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Governing the global commons: Linking carbon sequestration and biodiversity conservation in tropical forests ☆

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ABSTRACT

Biodiversity loss will be among the major impacts from climate change. Separate international political processes address climate change and biodiversity, yet the scientific evidence strongly links the two. For conservation groups, addressing climate change is increasingly necessary to protect biodiversity. Protecting tropical forests as biodiversity habitat is important as well to mitigating climate change, as deforestation and forest degradation represent a major source of greenhouse gas emissions. Thus, discussions currently underway on the political and technical feasibility of rewarding countries and their inhabitants financially for protecting their standing forests as carbon sinks are of vital interest to conservation groups.

1. Introduction

The Millennium Ecosystem Assessment (2005) and other recent scientific assessments (e.g. IPCC, 2007; Lovejoy and Hannah, 2005; Parmesan and Yohe, 2003) find that future climate change is likely to have significant repercussions for biodiversity through changes in habitat and species range, adding to existing threats like unsustainable harvesting, deforestation, disruption of migration paths by infrastructure and human settlements, and introduction of invasive species. Thus, conservation-minded organizations have had to confront climate change as a serious threat to their goals and objectives.

This article considers how conservation organizations have had to evolve in order to be able to respond effectively to the climate change problem. This represents the latest phase of an evolution that had previously seen many conservation organizations shift emphasis from domestic conservation efforts in rich countries, where they have achieved considerable success, to protecting biodiversity hotspots, many in tropical rainforests of developing countries.

Conservation, or environmental, non-governmental organizations (ENGOs for short) have also been reassessing the role of different types of institutions and exploring various incentive and financing mechanisms for biodiversity conservation. This has been a response in part to a broad shift in environmental policy thinking towards market-conforming regulation, and in part to the recognition of weak government capacity in many developing countries to enforce regulations (e.g., to police protected areas, stop illegal logging) in the face of strong economic and demographic pressures on environmental resources. As yet, however, efforts at mobilizing conservation finance through markets have met with only modest success. The evolving global carbon markets provide an opportunity to scale up the levels of finance for biodiversity conservation to the extent that measures designed to protect biodiversity and those to sequester carbon are mutually consistent.

The article proceeds as follows. The next section briefly discusses the prevalent models governing efforts to conserve biological diversity and to address climate change, respectively, pointing to the limitations of existing models from the perspective of capturing the joint benefits of biodiversity conservation and carbon storage. The article then touches on the new incentive and financing mechanisms, and on the new political coalitions which

☆ The views expressed here are solely those of the author and do not represent those of his affiliated institution.

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could contribute to realizing a closer alignment of biodiversity and climate change goals. Particular attention is given to tropical forests as rich biodiversity habitats and to current initiatives to provide financial incentives for reducing greenhouse gas emissions from deforestation. Some technical issues involved in linking carbon finance with biodiversity finance in this way are then briefly examined. Next, social equity issues involved in implementing the proposals under consideration are examined. The article concludes with a summary of the arguments and a few observations on areas for further research.

2. Current models and their limitations

Biodiversity conservation and climate change mitigation share a number of common features. Both involve supply of global public goods and require coordinated global action. In both cases the supply depends to a considerable degree on the actions of sovereign states and private actors within them. In the case of habitat for terrestrial biodiversity, governments regulate land use, but within those broad parameters private actors decide what sort of land use is most rewarding. Moreover, government regulation in this area is often hampered by weak enforcement. Thus, if a tropical forest is not protected by law, and sometimes even if it is, and if the timber market and/or agricultural market price incentive to clear cutting is strong, there is a high probability that the habitat will be destroyed or degraded. Clear assignment and enforcement of property rights can serve to create incentives for sustainable timber harvesting instead of clear cutting, but where biodiversity conservation and other services provided by the forest ecosystem are not priced, harvesting will be excessive and such services will be undersupplied.

In the case of both biodiversity and climate change, effective action depends on the agreement and cooperation of sovereign states. In turn, national governments must put in place legislation and regulations to implement any resultant treaty obligations. Ultimately, delivering the global public goods of biodiversity conservation and climate stabilization depends on influencing the preferences and behaviours of multiple individual and group actors.

2.1. Conventional approach to conservation

Conservation efforts in developed countries have involved a combination of *in-situ* measures—publicly designated nature reserves (e.g., national parks), conservation set-asides (e.g., through the creation of trusts to purchase land of significant conservation value), and biodiversity corridors—and *ex-situ* measures like zoos, botanical gardens and gene banks. As the focus of conservation efforts increasingly has shifted to developing countries and remaining global biodiversity hotspots, new approaches have been needed. In particular, it has been necessary to address the difficulties of protected area management in the context of extreme poverty and population pressures on scarce land and other natural resources. Mixed-use buffer zones surrounding parks and community-based forest management schemes have been employed in response to this challenge.

Traditionally, the financing of biodiversity conservation has been based on a donation-driven model (Swingland et al., 2002). Together with networks of national parks in many countries, one of the most important contributions to biodiversity conservation comes from ENGOs and the private philanthropies and individuals who support them. The Convention on Biological Diversity, in Article 20, calls for new and additional resources to be made available by developed countries to finance the establishment of protected areas in developing countries, but, as Barrett (2003) notes, few resources have been made available for this purpose. A new study (Hicks et al., 2008) finds that, with governmental endorsement of Agenda 21 at the Rio Conference on Environment and Development (UNCED) in 1992, biodiversity conservation received higher global visibility and increased development assistance. Donor support for biodiversity projects rose from $47 million in overseas development assistance (ODA) between 1980 and 1989, to $2.3 billion between 1990 and 1999. Still, this represents only about one-eighth of what the authors of Agenda 21 estimated would be needed from the international community to implement the proposed conservation measures.

2.2. Conventional approach to climate change mitigation

The international climate change policy regime as codified in the Kyoto Protocol is based on targets and timetables—i.e., to keep greenhouse gas emissions during the control period, 2008–2012, to within *x*% below or above a base-year level (usually 1990)—applicable to only a subset of emitters, viz., the Annex 1 (industrialized) countries. In this respect, it is different from the Montreal Protocol on ozone-depleting substances, which mandated a complete phase-out of controlled substances by all Parties, but with developing countries granted a grace period and financing from a dedicated fund to facilitate compliance. Integral to the Kyoto framework are so-called flexibility mechanisms which permit Annex 1 countries to meet targets through trading of carbon credits in an international market. The use of market mechanisms is a relatively recent innovation in environmental policy, with the first large-scale use of emissions trading enshrined in the US Clean Air Act Amendments of 1990, authorizing trading of sulphur dioxide (SO_2) emission credits among power plants.

Carbon markets are a central feature of the present international regime to combat climate change, and developing countries can participate in those markets as suppliers of carbon credits (called certified emission reductions—CERs) through the clean development mechanism (CDM). These project-based credits may come from a variety of investments, including in energy-efficiency improvements, renewable energy, landfill methane and reforestation and afforestation projects. Presently, however, there is no crediting of actions to avoid the release of carbon from destruction (or degradation[1]) of existing forests—referred to as reduced emissions from deforestation (RED, or REDD when forest degradation is included). Yet, deforestation and associated land-use changes account for approximately one-fifth of annual greenhouse gas emissions.

RED has been excluded from the CDM for a variety of reasons. These include: the problem of defining an appropriate baseline, or reference emission level from deforestation; uncertainty about the additionality of credits because of the possibility of domestic carbon leakage (where protection of forest in one location is offset by accelerated deforestation elsewhere); uncertainty about the permanence, or durability, of credited reductions (e.g., what happens if a credited forest is then felled or destroyed by a forest fire?); liability in the event of non-permanence; the risk that large forest-related carbon credits would retard the transition to a low-carbon energy system by depressing the world carbon price; concern of some countries that national sovereignty over their forest resources could be compromised by integrating them within global carbon markets (Olander and Murray, 2007). Methodological work ongoing under the auspices of the United

[1] Carbon emissions from forest degradation pose more complex measurement problems than those from deforestation. There is thus disagreement about whether (and how) to include avoided degradation in an incentive regime.

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Nations Framework Convention on Climate Change (UNFCCC) is attempting to shed light on and offer possible solutions to these problems.

In the remainder of this article, consideration is given to options for linking incentive and financing mechanisms for biodiversity conservation with those for greenhouse gas abatement. Viewing biodiversity conservation and climate change mitigation as joint objectives can lead to innovative approaches based on new political coalitions, incentive regimes and financing mechanisms. Particular consideration is given in what follows to the relevance of this linkage for conservation groups and their future strategies.

2.3. Towards a synergic approach

What does climate change mean for the strategies of the ENGOs?

With respect to their conservation strategies *per se*, ENGOs will need to consider how entire ecosystems are likely to be affected by climate shifts. The conventional approach of protecting key hotspots may no longer suffice if climate change substantially alters local ecosystems. More attention needs to be given to how to cope with shifts in geographic distribution and boundaries of such ecosystems and shifts in range of various species which they support.[2]

With respect to their broader strategies, ENGOs have begun forging links between biodiversity conservation, on the one hand, and the global carbon markets, on the other. As noted above, the existing flexibility mechanisms of the Kyoto Protocol only credit land-use change in the form of reforestation and afforestation, not the protection and sustainable management of existing forests. Yet, from the perspective of biodiversity conservation, the protection of existing multi-species primary growth forests is arguably more valuable than reforestation or afforestation, especially where the latter activities are based on monocultures, possibly involving non-native species.

The conservation of tropical forests has an opportunity cost which is a function of both world timber prices and the returns to alternative land uses such as agriculture and livestock raising. The steep rise in agricultural prices of recent years has significantly raised that opportunity cost in some places. So far, the international community has not shown a willingness to bear a significant share of the cost of tropical forest conservation in developing countries. This may have to do in part with the uncertainties involved in valuing biodiversity. Comparatively speaking, the valuation of the carbon sequestration benefits of tropical forests poses a less daunting challenge. Thus, now that carbon sequestration has emerged as a valuable additional benefit of forest conservation, the possibility exists that the international community will be willing to share more fully in the costs of avoided deforestation.

3. New incentive regimes and financing mechanisms

The incentives to continued deforestation are strong, not least due to the relatively new demand for agricultural land to grow crops for biofuels. Combined with weak government capacity for management of forests and enforcement of logging restrictions, these incentives frequently pose major obstacles to slowing tropical deforestation. On the other hand, political will and enforcement capacity have been improving in some key rainforest countries, with satellite surveillance technologies abetting enforcement.

New incentive regimes designed to reward sustainable forest management and sustainable agricultural practices are gradually taking shape. In addition, thinking and practice are evolving on how better to align incentives in the climate change regime with biodiversity conservation goals, and on how to devise new markets and business models which can yield financial rewards to the joint provision of biodiversity conservation and carbon sequestration services.

One relatively new market-based approach to deterring deforestation and habitat loss is voluntary certification of products and practices. Some certification schemes apply to the forestry sector, while others apply to agriculture. The best known of the former is that of the Forest Stewardship Council (FSC), while the best known of the latter is that of the Rainforest Alliance. What distinguishes all such schemes is their reliance on the preferences of environmentally conscious consumers as expressed through markets to drive certification demand. Presently, the acreage of forest and agricultural land covered by such certification schemes remains miniscule, but in both cases it is rapidly growing. In the case of forests, over the past 13 years, over 222 million acres in more than 82 countries have been certified to FSC standards. As of mid-2006, the total area of certified forest worldwide was around 667 million acres (Bishop et al., 2007, Fig. 2). This amounts to roughly 6.8% of the world's forests. Yet, consumer demand for products from sustainably grown timber is still far from universal, even in rich countries. Moreover, it is not clear how far the new middle classes of Asia and other emerging economies will share strong environmental preferences. Given the rapid growth and projected future size of emerging markets, consumption pressures on biodiversity habitat could remain strong for many years to come.

A somewhat different approach to rewarding biodiversity habitat protection focuses on supplying eco-tourism and other ecosystem-derived services through biodiversity conservation investments. There is long-term potential in this market insofar as the continued loss of biodiversity increases its scarcity value over time, consistent with the theory of exhaustible resources. A pioneer in the field of privately provided biodiversity conservation services was the publicly listed Earth Sanctuaries Ltd. (ESL) of Australia, which created several nature reserves to help protect indigenous species in that country while attracting significant tourism business (Daily and Ellison, 2002). At its peak of land ownership in 2001, the company owned sanctuaries covering more than 222,300 acres. Subsequently the company went bankrupt.[3]

Another interesting case is the biodiversity reserve known as ACG (Area de Conservación Guanacaste) in Costa Rica. This area of degraded forest was rehabilitated in significant measure using funds provided by private interests—in particular a private company which used a part of the reserve as a biological treatment site for citrus waste, which decomposes rapidly in the microbe-rich environment, in turn enriching the soil and suppressing the growth of non-native pasture grasses which served as kindling for forest fires. Even though this arrangement has ceased, the conservation area continues to generate significant revenue from ecotourism as well as from researchers. Also, the AGC has been a source of bio-specimens in an innovative bio-prospecting contract negotiated in 1991 (and twice renewed) between the pharmaceutical company Merck on the one side and the Instituto Nacional de Biodiversidad (INBio) on the other,

[2] I am grateful to Kristin Hayes of Fauna and Flora International for this point.

[3] See Conservation Finance blog of Lars Christian Smith: http://conservationfinance.wordpress.com/2006/09/02/earth-sanctuaries-ltd-goes-belly-up/

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including a royalty sharing agreement should any new pharmaceutical product or agricultural compound isolated or developed from the samples prove commercially successful (Daily and Ellison, 2002). Also, in collaboration with the Inter-American Development Bank, INBio has launched an initiative, supported by its Office of Biodiversity in Support of Business Development, to work with small private enterprises in the sustainable commercial development of biodiversity.[4]

While an early attempt—in the mid-1990s—by the managers of AGC to extend the range of marketable ecosystem services provided by the reserve to include carbon sequestration proved premature, the linkage of biodiversity and carbon services continues to be explored in different contexts. Its attraction lies in the fact that the value of a forest ecosystem would be enhanced if not one but two of its environmental services could be sold. Both these markets are still immature and illiquid, so it is difficult to assess the long-term potential. Still, it could be substantial, depending on the outcome of ongoing international discussions on financial incentives for RED.

If climate change is to be tackled by the international community, there is no alternative to deep cuts in net global greenhouse gas emissions by the middle of this century. Stern (2007) calculates that, to stabilize global concentrations at 450 ppm carbon dioxide equivalent (CO_2e), global emissions would need to peak in the next decade and then fall to 70% below current levels by 2050. Efforts to contain the costs of emission reductions could make forest-related investments highly attractive if, as recent analyses suggest (Stern, 2007; Enkvist et al., 2007), biological carbon sequestration represents a low- to moderate-cost abatement option. The challenge for the conservation community will be to encourage selection and design of investment projects which yield substantial biodiversity benefits as well.

The World Bank's BioCarbon Fund represents one example of this approach, using voluntary contributions from donor countries and private sources to finance demonstration projects in developing countries which sequester or conserve carbon in forest and agro-ecosystems. The fund also aims to deliver the joint benefits of biodiversity conservation and poverty alleviation. The first tranche, which began in March 2004, has a capitalization of almost $54 million; the second tranche, which began in March 2007, has a capitalization of $38 million; both are closed to new fund participation. Since 2006, the first tranche of the fund has supported three RED projects, one in Colombia, one in Honduras and one in Madagascar.[5] This is a pilot scheme and the capital available is very small relative to potential resource mobilization if credits from RED were tradable in global carbon markets.

More recently, the World Bank has launched a new Forest Carbon Partnership Facility, which supports pilot activities that reduce emissions from deforestation and degradation using a system of policy approaches and performance-based payments.[6] According to its publicity, the FCPF seeks to create a body of knowledge and experience that can facilitate development of a much larger global programme of incentives for REDD over the medium term (5–10 years). The targeted volume of the facility would be approximately $300 million. As of 25 May 2008, 39 tropical and sub-tropical countries had requested participation in the FCPF, and 20 of those had submitted a Readiness Plan Idea Note for consideration by the Facility's Readiness Mechanism. The FCPF will adopt a national approach to REDD on the grounds that it is necessary to mitigate the risk of "leakage" within a country (World Bank, 2008).

The global climate change regime could potentially open up an abundant new source of financing for biodiversity conservation. For that to happen, two things are necessary. First, countries' commitments to greenhouse gas reduction measures post-2012 need to be substantially strengthened. Second, the global policy regime will need to evolve towards greater crediting of sustainable forest and land management. In short, what is needed is, first, a significantly higher carbon price than at present and, second, a new type of carbon credit.

One place where such crediting is already occurring is in the still tiny but fast-growing voluntary carbon market, notably the Chicago Climate Exchange (CCX, which is the earliest established carbon market, having commenced operations in early 2004). Despite its voluntary character, when companies and other institutions agree to participate in CCX, they make legally binding commitments. The commodities traded are carbon financial instrument (CFI) contracts, each of which represents 100 metric tonnes of CO_2 equivalent. In this market, which does not conform to Kyoto rules, it is possible to purchase CFIs from forestry projects in certain regions involving forest conservation as well as forestation on adjacent sites. The list of qualified offset contracts also includes conservation tillage in agriculture.[7] All projects are independently audited by a CCX-approved verifier.

The breakdown of credits issued on the CCX website indicates that roughly 40% of all offsets issued through 2007 were for soil carbon projects—the largest share by some margin. Around 5% were issued to forestry projects, with no indication how many involved forest conservation. One of the forestry offset projects is in Brazil, one in Costa Rica, and one in Uruguay.

4. New political coalitions

Whether reduced emissions from deforestation will qualify for carbon credits in Kyoto-rules carbon markets depends in part on the strength and effectiveness of political coalitions. Non-state actors, particularly ENGOs and private foundations, have historically been prominent in nature conservation alongside governments, often acting as a spur to stronger state action. Governments, on the other hand, dominate deliberations on an international climate change regime, with private actors—businesses and NGOs—playing a subordinate role. In recent years, non-state actors have become more engaged in this process, given the high stakes. For business, engagement has been both proactive and reactive: with some leading businesses hoping to gain competitive advantage in technologies needed to comply with stricter future greenhouse gas regulations, and with many businesses hoping to shape regulation to their advantage through early engagement. For ENGOs, engagement has come from recognition that climate change could render unattainable their goal of biodiversity conservation. Not only are private actors engaging more with governments, but also ENGOs and private businesses are working more closely together to develop new approaches to reducing carbon footprints (see Bishop et al., 2007, for a discussion of innovative business models).

The Coalition for Rainforest Nations, led by Costa Rica and Papua New Guinea,[8] first made a proposal for providing financial

[4] See http://www.inbio.ac.cr/en/inbio/inb_prospbid.htm

[5] For more details on these projects, see: http://carbonfinance.org/Router.cfm?Page=BioCF&ft=About.

[6] http://carbonfinance.org/Router.cfm?Page=FCPF

[7] "Forest conservation credits for combined conservation and forestation projects on contiguous sites are credited on the basis of avoided deforestation rates specified for eligible geographic regions." See http://www.chicagoclimatex.com/content.jsf?id=242.

[8] Other members include: Bangladesh, Bolivia, Central African Republic, Cameroon, Chile, Congo, Colombia, DR Congo, Dominican Republic, Ecuador, El Salvador, Fiji, Gabon, Ghana, Guatemala, Honduras, Indonesia, Kenya, Lesotho, Malaysia, Nicaragua, Nigeria, Panama, Paraguay, Peru, Samoa, Solomon Islands, and Thailand. Brazil is notably absent.

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incentives to reduce greenhouse gas emissions from deforestation at the 11th Conference of the Parties (COP11) to the UN Framework Convention on Climate Change, held in Montreal in December 2005. The Coalition sought to incorporate certified emissions offsets related to avoided deforestation within global carbon markets by revising the Marrakech Accords, amending the Kyoto Protocol, or developing a linked 'optional protocol' under the UNFCCC. At that time, several scientists and NGOs, led by the US-based Environmental Defense Fund, reiterated earlier calls for inclusion of reduced emissions from deforestation in Kyoto trading mechanisms. The COP requested its Subsidiary Body for Scientific and Technical Advice (SBSTA) to evaluate the RED issue and report back to COP13, which took place in Bali in December 2007 (Griffiths, 2007). At COP12 in Nairobi in 2006, Brazil tabled a proposal based on flat payments per acre protected relative to a reference emissions rate, to be funded by ODA rather than through the carbon markets. If emissions were to increase relative to the reference rate, then a country would suffer a deduction of the corresponding amount from future ODA payments (Karousakis, 2006).

In September 2007, several key members of the Coalition for Rainforest Nations, plus Brazil, announced the formation of a new group, the F-8 (or Forestry Eight)[9] to strengthen the bargaining position of rainforest nations ahead of the Bali COP in December 2007 with a view to having forests included in the Bali Roadmap towards a post-2012 agreement. They succeeded in this endeavour. The Conference of the Parties acknowledged "the potential role of further actions to reduce emissions from deforestation and forest degradation in developing countries in helping to meet the ultimate objective of the Convention" and endorsed "the further consideration … of policy approaches and positive incentives on issues relating to reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests, and enhancement of forest carbon stocks in developing countries."[10]

In the Coalition for Rainforest Nations and F-8, ENGOs have an opportunity to forge alliances with developing country governments whose support in the intergovernmental negotiations will be critical to inclusion of incentives for REDD in a post-2012 agreement.

On September 10, 2007, a group of ENGOs, universities and scientific organizations under the umbrella "Global Canopy Programme" joined together with indigenous groups in the Brazilian Amazon to sign the "Forests Now Declaration" which calls for the inclusion of RED in all carbon markets, "especially those created by the UN Framework Convention on Climate Change."[11]

In considering incentive regimes and financing mechanisms, it may be worth distinguishing among tropical-forest-rich countries, as rates and drivers of deforestation differ as do the capacities of governments to implement measures to slow the process. Rudel et al. (2005) provide a typology of countries in different "forest transitions" from deforestation to reforestation/afforestation, induced either by labour shortages (Europe) or by shortages of forest products and severe environmental problems from forest loss (China and India). Other countries have yet to make the transition and are still experiencing rapid deforestation. These fall into two categories: middle-income countries like Brazil and Indonesia which have abundant forests, large forest-based industries and strong development pressures on forests, and low-income countries like the Congo, Sierra Leone, Togo and Haiti, where deforestation and forest degradation are driven by dire poverty and in some cases conflict. A practical RED financing mechanism could be different for the two groups—with integration of RED into global carbon markets likely to prove more difficult in the latter than in the former. Still, where an effective forest management mechanism exists, whether at national or regional level, it may be possible even for low-income countries to participate effectively in forest carbon markets. Thus, for example, the Central African countries grouped in COMIFAC (Commission des Fôrets d'Afrique Centrale) have indicated a preference for reliance on market mechanisms.[12]

5. Resolving technical issues

Whatever the approach to RED financing, a number of questions need to be addressed (see Karousakis, 2007). The first and most fundamental is how to determine the baseline against which to measure and credit reduced emissions from deforestation. One proposal (cf. Olander et al., 2006) is to use a national-level reference historical period as baseline. This is intended to avoid the problem of emissions leakage associated with project-specific baselines. A drawback of the national approach is lesser measurement accuracy than with projects. Still, the technologies exist—notably satellite imagery and remote-sensing data—to estimate historic national deforestation rates, but there is a crucial next step of estimating the greenhouse gas emissions associated with that deforestation. This will require work on building forest inventory and carbon stock data.

In a national baseline approach, national governments would be responsible for devising strategies to slow deforestation. This is likely to involve creation of new protected forest areas or stricter enforcement of existing protected areas, but the balance can vary widely across countries and even localities, for example between different types of ownership and management (public, private, communal) of such areas.

If forest degradation were to be included in a compensation scheme, this would raise additional technical issues, starting with definition, detection, and measurement of associated carbon emissions. For instance, what types of forest management would be considered as constituting degradation: would all selective logging or only that which is part of permanent conversion to non-forest use or shifting cultivation?

There are also a number of mechanism design issues which need to be addressed, including: How to estimate the opportunity costs of forest conservation for the purpose of determining appropriate incentives and compensatory payments? Who would be the sellers of forest carbon credits: governments, private entities, individual or community landowners? Who would be eligible buyers: governments, private enterprises, non-profits, individuals? Will payments be made up-front, ex-post for verified emission reductions from baseline, or in a staggered format? As there will be upfront costs to governments of putting in place the investments and other measures to ensure delivery of emissions reductions from deforestation, host countries would need to work

[9] The F-8 included at launch: Brazil, Cameroon, Congo, Costa Rica, Gabon, Indonesia, Malaysia, and Papua New Guinea. Countries which have since joined the group include Colombia and Peru.

[10] UNFCCC, "Decision -/CP.13: Reducing emissions from deforestation in developing countries: approaches to stimulate action", COP13, Bali, Indonesia, December 2007.

[11] See http://www.globalcanopy.org/main.php?m=4&sm=15&ssm=19 for further details.

[12] See Paper No. 8 (Gabon on behalf of group of Central African countries) in UNFCCC (2006).

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with investors to devise financing mechanisms which provide them with the initial capital while managing the risk to investors of project default (Myers, 2007). Another question is whether payments would cover administrative and capacity building costs of running the RED programme. At the project level, a particular concern is whether small-holders or poor communities would be put at a disadvantage because they lack the means of mobilizing the up-front financing needed. We turn to equity issues in the next section.

6. Social equity and benefit sharing

Optimally, global climate change mitigation and biodiversity conservation measures should advance sustainable development in each of its three dimensions: social, economic and environmental. The social aspect needs to be given due consideration by the international community when considering how best to incentivize avoided deforestation. In many tropical developing countries, forests are an important means of livelihood for local communities, many of them poor. Often the members of those communities are indigenous peoples. It is important to understand how a specific proposal for rewarding RED might affect their social conditions and to ensure that the rewards for conserving forests are equitably distributed among such communities.

While it may seem easy to ensure a fairer sharing of such benefits than of those from forest resource exploitation—where powerful political and commercial interests have tended to dominate, only a strong voice of civil society, including indigenous groups, will ensure that this is the case. Forest-dependent communities are understandably concerned to ensure that the augmented value of standing forests not become cause for powerful interest groups to assert property rights over those assets in contravention of their customary rights, whether formal or informal. If standing forests' value should come to be governed largely by global carbon markets, then rising carbon prices could intensify conflicts over ownership of forest resources, possibly to the detriment of the poor and powerless (Landell-Mills, 2002).

Thus far, there is little direct experience of forestry-based carbon projects on which to evaluate social impacts. There are a few, however, supplying credits to the voluntary carbon markets, and these point to some preliminary lessons, including on the importance of educating and informing communities about the rationale, functioning, obligations and benefits of forest carbon market participation. An assessment of a carbon forestry project in Ecuador found that local people were not adequately informed of their contractual obligations, including penalty clauses and liability for unforeseen costs, that they experienced long delays in receiving payment from the forestry company managing the project, and that their attempts at getting the company to be more transparent and accountable were routinely rebuffed (Griffiths, 2007). Perez et al. (2007) examine the scope for low-income farmers in semi-arid Africa to benefit from carbon sequestration, should soil management practices be integrated more fully into carbon markets. They stress the demanding institutional and technical requirements for effective participation in those markets, ranging from farm-level practices and technologies, to the ability of dealers and brokers to monitor carbon stocks at a landscape level, to the institutional capacity to aggregate carbon credits, to financing mechanisms to ensure that incentive payments reach farmers (e.g., through advance purchase commitments which reduce farmers' risk), to transparent and accountable governance structures.

Involvement of communities from the start would enhance the chances that a given forest (or agro-) carbon project yields significant and widely shared local economic benefits. Non-governmental organizations probably enjoy a comparative advantage vis-à-vis governments and large corporations in operating on a small scale and at the community level, with stakeholder participation. Thus, mastering the process of designing, developing and implementing such small-scale, community-based carbon forestry projects could afford significant new opportunities to NGOs.

Even if well-designed, however, small-scale community forestry projects may still face competitive disadvantages in carbon markets vis-à-vis larger plantation projects. As Boyd et al. (2007) observe, less than 10% of entities worldwide which are certified by the Forest Stewardship Council are community-owned forests. They attribute this, *inter alia*, to the significant economies of scale in the certification process and the lack of access by such forests to certified chain-of-custody processes. Thus, if governments and the international community seek to ensure that the social benefits of carbon forestry projects complement the environmental benefits, they may need to consider subsidizing the fixed costs of carbon market participation for small-scale community carbon sequestration projects—e.g., the costs of third-party verification.

7. Conclusions

The article has identified the common ground for collaboration between biodiversity conservation groups and those working to tackle climate change. ENGOs are having to adjust their traditional models as the climate change agenda has come to be seen as increasingly critical to biodiversity conservation. Also, deliberations on how best to promote efforts to reduce carbon emissions from deforestation have the potential of mobilizing significant additional resources for protection of key biodiversity habitat. More generally, markets and business models which effectively link the supply of biodiversity conservation services with carbon sequestration services are still mostly in an experimental phase and could benefit from a focus on further development. ENGOs can make common cause with private entrepreneurs and financiers in developing such markets, but governments will be critical in providing a conducive policy framework.

Meanwhile, the Kyoto-rules carbon markets have yet to encompass reduced emissions from deforestation, though progress is being made in addressing both technical and political concerns. Voluntary carbon markets offer some space for crediting storage of carbon in soils and forests, and the experience gained there could provide valuable lessons for transfer in the event that REDD is included in a post-2012 international agreement. Not all of those lessons are positive, but—at such an early stage of experimentation—learning from mistakes is also vital. Among the biggest challenges will be to ensure that local communities dependent on forest resources for their livelihoods are, at a minimum, not harmed by forest carbon projects. More positively, engagement of such communities in institutional design from the beginning will be essential to ensuring that their rights are protected and that they share equitably in any revenues generated from carbon sequestration in forests they manage and protect.

The preceding discussion suggests a number of areas for further research, some of a more technical nature (not addressed here), others having to do with political economy, sociology and economics.

One uncertainty calling for research is whether low-cost forest carbon sequestration projects can also be biodiversity-friendly ones, or whether low-cost forest carbon sequestration tends to favour reforestation/afforestation through monoculture over the conservation of species-rich primary forests or the (re)-planting of multi-species forests. If the low-cost approach to forest-based carbon sequestration also happens to be biodiversity enhancing,

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this could attract interest and investment from the pharmaceutical industry for example, and perhaps also the eco-tourism industry.

A second area for research, where sociology, political economy and economics intersect, would examine how sensitive the costs and benefits of carbon sequestration in standing forests—or, more generally, of biodiversity-friendly carbon sequestration—are to local property rights and forest management regimes and to other institutional variables. What sorts of regimes provide sufficient financial incentive to communities and other stakeholders to conserve forests in the face of the familiar countervailing incentives to fell them? Landell-Mills (2002) points out that the efficient operation of markets for forest-related environmental services may depend on "the strength of informal systems of monitoring and enforcement that minimize requirements for costly formal alternatives" (p. 275). If so, social capital is a complement to natural capital in the forest ecosystem services production function, which would seem to favour investment in areas rich in social capital. Are these areas also generally rich in income and wealth, or is there no such correlation? The answer to this question is crucial to assessing the prospects for an equitable sharing of the benefits from supplying forest ecosystem services to meet the growing challenges of both biodiversity conservation and carbon sequestration.

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