out the broader relationships between benefit flows at multiple scales and different actors' well-being. Such an approach would better consider how these other stakeholders, including marginalized and resource-poor people, would be affected by PES schemes and how they would experience and react to these changes. It would also help visualize how PES incentives are likely to alter relationships with and among communities, and between people and nature. At a minimum, this type of engagement would require outreach and support in order for PES scheme participants to meaningfully engage in decisionmaking. This would involve access to credible and comprehensible social and ecological data, to allow people to weigh their options and contribute to decisionmaking in line with free, prior, and informed consent principles (Ribot and Larson 2012, McDermott et al. 2013).

However, a deeper engagement in participatory PES design has been largely neglected to date (Petheram and Campbell 2010). Indeed, there are considerable challenges to engaging stakeholders in negotiations and conflict management (e.g., Redpath et al. 2013) and to understanding the internal community inequalities, the empowerment of marginalized groups, and the facilitation of participatory decisionmaking. Moreover, the various nonmaterial and noneconomic (e.g., religious, relational, cultural, ecological) benefits of ecosystems are often difficult to capture and to consider within the prevailing market logic and economic valuation (Gómez-Baggethun and Ruiz-Pérez 2011, Chan et al 2012). Overcoming these challenges would necessitate a broader recognition of the diverse values and identities attached to ecosystems, beyond economic appraisals that characterize the prevailing efficiency-focused design of PES schemes.

Accounting for equity—particularly, the procedural and recognition aspects—would entail the integration of participatory decisionmaking tools into PES design (e.g., Petheram and Campbell 2010). It may further depend on an adaptive governance approach (Kenward et al. 2011). Such a framework would imply a more flexible and dynamic approach to

Figure 5. Reforestation activities for carbon offsetting and fuelwood collection in an indigenous commons, Chiapas, Mexico. The reforestation activities involve tree species that often fail to match the preferred options of women, who are primarily responsible for fuelwood collection and who prioritise tree species that deliver higher quality firewood and animal fodder, including oak (*Quercs *sp.) and willow (*Salix *sp.). Photographs: Esteve Corbera.

PES. It would further prioritize the development of a more strategic and systematic approach to adaptive learning and to the design of PES mechanisms than the current ad hoc trial-and-error approach documented for most existing PES adaptations.

An adaptive approach to PES governance might include various interconnected elements. For example, socially inclusive decisionmaking in PES could potentially lead to schemes that involve flexible contracts that allow for built-in periodic renegotiations and termination options. This would open the scope for renegotiating targets and objectives in light of unforeseen social, economic, and ecological changes (Engel et al. 2008). Such flexibility might be crucial in the context of changing market conditions (e.g., commodity prices) and evolving participant needs and would be crucial in the context of long-term (often decadal) PES contracts. In addition, adaptive PES management would depend not only on inclusive PES design but also on ongoing monitoring of both ecological and equity impacts or outcomes, likely including participatory evaluation (Jack et al. 2008), with an emphasis on known socioeconomically disadvantaged groups.

Conclusions

As PES schemes become increasingly popular, there is a clear need to integrate the lessons from previous conservation instruments, including a greater appreciation for the human dimensions of conservation (Kanowski et al. 2011). In addition to the optimization of scarce financial resources channeled for conservation, PES must be recognized as operating as part of complex institutional landscapes in which formal and informal norms, policies, regulations, and markets interact. Not only must these complexities be recognized, but they should be integrated in PES design. In practice, emerging PES schemes often bear little resemblance to the imagined, efficiency-driven, market-environmentalism model, because they operate within everyday cultural, institutional, and political realities that influence stakeholder behavior (Muradian et al. 2013). Beyond the contested theoretical models of economic rationality, on-the-ground realities need to inform future research and the further refinement of conservation instruments.

However, we must also evaluate the trade-offs associated with integrating equity dimensions into PES planning. Crucially, equity-conscious design potentially increases the costs and complexities of conservation, which delay decisions in which actions are urgent or money needs to be quickly disbursed. It is necessary to determine to what extent and under what circumstances and time scales equity considerations can improve the robustness of conservation and environmental management outcomes while offering a net economic payback. This type of evaluation will become particularly important in the context of new mandated social safeguards within REDD+ incentive schemes.

Similarly, the viability of equity-blind approaches to conservation needs to be more critically assessed. This implies identifying circumstances in which conservation successes can be achieved with little concern for equity, such as in the case of well-enforced protected areas, where conservation may still be possible in spite of negative equity impacts. These will be cases in which normative or moral rather than economic assessments will be required. But the available evidence suggests that much conservation operates under circumstances in which a sensitivity to equity resonates with a concern for ecological effectiveness.

All this calls not only for an expanded knowledge base but also for greater research space and strengthened science–policy interactions that will improve our understanding of how conservation interventions influence and are shaped by behaviors and social norms over time (Kinzig

et al. 2013). This is occurring through growing, vigorous debates about REDD+ forest carbon payments and a renewed dialogue over broader PES design (box 1; e.g., Kinzig et al. 2011, Corbera and Pascual 2012, Muradian et al. 2013, Wunder 2013). The recently established United Nations' Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) could represent a particular opportunity to bridge diverse scientific perspectives and traditional knowledge systems to better inform conservation scheme designs. However, this also represents a crucial site for strengthened cooperation among ecologists, conservation practitioners, and social scientists to better articulate the relationships between scheme design and ecological outcomes (see Kinzig et al. 2013). Although the debates over PES design have often been dominated by economists, input from other social disciplines (e.g., anthropology, psychology, sociology, history) and from the life sciences could potentially facilitate a more critical evaluation of the effectiveness and trade-offs associated with different PES designs (e.g., Halpern et al. 2013). Such evaluations should include a consideration of various nonmaterial dimensions (Chan et al. 2012) while also recognizing that decisionmaking will, in many cases, also benefit significantly from evaluations in which measurable outcomes are considered—to which life scientists can undoubtedly contribute.

Incentive-based schemes hold promise—including their potential to promote voluntary conservation and to shield conservation from its traditional fiscal constraints. In an era of global uncertainty and volatility, tough decisions about how and where to invest inevitably bring a focus on economic efficiency. However, schemes are unlikely to succeed in the long term unless they integrate lessons learned from experiences on the ground, including lessons about social equity. Parallel efficiency–equity debates have emerged across several sectors, to interrogate the broader relationships among human capital, equality of opportunity, and economic prosperity (Stiglitz 2012). Across contexts, the evidence increasingly suggests that equity also matters for instrumental reasons and cannot be removed from decisionmaking; they can only be partially and temporarily obscured.

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Supplemental material

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