Climate change and protected areas

Financing avoided deforestation through the Carbon Market— a contribution to the debate

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Abstract. Reducing Emissions from Deforestation and Land Degradation (REDD) became a hot topic at UNFCCC meetings since 2005. Most countries where deforestation occurs call for a mechanism that would render REDD project activities eligible to funding mechanisms, on behalf of the fight against global warming. But they also raise "outstanding methodological issues" that remain unsolved, such as the difficulties to establish reference scenarios about national emissions. This article proposes a mechanism that could solve some of these issues. The key features of this mechanism would be the direct payment of a significant share of the carbon rent to local stakeholders having historically constituted use right over the forests, and the aggregation of national reference scenarios into a single global deforestation baseline.

Background information

In 1992, the United Nations Framework Convention on Climate Change (UNFCCC) was signed, which, together with the Convention on Biological Diversity (CBD), signalled the increasing attention being paid to global environmental issues by the international community. Framed within the sustainable development ideal, the UNFCCC's main objective was to achieve the "stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent anthropogenic interference with the climate system" (UNFCCC: Article 2), but also to promote "a supportive and open international economic system that would lead to sustainable economic growth and development in all parties" (UNFCCC: Article 3.5). In this context, developed countries were "to take the lead in combating climate change and the adverse effects thereof" (UNFCCC: Article 3) while "the specific needs and special circumstances of developing country parties" (*ibid*.), for whom "economic and social development and poverty eradication are the first and overriding priorities" (UNFCCC: Article 4.7), were to be given "full consideration" (*ibid*.: Article 3.5). This would be

achieved by putting in place mechanisms for the transfer of financial resources and by encouraging transfer of technologies and capacity building in developing countries.

The Conference of the Parties (COP) is charged with promoting the effective implementation of the Convention, and technical advice is provided by the Subsidiary Body for Scientific and Technological Advice (SBSTA) and a Subsidiary Body for Implementation (SBI). The first important legal instrument agreed upon by the COP was the Kyoto Protocol, established in 1997. This protocol defined the objectives to be achieved in terms of reduced emissions of greenhouse gases, but also enabled the trading of emissions rights between parties. According to article 2, developed countries were to reduce their overall emissions of greenhouse gases "by at least 5 per cent below 1990 levels in the commitment period 2008 to 2012," (either by reducing their own emissions or by buying certified emission rights from other parties) while no emission cap was defined for developing countries. Developing countries, however, could contribute to achieving the ultimate objective of the Convention by implementing project activities resulting in Certified Emission Reductions (CER), and by selling these CERs. Among the activities eligible under this "clean development mechanism" (CDM) are land use, land use change and forestry projects (LULUCF). But following the accords of the seventh COP (Marrakesh, November 2001), it was decided that only afforestation and reforestation activities would be eligible for the CDM during the first commitment period (2008-2012). No CER could thus be granted for activities aimed at reducing emissions from deforestation or land degradation (REDD). This decision, however, was quickly contested and a series of workshop were organised to discuss the issue.

The REDD Debate

Advocacy for the eligibility of REDD activities to the Clean Development Mechanism started at the eleventh COP (Montreal, December 2005). Papua New Guinea and Costa Rica reminded the conference that although land use change (mostly deforestation) accounted for 10 to 25 per cent of human induced greenhouse gas emissions, the UNFCCC provided "neither a mandate nor an incentive for reducing emissions from tropical deforestation" (COP 2005: p.7). The UNFCCC, in response, invited parties and accredited observers to submit their views on the possibility of including a REDD mechanism to the UNFCCC, under the Kyoto protocol or by preparing a new protocol. Papua New Guinea, Costa Rica and Brazil were the first countries to answer. They presented their experience in terms of incentives for reducing deforestation, during a first workshop on avoided deforestation held in Rome, in September 2006 (SBSTA 2006). The UNFCCC secretariat eventually received 19 submissions,[1] which were reviewed by the SBSTA and discussed during a second workshop,[2] held in Cairn, Australia (March 2007).

Most propositions agreed about the core principle of the REDD mechanism: a baseline scenario would be established for each concerned party by calculating current emissions and future trends in term of deforestation and forest degradation, in absence of REDD mechanism.

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Avoided emissions eligible for sale on the carbon market would correspond to the difference between this reference scenario and actual emissions during the commitment period (after 2012). But many concerns were also expressed in the submissions, such as:

- the difficulty or impossibility to estimate future trends, which led to preference for a baseline scenario based on current emissions only;
- the necessity of building capacities and strengthening institutions in developing countries, through the creation of an enabling fund;
- the importance of having a flexible mechanism enabling a wide range of policy options (market and non-market based, mandatory or volunteer);
- the necessity of guaranteeing an equitable share of the carbon credits, especially with regard to the rights of indigenous people living in forested areas;
- the problems of leakage and of permanence, and the technical difficulties of assessing and mitigating these problems;
- the importance of considering forest degradation as a REDD modality, in order to create incentive for sustainable forest management;
- the importance of guaranteeing that early actions undertaken by developing countries before the second commitment period (before 2012) will be creditable;
- the necessity of creating a forest stabilisation fund, in addition to the avoided deforestation fund, in order to also support countries where deforestation is low according to the baseline scenario.

The two last points, raised by most countries involved in the debate, illustrate the difficulties that result from adopting a mechanism where financing would depend on an additional effect in comparison with the pre-policy baseline scenario. Countries whose deforestation rates are currently higher would be more rewarded, which would create an incentive to deforestation during the pre-commitment period, unless the concept of early action credit was accepted. Conversely, countries that improved the governance of their forests before the commitment period, would not be rewarded, creating inequities that could become disincentives to good governance— unless a stabilisation fund was created.

Discussions continued at the thirteenth COP (Bali, 2007). In the Bali Action Plan (Decision 1/CP.13), the COP explicitly recognises REDD as being part of a "comprehensive process" aimed at enabling "the full, effective and sustained implementation of the Convention" (COP 2008: p. 3). Decision 2/CP.13 further "invites parties … to reduce emissions from deforestation and forest degradation on a voluntary basis" (COP 2008: p. 8) and to build national capacities to estimate and reduce these emissions. But no policy instruments are defined at this stage, and the question of whether REDD project activities will be ruled by the Kyoto protocol and will be eligible for the Clean Development Mechanism remains open. SBSTA is requested to continue its review of submissions by parties and to undertake a programme of work aimed at addressing the many "outstanding methodological issues" that emerged during the discussions. International organisations are also called upon to support the building of national capacities and to finance pilot projects whose experience will help map out the future mechanism. The World Bank, for example, established a Forest Carbon Partnership Facility

(FCPF) in order to build REDD capacities in a series of volunteer developing countries and to test the financial mechanism currently being discussed in UNFCCC meetings. A coalition of United Nations Organisations (FAO-UNDP-UNEP) is preparing a similar program to build REDD capacities in developing countries. In sum, there is an increasing consensus about the necessity to put in place a mechanism that would finance REDD activities, and some experiments have been conducted in order to test some possible modalities of this mechanism, but many "outstanding methodological issues" (SBSTA 2008: p. 16) remain associated with the options currently envisioned.

Discussion

An Inescapable Contradiction

The REDD debate illustrates the increasing concerns of the international community about global environmental degradation and climate change. It also illustrates the preference for market mechanisms and the influence of economics in the design of policy instruments. For many analysts,[3] the expansion of global markets is one of the main causes of global deforestation, as shown by the acceleration of forest clearing that usually accompanies commodity booms. Is there a paradox, then, in attempting to slow deforestation by a further expansion of markets, *i.e.*, by giving a monetary value to the carbon stored in forests? I believe that this represents the core question that pervades within ideological debates about the REDD mechanism, and that the answer to this question determines whether the "outstanding methodological issues" will be solved in the end, *i.e.*, whether the REDD mechanism will work.

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Social Marginalisation and Resources Capture

The ideological tension that surrounds the REDD debate relates to the political economy of natural resources, which is the area of study of political ecology. The insights of this field are thus particularly relevant for this discussion.

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Among the narratives developed by political ecologists are the degradation and marginalisation thesis, and the conservation and control thesis.[4] According to these theses, state interventions aimed at conserving the environment lead to the erosion of indigenous modes of resource management, resulting in more degradation and the marginalisation of the weakest social groups. Moreover, state conservation policies are often motivated or biased by claims over resource ownership and use, which erodes further the institutions and rights of indigenous people. An abundant literature has been produced regarding these matters since the early eighties.[5] and political ecology is now increasingly influential among policy makers and the scientific community addressing forest governance issues. *Kanninen et al.*[6] for instance, argue that the direct transfer of payments to individual forest users (which the REDD mechanism may enable) could lead to "conflict and the marginalisation of less powerful claimants" in the absence of clear property rights and use rights. The political viability of such policy reforms would be low

because "it would require significant political will to overcome vested interests in current policies and plans".[7] There are indeed many case studies showing that social exclusion seems to be the rule, rather than the exception, in carbon sequestration projects, and other approaches putting in place payments for environmental services.[8]

Are There Alternatives?

The issues pointed out by political ecologists clearly have to be overcome if the REDD mechanism is to work. Facing this challenge, we can wonder whether the international community should find another approach to slow global warming and deforestation.

My position is that, concerning global warming, avoiding deforestation should not be regarded as a significant pathway. The shift to alternative sources of energy has a much higher potential to mitigate global warming, as shown for instance by studies conducted by the German Aerospace Center for the German Government. Moreover, the many uncertainties associated with the REDD approach, with regard to leakage and permanence for example, will never be totally alleviated. It will be a Sisyphean task to guarantee that the pressure on remaining forests will remain low, even in the foreseeable future, because we know nothing about the political and social context that will prevail in the few countries that are still significantly covered by forests.

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But for addressing the issue of deforestation itself, which, beyond its impact on climate, also causes biodiversity losses, the REDD approach may provide a unique opportunity. It appears quite impossible to avoid the cynical statement that forests, when they have no significant monetary value (*i.e.*, once they are logged), are doomed to be cleared for producing marketable or consumable items, except for a few areas that can attract ecotourists or are unsuitable to other land uses. The commoditisation of nature has been widely criticised by NGOs and social movements defending the rights and interests of indigenous people living in forests, but the fact is that forest land is already a commodity, or will soon be, as road networks continue to extend and development plans continue to be advanced. Remaining forest land and resources may be doomed to be captured by elites during the next decades, unless the rights of people currently living on these lands are secured. The REDD mechanism can obviously accelerate land and resource capture, but can also be seized as an opportunity to secure indigenous rights, if a genuine commitment to tackle social issues emerges.

Picture 1. In Malawi, widespread use of woodfuel for tobacco drying has resulted in massive forest deterioration and loss, even in forest reserves as pictured here. (*Courtesy Nigel Dudley, Equilibrium Research*)

In sum, based on the assumption that the REDD mechanism is the only available solution to significantly reduce and stop deforestation on the one hand, and that this mechanism will be unfair and inefficient if it doesn't address the issues of resource capture and social marginalisation on the other hand, I propose to concentrate efforts on the design of a REDD mechanism capable of answering these interdependent social and environmental issues. I will now propose a few avenues that could be explored to achieve this objective.

Channelling Payments to the Historical Users of Forest Land and Resources

My first proposition is that a significant share of REDD funding should be channelled directly to stakeholders having historically constituted use rights over the concerned forest land and resources, and that the regulation of this channelling should be part of the REDD mechanism.

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The main objection that could arise is that states have sovereignty over their forests, and should decide for themselves how to use the finances provided by carbon sale. But most concerned states have already signed the Convention on Biological Diversity, whose core objective includes "the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources" (CBD: Article 1). Carbon is, obviously, not a genetic resource, but REDD mostly concerns carbon stored in the main reservoirs of biodiversity (in primary forests). This carbon will represent, if the REDD mechanism is adopted, the most valuable item of these reservoirs, which justifies the application of the CBD principles to the REDD mechanism. Moreover, both the CBD and the UNFCCC stipulate that "economic and social development and eradication of poverty are the first and overriding priorities of the developing country parties" (CBD: Article 20.4; UNFCCC: Article 4.7). This principle would be violated if REDD funding were captured by elites, or if the loss of access to forest land and resources by local communities was not compensated.

A second expected objection would be the argument that REDD funding could be more efficiently used if received by states or regional and local government bodies, or by NGOs and other organisations collaborating with these bodies for the implementation of development or conservation activities. This raises the question of knowing whom, among government bodies, the civil society or individual recipients, would make better use of REDD financial resources. There is no room to engage in an in-depth discussion of these matters here, but I make the assumption, based on the strong correlation between my personal experience in development[9] and an abundant literature on the subject,[10] that inefficiency is the norm rather than the exception in development projects, while farmers, on average, proceed to wise investments in their agricultural system as soon as they have a capacity to invest. Channelling carbon payments directly to the actors who actually shape the land could thus be seized as an opportunity to test a new paradigm (direct versus indirect support) within the development aid system. Ferraro and Kiss[11] provide several arguments justifying this paradigm change in the case of conservation programmes.

A third possible objection would be that if local stakeholders received the whole

carbon rent, proportionally to the area under their authority or upon which they have use rights, the resulting cash flow could, in certain cases, significantly disturb their culture, their economy and their society. For this reason, I propose payments that do not excessively exceed the opportunity cost of abandoning activities that are not compatible with the avoided deforestation objective (in most cases, the cost of renunciation of further forest clearing, as sustainable resources extraction would not significantly decrease carbon stocks). In addition to enabling a smoother transition to a new economic system based on forest resource extraction, the advantage of this scheme is that, in many cases, the opportunity cost of non-clearing is lower than the revenues generated by the sale of carbon. In Madagascar, for example, eastern rain forests store 80 to 450 tons of carbon per hectare,[12] while the economic impact of protected areas on the population living around them (due to a ban on forest clearing and to the limitation of resource extraction) varies from about US$20 to 70 per year.[13] If we consider the median value of carbon stored in forests (185 tons per hectare), sell this carbon at US$10/ton, and put the money (US$1,850.00) in a bank account with a 4 per cent interest rate, the annual interest rate will be US$74.00 the first year. This means that the carbon stored in a single hectare of forest can compensate for the foregone revenue associated with conservation programmes, or that two hectares could significantly improve the livelihood, or increase the investment capacity of the recipients. Part of the carbon rent could thus still be channelled to government bodies, enabling recipient states to finance mainstream policies (infrastructure, education, health, etc.) with a full sovereignty on the use of their share.

This dispatching of the rent, however, should be regularly revised in order to adjust to the variations of the opportunity cost of not clearing forests, which could increase as a consequence of commodity booms or of the development of more intensive agriculture systems. A security mechanism will also have to be designed to prevent the depreciation of the capital in case of financial crisis. Commitment to these adjustments must be legally binding and must be defined as part of the REDD mechanism. Otherwise, the recipients would be frozen in their current economic situation, or in a dematerialised economy, and the system could quickly become inequitable. On the other hand, it can be expected that the profitability of sustainable resource extraction will increase in the future, enabling a rematerialisation of the economy and a decrease of the payments.

A last, and paramount, aspect of the mechanism I propose is that the use rights that justify the direct payment of compensations must be legally recognised. It could hardly be expected that payments would be issued if such a legal recognition did not occur. This is why the REDD mechanism, as soon as it implies a mandatory sharing of the carbon rent with local stakeholders, should be viewed as an opportunity to guarantee the rights of indigenous people over forest land and resources.

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Creating a Global Forest Fund

My second argument is that, in the global world within which we live, it would be illusory to expect that incentives

applied in a given location would have no impact on other locations. In other words, leakage will occur at a spatial and temporal global scale, the problem of permanence being indeed an aspect of leakage. The demand for a stabilisation fund and for easy action crediting may indeed all reflect the issue of leakage.

Logically, the only way to solve this issue, at least in the long term, would be to define a baseline scenario at global scale (based on the annual global deforestation rate) and to create a global fund whose annual endowment would reflect this global annual deforestation rate. If the objective was to reduce the deforestation rate to zero (*i.e.*, to avoid 100 per cent of current deforestation), the annual endowment should be equal to the value of the carbon released every year by deforestation. If the objective was more modest and consisted of avoiding X per cent of current deforestation, with X<100, then the fund should be annually endowed with X per cent of this value. Ultimately, the fund would be endowed with a value equal to the total value of the carbon stored in primary forests, or to X per cent of this value, after a number of years equal to the total amount of carbon in stock divided by the annual release. If the mechanism was successful, 100 per cent of the surface of primary forests would be conserved in the first case, and X per cent of this surface would be conserved in the second case. The value X would thus represent the commitment of the international community to tackle the issue of deforestation.

The advantage of this scheme, in comparison with the modalities that are presently discussed in UNFCCC meetings, is that the tricky calculation of baseline emissions, and the additional effects of policies or projects at the national scale, would become unnecessary, which would greatly reduce the transaction costs. The baseline would be global and would be determined using global remote sensing tools that are already in place. The additionality would be considered by determining a global coefficient Q that would aggregate national tendencies, with Q=1 if we assume that deforestation will be constant in absence of REDD mechanism, Q>1 if we assume that deforestation will increase (in this case, the endowment of the fund would have to be corrected every year in consideration of the factor Q), and Q<1 in the opposite case. The variations of the additional effects at national and regional scale, however, would still be taken into consideration, but indirectly. They would be reflected on the variations of opportunity costs of non-clearing, and would thus translate into a variation of the payments channelled to the stakeholders who use the forests.

Due to the disappearance of the distinction between countries with low and high deforestation rates, the fund, starting as an avoided deforestation fund, would become a stabilisation fund in the long term. It would represent, in the end, a sort of global guarantee fund for primary forests, reflecting the recognition of the intrinsic value of biodiversity by the international community, explicit in the first paragraph of the CBD, and demonstrating the commitment to conserve primary forests and bequeath them to future generations. Moreover, the carbon rent could be merely the first

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step for creating this guarantee fund, as more endowments, enabling higher payments, could be later provided in the name of biodiversity conservation, or in the name of other environmental services, if the increasing opportunity costs of the ban on forest clearing rendered carbon financing insufficient, and if a commitment existed for internalizing a larger array of externalities. This means that the fund could be endowed by a combination of private and public sources. Conversely, the annual payment could be diminished if new economic opportunities arose from the conservation of these forests, as mentioned earlier. The guarantee fund could then be cancelled or its endowment could be used to tackle other environmental issues. The possibility of reversing the process is essential, and must be addressed in the design of the REDD mechanism, in order to avoid the risk of sovereignty loss over forests.

Coming back to the issue of leakage, it could still occur during the transition period (before the total endowment of the fund). But it could be minimised in two ways: by channelling funding to the countries or regions where forests are most threatened, and by conditioning payment to the absence of leakage at the national scale. But this would not imply coming back to the mechanism presently discussed in UNFCCC meetings (the calculation of payments according to a national baseline scenario), because funding, being decoupled from national baseline data, could follow the leaks by moving toward areas where forests are more threatened. In the end (when the full endowment of the fund would be achieved), all forests (or X per cent of forests) would be secured, and leakage could not occur, or would imply the cancellation of payments.

Concerning logistical aspects, the financial mechanism of the UNFCCC already includes the GEF, the Special Climate Change Fund, the Least Developed Country Fund and an Adaptation Fund. Rather than creating a new fund, it may be preferable to use one of these existing funds to set up the mechanism. I encourage professionals familiar with the functioning of these financial mechanisms to make some proposals. The United Nations Forum of Forests has already instigated a dialogue about how to better coordinate the multiple instruments that support sustainable forest management,[14] and the elaboration of the REDD mechanism could be linked to this dialogue. It will also be necessary to proceed to a global monitoring of deforestation, and of the impact of the payments. The FAO, which regularly assess global forest resources, could play a prominent role at these levels.

There is the concern about the cost of this solution. We can consider this issue in two manners. First, we can consider the amount of money that will actually have to be disbursed for endowing the fund. In the X=100 scenario (if the objective is to secure all remaining forests), US$6 to 25 billion could be provided every year, representing the 0.6 to 2.5 billion tons of carbon released anually by land use change[15] if the carbon price is US$10/ton. This value is not elevated if we compare it to agricultural subsidies, which totalled US$235 billion in OECD countries in 2002,[16] or if we compare it to distorting energy subsidies paid by governments, which may total US$250 billion/year worldwide.[17] Moreover, only the annual interest rate would be spent in the form of subsidies. If this amount did not cover the opportunity cost of stopping deforestation, complementary funding would need to be provided, or

the regions where this opportunity cost is higher would have to be abandoned.

Secondly, we have to consider the actual cost for the society. According to Stern,[18] the social cost of carbon release in the atmosphere may be US$85/ton and avoiding deforestation may be the cheapest way to diminish carbon release, due to the low opportunity cost of abandoning forest conversion in most regions where it occurs. The benefit of avoiding deforestation is obvious. The benefit of a REDD mechanism would, moreover, be very valuable qualitatively speaking, because money transfers would enable a genuine Pareto equilibrium, *i.e.*, a situation where nobody is made worse off by the benefits of others. Pareto equilibriums are notorious for being particularly difficult to obtain in conservation programmes in developing countries, where there are usually winners and losers.

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Conclusion

The increasing market value of carbon creates an unprecedented opportunity to design new mechanisms for financing environmental conservation and development. From 1996 to 2005, the GEF invested US$1.2 billion in project activities.[19] If it was used as the financial mechanism for the transfer of REDD credits, its endowment would be multiplied by 5 to 20 fold. Moreover, we can expect carbon finances to increase in the future, because we are only at the beginning of our concerns about global environmental changes.

From an economic standpoint, and considering the Coase theorem, this transfer would be worth implementing, even using public funds. For this reason, I would prefer a REDD mechanism not linked to the Kyoto Protocol (a specific REDD protocol could be prepared), and the creation of a global forest fund endowed by raising a carbon tax. But the second option, which consists of endowing the fund from private sources, by selling certified emission reductions to polluters, still deserves to be considered in UNFCCC meetings. If it was adopted, the legal framework should logically be the Kyoto protocol, and reduced emissions should be eligible to the Clean Development Mechanism. This solution would be ethically and philosophically less satisfying, because is consists in transforming the internalisation of a social cost (the payment for one's own carbon release) into a profit (the difference between this payment and the cost of avoiding carbon release elsewhere). But it would have the advantage of enabling a quicker endowment of the fund, by using policy instruments already in place. The first option (public endowment) could indeed be envisioned for the longer term, for a complementary endowment of the fund that would secure the mechanism, especially if the opportunity cost of stopping forest clearing increased in the future while carbon price decreased. We could also imagine an initial public endowment that would launch the mechanism more quickly, and that later would be reimbursed by carbon sale.

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The final outcome of the fund could be the achievement of a Pareto equilibrium, regarding those who bear the costs of biodiversity conservation and

Picture 2. Deforestation to the edge of Ngorongoro Conservation Area, Tanzania (*Courtesy Sue Stolton, Equilibrium Research*)

climate control. Economists usually require two conditions to achieve such equilibrium: low transaction costs and secure property rights. Considering a global emission baseline instead of national baselines would enable low transaction costs, while securing the use rights of indigenous people, who are, in most cases, the direct users of forest resources, would be part of an answer to the second condition.

Beyond the new impetus it would give to conservation efforts, this approach would further have the advantage of favouring a very significant paradigm change in the aid system. The REDD money transferred to developing countries would not serve to finance projects and programmes designed by aid agencies. Part of it would be channelled directly to local stakeholders, *i.e.*, to economic actors directly involved in productive activities, who would then invest it in their agricultural systems. This could solve the problem of high transaction costs and low disbursement rates that characterise large multilateral and bilateral donors. States and other government bodies would receive a second part. They could use these payments to finance mainstream policies in various sectors, such as education, health, infrastructure, etc., with a full sovereignty that would reflect their governance over their forests. A third part would serve to finance the institutions in charge of implementing and monitoring the mechanism.

I will conclude with two final remarks. First, the proposition presented here opens avenues that are quite different from those debated during UNFCCC workshops and conferences, and may be at odds with the approaches currently being tested with support from the World Bank and other facilitators. But the key features of the architecture of the future REDD mechanism are not legally defined yet. All options remain open, even the elaboration of a REDD mechanism not framed within the Kyoto protocol. Activities currently undertaken under the REDD auspices are merely experiments, and may succeed as well as fail. This point should not be forgotten. It implies that more policy options should be tested if the optimal solution is to be found. There is indeed a paradox in the fact that the calculation of payments according to additional effects in comparison with national baselines seems to be accepted as a core principle of the REDD mechanism, while it is also the cause of most doubts and critiques. I hope that this discussion will shake this principle, and that some organisations will be interested in testing on pilot sites the approach proposed here, in partnership with volunteer communities. This may be the most efficient way to achieve future advancement in the debate.

Activities currently undertaken under the REDD auspices are merely experiments, and may succeed as well as fail.

Second, some readers will have noticed that I did not mention the term PES (Payment for Environmental Services) in this article. I prefer instead to simply use the term payment, or subsidy. This is because PES implies the precise definition of a service provided by the recipient, and the identification of the actors providing this service. The risk is that only services implying an active role would be considered (for example, patrolling in order to control forest clearing), and that specific stakeholders more capable of providing these services would be identified. Funding would thus drift toward the most powerful actors, those who can afford to dedicate time to the service, or who can access information, organise and communicate their interest for providing the service. This would pave the way to resource capture. Subsidies, conversely, only implies the acceptance of a collective rule, and can be received by any members of the community that set up or accept this rule.

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Notes

1 SBSTA 2007b.

2 SBSTA 2007a.

3 Rudel 1993; Colchester and Lohmann 1995; Peet and Watts 1996; Angelsen and Kaimowitz 2001; Lee and Barrett 2001; Geist and Lambin 2002; Moran and Ostrom 2005; Palm *et al.* 2005.

4 Robbins 2004.

5 see Robbins 2004.

6 Kanninen *et al.* 2007 p. 48.

7 Kanninen *et al.* 2007 p. 49.

8 Landell Mills and Porras 2002; Rosa *et al.* 2004; Griffiths 2007.

9 Pollini 1992, 1999, 2007, 2009.

10 *i.e.* Hancock 1989; Ferguson 1990; Scott 1998; Rossi 2003; Goldman 2006.

11 Ferraro and Kiss 2002.

12 Rarivoarivelomanana 2001.

13 Shyamsundar and Kramer 1997; Ferraro 2002.

14 El Lakany 2007.

15 IPCC 2001, in Palm *et al.* 2005.

16 OECD 2003.

17 Stern 2006.

18 Stern 2006.

19 El Lakany 2007.

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Protected areas, climate change and disaster mitigation

Sue Stolton, Jonathan Randall and Nigel Dudley

Abstract. Natural hazards such as floods, droughts, typhoons and storms are increasingly developing into major human disasters. Climate change is contributing to climatic instability and the breakdown of ecosystem services is increasing the intensity of impacts. There is growing recognition that natural ecosystems can in many cases play a positive role in disaster prevention. The following paper looks at how protected areas can contribute to disaster mitigation strategies under conditions of climate change— a benefit that has perhaps been undervalued in the past.

Introduction

Over the last 50 years the number of so-called "natural disasters"— caused by floods, fires, storms, typhoons, avalanches, tidal waves and earthquakes, among others— has increased dramatically. About 100 disasters per decade were reported from 1900-1940, then around 650 during the 1960s, 2,000 in the 1980s and almost 2,800 in the 1990s.[1] In 2001, one author predicted that the "*1990s may go down in history as the International Decade of Disasters, as the world experienced the most costly spate of floods, storms, earthquakes, and fires ever*".[2] But this trend has continued into the 21st century with major disasters such as the Mozambique floods in 2000, Indian Ocean tsunami in 2004, Hurricane Katrina in 2005, and most recently Cyclone Nargis in Myanmar and Sichuan Province earthquake in 2008.

Two main factors are contributing to this change. First, some of the factors associated with climate change seem to be increasing climate instability and thus the potential for a disaster to take place, and second the role our ecosystem plays in mitigating the impacts of disasters appears to be decreasing. This article, which is based on the recent WWF report *Natural Security: Protected areas and hazard mitigation*[3] reviews these factors, the impacts of these changes and the role that protected areas in particular can play in preventing and mitigating the impacts of disasters.

Changing climate

Evidence of a link between climate change and climate variability, including more extreme weather events, is mounting rapidly. According to climate experts, as our climate changes the hydrological cycle will intensify. In particular, rainy seasons will become shorter and more intense and droughts will grow longer. The Intergovernmental Panel on Climate Change (IPCC) states quite clearly that the "*warming of the climate system is unequivocal,*".[4] The changes are having a direct impact on the hazards which can lead to disasters. Although geological hazards (which are not generally affected by climate) tend to lead to the greatest loss of life per event, hydro-meteorological hazards are affecting ever larger numbers of people: an estimated 157

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million people were affected in 2005, up by seven million compared to 2004.[5]

According to the World Water Council (WWC) "*Extreme weather records are being broken every year … Economic losses from weather and flood catastrophes have increased ten-fold over the past 50 years, partially the result of rapid climate change*".[6]

Although we are still only beginning to understand the links between our climate and global warming, climate change impacts, whatever the cause, are being felt all over the world. During the 1960s and 1970s, more than 90 per cent of the natural disasters in the United States were the result of weather or climate extremes, in particular due to increased precipitation; and the magnitude, frequency and cost of these extreme hydrological events in some regions of North America are predicted to increase further.[7] In subtropical South America, east of the Andes, annual precipitation has increased in some areas by as much as 40 per cent since the 1960s.[8] Data on the West African drought of the 1970s and 1980s showed that decreased precipitation of 25 per cent led to a 50 per cent reduction of water flowing into lakes and rivers.[9]

Climate change has the potential to increase the severity of all types of hydro-meteorological hazards. For example flooding risks can increase in a number of ways: from the sea (higher sea-levels and storm surges); from glacial lake outburst (a problem in countries such as Nepal); and from rainfall— for instance, heavier rainfall or rainfall that is more prolonged than in the past.[10] The intensity and frequency of extreme rainfall and the projected decline in return period (*i.e.* an estimate of how long it will be between rainfall events of a given magnitude) of extreme rainfall events are also likely to result in more numerous landslides.[11]

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Reduced ability to cope with natural hazards

The International Strategy for Disaster Reduction points out that *"Strictly speaking, there is no such thing as a natural disaster, but there are natural hazards, such as cyclones and earthquakes … A disaster takes place when a community is affected by a hazard … In other words, the impact of the disaster is determined by the extent of a community's vulnerability to the hazard. This vulnerability is not natural. It is the human dimension of disasters, the result of the whole range of economic, social, cultural, institutional, political and even psychological factors that shape people's lives and create the environment that they live in."*[12]

The risks of a natural hazard developing into a natural disaster are increased by major breakdowns in ecosystem services as well as increasing levels of poverty amongst the poorest sectors of society leading to settlement in hazard-prone areas. Forest loss, changes to freshwater flow patterns, soil erosion, and the destruction of natural coastal defences such as mangroves and coral reefs contribute to breakdowns in ecosystem services.

The Millennium Ecosystem Assessment estimates that approximately 60 per cent of the world's ecosystem services (including 70 per cent of regulating and cultural services) are being degraded or used unsustainably, and notes that: "*Changes to ecosystems*

Picture 1. People picking up remains of houses after hurricane Mitch Tegucigalpa, Honduras (© *Nigel Dickinson / WWF-Canon*)

have contributed to a significant rise in the number of floods and major wild fires on all continents since the 1940s".[13] The Intergovernmental Panel on Climate Change has similarly noted that: "*The resilience of many ecosystems is likely to be exceeded this century by an unprecedented combination of climate change, associated disturbances (e.g., flooding, drought, wildfire, insects, ocean acidification), and other global change drivers (e.g., land use change, pollution, over-exploitation of resources)*".[14]

Impacts

The social impacts of disasters include loss of lives and livelihoods, injury and displacement, increased risk of disease, interruption of economic activities and loss of, or damage to, infrastructure, communications and important cultural values and heritage.[15] The World Health Organisation's Collaborating Centre for Research on the Epidemiology of Disasters (CRED) has been maintaining an Emergency Events Database (EM-DAT) since 1988. EMDAT contains core data on the occurrence and effects of over 12,800 mass disasters in the world from 1900 to present.[16] From this data the major five natural hazards by number of deaths are (starting with the highest death toll): drought; storms; floods, earthquakes and volcanoes.[17]

The number of people affected by disasters remains staggeringly high; more people are affected by disasters than by war.

The number of people affected by disasters remains staggeringly high; more people are affected by disasters than by war. At any one time it is estimated that 25 million people are displaced from their homes as a result of disasters.[18] The estimated figures for the number of dead provide chilling testimony to the devastating effect of disasters with over a million people being killed between 1970 and 1979; over 800,000 between 1980 and 1989; over 600,000 between 1990 and 1999 and already well over a million during the new century.[19]

Engineering responses

It used to be assumed that we could engineer our way out of natural hazards. Some spectacular failures, coupled with a greater understanding of ecology, have led to the recognition that poorly designed attempts to prevent natural hazards can do more harm than good. Fire suppression, flood controls and landslip barriers can sometimes fail to stop disasters while adding stress to the natural environment, disrupting environmental services and, paradoxically, making people more vulnerable by giving them a false sense of security.

For example, nearly half of the 3,782 km long Mississippi River in the US now flows through artificial channels, introduced in part to control flood surges. But this has simply moved the problem downstream and blocked off natural floodplains that once absorbed excess rainfall. The 1973, 1982 and

1993 floods are thought to have been worse than they would have been before structural flood control began in 1927. After the 1993 flood, a federal task force recommended replacing the policies of structural means for flood control with floodplain restoration and management.[20]

This is not to claim that all artificial barriers, levees, dykes, soil stabilisation schemes and other disaster mitigation strategies based on civil engineering solutions are useless; such initiatives are and will continue to be at the heart of attempts to protect lives and livelihoods. However, there is now increasing recognition that some of the engineering solutions have been overused, or used in the wrong places, or applied without due consideration of their wider effects on ecosystems and human well-being.

Ecosystem services and protected areas

Research shows that the cost of disaster reduction is usually much less than the cost of recovery from disasters.[21] The World Bank and the US Geological Survey estimate that global economic losses from natural disasters in the 1990s could have been reduced by US$280 billion if US$40 billion had been invested in a range of preventive measures.[22] Put simply, the Bank suggests that every dollar invested in effective disaster reduction measures saves seven dollars in terms of reduced losses from natural disasters.[23]

Dollar invested in effective disaster reduction measures saves seven dollars in terms of reduced losses from natural disasters

Disaster reduction measures include developing response strategies, avoiding settlements and other activities in risk prone areas and increasing the quality of building infrastructure to withstand natural hazards. Increasingly, disaster specialists are also looking at the role of natural ecosystems, including those maintained within protected areas, as ways of preventing natural hazards from developing into disasters.

The concept of ecosystem resilience is defined as the ability of a system to undergo, absorb and respond to change and disturbance, while maintaining its functions.[24] Many ecosystems are adapted to withstand natural hazards and such extreme events may sometimes be needed to maintain health and vitality.[25] For instance, fire can germinate seeds and provide space for re-growth; floods can bring fertility; and even small landslides and avalanches can open up the forest canopy and stimulate regeneration. However, this is not the same as natural ecosystems buffering human societies against disaster. Fire and flooding may renew the ecosystem but still be disastrous for people. The extent to which natural ecosystems can absorb or deflect natural hazards is complex and variable and still surprisingly poorly understood. It appears that at certain scales of hazard, natural ecosystems are likely to be overwhelmed, so that for example forests can and do help to reduce minor floods but are less effective at mitigating, once in a century floods. In addition, if we want natural ecosystems to mitigate disasters in ways that are convenient for ourselves, then this may require particular management

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approaches and it therefore follows that disaster relief aspects will need to be reflected in management plans and budgets.

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Protected areas might play a role in preventing a disaster happening if, for example, they can help to stabilise climate through sequestering carbon, but their most immediate role in disaster risk reduction is to ameliorate the effects of a natural hazards once it has taken place.[26] In this regard, protected areas can play three broad roles in preventing or mitigating disasters arising out of natural hazards:

- Maintaining natural ecosystems, including coastal mangroves, coral reefs, floodplains, and forests may help buffer against natural hazards
- Maintaining traditional cultural ecosystems that have an important role in mitigating extreme weather events, such as agroforestry systems, terraced crop-growing and fruit tree forests in arid lands
- Providing an opportunity for active or passive restoration of such systems where they have been degraded or lost

Flooding

Natural or semi-natural habitats can help to mitigate flooding in two main ways, by: providing space for floodwaters to go without causing major damage; and absorbing the impacts of floods with natural vegetation. For example the Wetlands Reserve Program (WRP) is a national voluntary programme throughout the United States aimed at restoring, enhancing and protecting wetlands. By the end of 2006 nearly 750,000 ha of land was included in the programme.[27] In England, the state conservation body Natural England has argued that the restoration of peat bogs, natural floodplains and lowland marshes should be "*not a replacement for, but a necessary complement to existing flood defences*".[28] Creating protected areas on floodplains can be a win-win option, by addressing a major gap in global conservation and reducing risks to human populations. Inland waters are currently badly under-protected (*e.g.* only 1.54 per cent of lake systems are in protected areas).[29]

Landslides, avalanches and rockfalls

Protected areas retain natural vegetation, particularly forests, which can in certain circumstances, prevent and mitigate sudden earth and snow movements by stabilising soil and packing snow in a way that stops the slippage starting and slowing the movement and extent of damage once a slip is underway. Research shows that in Switzerland increased landslide activity can be linked to periods of deforestation over a period of several thousand years.[30] In a review of landslips in Europe for the European Commission, the authors noted that "*The reforestation of hill slopes can help to reduce the occurrence of shallow but still dangerous landslides (mainly mud flows*

and debris flows)" and again that "*excessive deforestation has often resulted in a landslide*". [31]

Tidal waves and coastal erosion

Protected areas help to retain natural vegetation, reefs and landforms that can help block sudden incursions by seawater, with particular benefits from coral reefs, offshore barrier islands, mangrove forests, sand-dunes and coastal marshes. Since the early 1990s, many countries in Asia have been attempting to calculate the economic value of their mangrove resources and have subsequently introduced restoration programmes in recognition of their coastal protection role as in Bangladesh.[32] In Malaysia, the value of maintaining intact mangrove swamps for storm protection and flood control has been estimated at US$300,000 per km, which is incidentally the cost of replacing them with rock walls,[33] a barrier that needs to be replaced periodically unlike mangroves.

Drought and desertification

Protected areas can provide barriers against the impacts of drought and desertification by reducing pressure, particularly grazing pressure on land and thus reducing desert formation. Protected areas also maintain populations of drought resistant plants to serve as emergency food during drought or for restoration. The role of protection strategies in providing insurance against drought has been utilised for centuries and, for example, is the basis of the *hima* system that set aside land to protect grazing in the Arabian Peninsula and was formalised under Islam.[34] Today, there is increasing recognition that protection of natural vegetation may be the fastest and most cost-effective way of halting desert formation. In Mali, the role of national parks in desertification control is recognised, and protected areas are seen as important reservoirs of drought-resistant species.[35] In Djibouti the Day Forest has been made a protected area, with regeneration projects initiated, to prevent further loss of this important forest area and attendant desert formation.[36]

Picture 2. Landslide which left 3000 homeless, West Papua, Indonesia (former Irian Jaya) (© *Alain Compost / WWF-Canon*)

Fire

Protected areas can protect against fire by limiting encroachment into the most fire-prone areas; maintaining traditional cultural management systems that have controlled fire; and protecting intact natural systems that are better able to withstand fire. It should be noted however that badly managed protected areas (*e.g.*, those with long-term fire suppression regimes) can almost certainly increase fire risk as compared to some traditional management systems. In fire dominant areas there is often a trade-off between managing for biodiversity

Picture 3. Devastated coastal area in Aceh province of Indonesia after the 2004 tsunami (© *Yoshi Shimizu / WWF-Canon*)

elements (*e.g.*, includes leaving forests to attain old-growth characteristics and support deadwood species) and managing to reduce fire risk. In countries like Australia protected area managers often use prescribed fire in protected areas to reduce threats of large-scale fires developing and moving out into surrounding farmland and settlements.

Hurricanes and typhoons

Protected areas can help address problems of hurricanes and typhoons through their role in mitigating floods and landslides, and directly buffering communities and land against the worst impacts of a storm event (*e.g.* storm surge). There has been a debate about whether or not natural vegetation, including forests, can help absorb the main impacts of such storms and thus reduce effects on people, crops and property. By observing the impact of Hurricane Jeanne on several Caribbean islands in 2004, researchers discovered that the health of upland forests played a role in flood severity and landslide formation. Although rainfall was similar across the islands, its impacts were very different. Storms resulted in seven flood-related deaths in Puerto Rico, 24 in the Dominican Republic and over 3,000 in Haiti. Researchers concluded that the main reason for the difference was related to rural-urban migration and the consequent change in forest cover, particularly in mountain regions. Forest cover in Haiti has been reduced through planned and unplanned deforestation to less than three per cent. Seventy years ago, forest cover in Puerto Rico was similarly degraded and severe erosion and floods were common, but today forest cover has increased to almost 40 per cent and a similar process of forest recovery is underway in the Dominican Republic.[37] Salvano Briceno, Director of the ISDR, claimed: "*Environmental degradation has been the main cause of the devastating floods, which occurred last year in Haiti and the Philippines. The entire United Nations system, together with member states, national and regional organisations, have to commit themselves fully to disaster risk reduction policies if we want to avoid a re-emergence of such events there or anywhere else in regions often prone to natural disasters".*[38]

Conclusions

It is widely accepted that climate change is having an impact on the prevalence of so-called natural disasters. What is not as recognised, however, is the important role that ecosystem services can play in disaster mitigation. Many local people instinctively link declining environmental quality with increasing vulnerability to hazards, but these links have often not been made explicit in local planning, or governments have been ineffective in controlling the causes of environmental decline. Continuing debate about the role of ecosystem services is to some extent undermining efforts to develop a concerted response aimed at protecting and improving environmental services against natural hazards. Although, there

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The first priority for addressing human-caused climate change is to stop its progress by restricting greenhouse gas emissions. Because we are already seeing the impacts of climate change, we must also consider how to mitigate and adapt for its impacts. Protected areas can play a role in maintaining strategic natural habitats to protect against natural disasters which have been made more severe by climate change. These functions deserve wider recognition and should be included in protected area system and site planning and in their funding strategies.

An Action Plan for Integrating Disaster Mitigation Planning into Protected Areas

Research

1. A great deal is already known about the role of natural ecosystems in mitigating disaster. Further research should now focus on the scale of disasters for which natural ecosystems can provide effective mitigation strategies. Appropriate natural resource management strategies should be identified.
2. Additional tools are needed to help planners identify the most valuable places where natural ecosystems need to be protected and/or restored to provide disaster mitigation services— through, for example, overlaying ecosystem data with hazard mapping in an opportunity analysis.

Planning

3. At a national and regional/transboundary scale opportunity analyses should be used to identify places where natural systems could mitigate disasters and to develop associated protection strategies, including the establishment of new protected areas.
4. At a protected area scale, some protected area authorities may consider revising their management objectives and management plans to better reflect and conserve the contribution of their protected areas in providing ecosystem services, including mitigating disasters.

Policy

5. The links between protected areas and disaster mitigation need to be made explicit when implementing or revising the various disaster reduction initiatives such as the Hyogo Framework for Action 2005-2015, Convention to Combat Desertification, etc
6. Similarly, lending agencies and donors supporting protected area establishment and management should consider the disaster mitigation role of protected areas in project planning and implementation and facilitate the integration of environment and disaster management professionals.
7. Protected area managers and agencies need to build a working relationship with those working on disaster

management before disasters happen to maximise synergies and opportunities.

8. Effective examples of where land and sea-use management are contributing to disaster mitigation need to be identified, application of management options field-tested and results disseminated to help other protected area mangers and agencies as well as disaster recovery agencies.
9. The underlying causes of the increase in hazard and disaster occurrence, such as climate change, forest loss and hydrological disturbance, should be addressed as part of a preventative strategy.

Funding

10. Further development is needed on economic evaluation of protected area contribution towards disaster mitigation and to investigate funding options for maintenance of natural defence systems, including innovative use of Payment for Environmental Services schemes and use of insurance premiums to maintain strategically important ecosystem services.
11. The effectiveness of protected areas in disaster mitigation is closely linked to management success, so that some of the funds available for disaster mitigation should be allocated to improve management effectiveness of protected areas.

Management

12. Once plans have been developed, protected area managers need to ensure that steps needed to maximise disaster reduction potential are included in day-to-day work programmes and priorities including relationship building with local disaster response agencies

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Notes

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14 IPCC 2007.
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29 Chape *et al.* 2003.

30 Dapples *et al.* 2002.

31 Hervás 2003.

32 Saenger and Siddiqi 1993.

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34 Bagader *et al.* 1994.

35 Berthe 1997.

36 UNCCD 2006.

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Rethinking the Landscape— does climate change herald a new role for the UK's national parks?

Adrian Phillips

Abstract. Conservation effort in the UK is focused primarily upon lived-in landscapes, as its small, densely populated and fertile countries have a long history of human settlement and multiple use landscapes. This article looks at the IUCN Category V (Protected Landscapes / Seascapes) in the UK. Initially an unwelcome picture of the threats that climate change could bring to these protected landscapes is drawn. Indeed it is suggested that an increasingly degraded landscape subject to new dangers, like soil erosion, flood and sea incursions would become less attractive and less worthy of support. The article argues that to avoid this gloomy scenario the role and economies of national parks need to change to better correspond to economic, social and environmental reality. Rather than try to maintain a pattern of land use that is increasingly under threat from economics and a changing climate, a new vision is needed. The article thus proposes a wholly different vision of the UK's national parks— where environmental services are valued. Such a vision is however not easy to achieve, and the political challenge of bringing this about is acknowledged.

The United Kingdom's National Parks

Blessed by a relatively gentle climate and mostly fertile soils, the four countries of the United Kingdom (England, Wales, Scotland and Northern Ireland) have a long history of human settlement, and of the exploitation of land and natural resources. Its total population is about 60 million. While England is one of the most densely populated parts of Europe, Scotland has some very wild and remote landscapes, but even here almost all land and water is in some form of multiple use. Conservation effort in the UK has therefore focused upon lived-in landscapes: indeed the UNEP/WCMC database features only two protected area management categories in the UK: IV (Managed Nature Reserves) and V (Protected Landscapes/Seascapes).

This article is about one of the Category V areas: National Parks. There are nine parks in England (covering 8 per cent of the land area), three in Wales (20 per cent), and two in Scotland (7 per cent). One is planned in Northern Ireland. The areas designated are characterised by their scenic beauty, mostly as mountain and moorland, but also including hill, wetland and coastal scenery. They are all lived-in landscapes with a total population of about 289,000, but with important landscape, wildlife, heritage and cultural values. So, despite their name being synonymous with the National Parks described by their management objectives as Category II in the IUCN guidance on protected area categories, they are in fact Category V protected areas— Protected Landscapes/Seascapes - in the IUCN system. Most land is privately owned, mainly by farmers and landowners but also by other public and private bodies, including conservation non-governmental organisations (NGOs) like the National Trust and county wildlife trusts. The dominant land use in most of the parks is traditional hill sheep farming, though other kinds of farming, forestry and other land uses also occur.

In England and Wales, National Parks are a special kind of local authority, administered through a central/local government partnership, and subject to national guidance. In Scotland, they are non-departmental government bodies. But in all UK National Parks, the authorities are made up of (i) local government representatives, and (ii) appointees of the minister in England, of the National Assembly in Wales or of Scottish Ministers. The National Parks have powers to control land use, influence the management of land and water, and promote public understanding of the area and appropriate forms of recreation. For this, they are relatively well resourced and receive nearly all their net funding from central government.

Picture 1. Snowdonia National Park, Wales (*Courtesy Nigel Dudley, Equilibrium Research*)

The statutory purposes of the English and Welsh parks are to:

- conserve and enhance their natural beauty, wildlife and cultural heritage, and
- promote public understanding and enjoyment of their special qualities.

If these purposes cannot be reconciled, priority is given to conservation. In pursuing the two purposes, the park authorities must "foster the economic and social well being of local communities".

Climate Change and the National Parks

There are of course many uncertainties in trying to understand the likely impact of climate change on the National Parks, both because it is not yet possible to predict future climate with complete confidence and because assumptions have to be made about how quickly society will respond by moving to a low carbon economy. However estimates are now being given with increasing confidence, for example in the publications of the UK Climate Impacts Programme.[1]

So a picture of the future is emerging. By the end of this century, the average temperature in the UK could be as high as 5^0C above current levels. While this is towards the top end of the possible range of increases, there has been a disturbing trend towards ever-higher predictions. Projections, which were considered alarmist only a few years ago, have now become within the range of the possible. With the rapid thawing of Arctic sea ice and the slightly slower melting of the Greenland ice sheet, the climate of the northern hemisphere will surely be very different in future. Certainly in Britain it will be warmer, with wetter winters, usually drier summers, and more frequent and more intense storms and rainfall. In the parks, the impacts are bound to be complex and wide ranging. Everything will be

affected: the natural world of wildlife, trees, water and soils; the historic heritage; and the economy, especially primary land users like farming and landscape-dependent economic activities like tourism. There is too the prospect of the sea being about 80cm higher than now by 2100 (which is a rise of about five times faster than has occurred in the past century); and more violent storms will be driving it further inland.[2]

So a characteristic vegetation type, heather moorland, could be at risk from fire— one has only to look to Greece in 2007 to see what fire can do in a blazing hot, dry summer. Many upland woodlands will be under stress, with species ill adapted to the climate of, say, South West France. For example, the internationally significant bryophyte rich woodlands of the Lake District would not survive such conditions. Indeed woodland everywhere in the parks will be more at risk from disease and pests, as well as drought, flood and storms. And recent flooding episodes affecting picturesque villages in upland valleys will become more frequent with painful human and heritage consequences.

The UK's hitherto fairly gentle climate has protected Britain from large scale soil erosion, but— without that buffer— loss of soils will be more marked, and nowhere more so than where slopes are steepest, as in the upland parks. The coastal parks, but the Norfolk Broads especially, are at ever-greater risk from storm surges and saline intrusions that will devastate the existing ecology. Familiar and much-loved patterns of farming cannot hope to survive unaltered when the very climate, to which they are an adaptation, changes too. And new and not wholly welcome pressures will come from tourism that seeks to escape hotter cities and a torrid Mediterranean.

In addition, the park landscape is vulnerable in the fight back against climate change. Because of their altitude and proximity to the sea, they are some of the windiest places; they are often the best places to collect and store water; and useful sources of tidal power lie near several parks. Tapping this potential will make an impact (even if large scale wind farms are excluded).

In short, the national parks will be in the front line of climate change and of society's response to it.

Threat or opportunity?

On top of climate change, there are other factors working against the maintenance of the traditional landscapes of the national parks, with all their natural and cultural values. The most powerful of these are developments in world agriculture, which— along with climate change— could cause parts of upland Britain to become attractive for intensification and possibly cereal farming. Wildlife, landscapes, cultural traditions and tourism would all suffer. Inevitably the strong community life associated with hill farming would go too.

As things now stand, therefore, we can foresee a future that few would welcome: the erosion of the land-based human communities and their valued traditions; and a landscape increasingly dominated by a contrast between

The national parks will be in the front line of climate change and of society's response to it.

intensively farmed areas growing cereals on the better land, and the rougher hill country run more and more as ranch areas— or acquired for hobby farming by wealthy individuals from around the world. In this landscape, nature would be more degraded than now, and subject to new dangers, like soil erosion, flood and sea incursions. Altogether, the national parks seem destined to become less attractive and less worthy of support.

Instead of trying to maintain a pattern of land use that is increasingly under threat from economics and a changing climate, a new vision is needed.

If this future is to be avoided, then the role and economies of national parks need to change direction and better correspond to economic, social and environmental reality. Instead of trying to maintain a pattern of land use that is increasingly under threat from economics and a changing climate, a new vision is needed.

In this vision, there will certainly still be an important place for farming, in a form with which we are broadly familiar. Where the terrain, soil, climate and market access allow it, and the entrepreneurial energy exists, traditional farming should be encouraged to regroup, so to speak. This will require the careful amalgamation of farms aimed at creating more competitive units; adding value to farm produce by— for example— promoting locally-branded foods or organic produce; and some diversification. Already this is happening in many places, and it is to be welcomed and supported, because it is a way of marrying tradition to modern needs.

But this solution cannot work everywhere. Rather than supporting marginal farming systems, much of the future upland economy should be based on delivering a range of environmental services (carbon, water, soils, biodiversity) to society. There should be both public support and a real market for these. Take, for example, the vital role that the upland parks can perform for society in capturing carbon and storing it in peaty soils: already a carbon market is emerging that could— with imagination— be made to pay for such services. It is a reasonable proposition too that up-stream water management that reduces flood risk will also be a service that society (or even insurance companies?) would be ready to pay for in future. In an ever more crowded land— there are predictions that maybe 70 million will be living in the UK in 25 years time— these extensive upland areas will also become of growing value as refuges for nature. And the contribution that the uplands can make to the health and education of future generations is one society should also be ready to pay for, if the case can be made.

What would such a landscape look like? Most obviously, broadleaf woodland would be much more dominant. Trees are generally good for all sorts of reasons— water capture and regulation, biodiversity conservation, soil protection, carbon management, as a renewable energy source, shielding development and buffering intrusive recreation activities. But it should not be wall-to-wall plantation forests, but partly open and often grazed, though grazing will be mainly for purposes other than supporting farm incomes. Tough breeds of cattle, sheep and ponies should be used to graze lightly the fells and woodlands, and help to maintain

a diverse habitat; in other places, deer will do the job. Many artificial upland drainage systems should go, with water being held in re-wetted upland catchments for as long as possible, not removed as fast as possible with all the downstream consequences. And wetted peat bogs can store much carbon. (An example of a landscape of this kind is illustrated by the photograph of a pioneer scheme in the Lake District National Park which is designed to give more space for natural processes to proceed without human interference).

Some national parks, and parts of many others, are not uplands. Here the pressure for more intensive farming should be resisted where it will be particularly damaging, but in general the same principle should apply— the parks should be used more for their ability to conserve natural resources, accommodate to the effects of climate change and re-discover a national purpose. So, for example, the present rivers and freshwater lakes of the Norfolk Broads could become a fascinating and wildlife-rich landscape of tidal marshes, creeks and lagoons; the two parts of the New Forest, now divided by a busy main road, could be reunited by building lengthy eco-tunnels (as the Dutch have done) to allow the free flow of wildlife and people across the road; and the proposed South Downs National Park could be re-shaped mainly as a landscape of grasslands, scrub woodlands and semi-wild country in the crowded South East.

Parks should be used more for their ability to conserve natural resources, accommodate to the effects of climate change and re-discover a national purpose.

Bringing about such a vision

This vision would help to re-establish a role for national parks within the UK in future. First and foremost, they would supply ecosystem services to the country. But also, as places that are wilder than the rest of Britain, they would provide new habitats for biodiversity, supply a kind of spiritual refuge for a densely settled country with high levels of urbanisation, and offer landscapes that can readily accommodate low impact forms of recreation.

Picture 2. Ennerdale, Lake District National Park, England (*Courtesy Adrian Phillips*)

However, the political challenge of bringing this about is formidable. There are likely to be two main areas of opposition.

First there are the human communities who live in the parks, and especially those which farm it. This is by nature a conservative community: farmers are used to life in quite harsh physical conditions and do not always look kindly on outside suggestions about how their land should be used. The skills and traditions of such people lie in farming: while there will be a continued need for these, fewer people will be able to live off hill sheep farming in future (and those that will survive and prosper will need to adapt their farming and marketing to exploit new markets). This is a very sensitive area: it is not just about future landscapes, but about people, their livelihoods, cultures and traditions. Indeed to question the long-term viability of the upland farm economy, and thus the community that it supports, is to venture onto terrain where few politicians will dare go.

The other source of resistance is likely to come from parts of the conservation movement itself. Many who love the national parks are committed to two propositions: that we should struggle to keep the traditional landscapes of all parts of the parks, even if this is not economic over the long term; and that parks are still about 'landscape plus access' as defined in the founding legislation of 60 years ago (a view which ignores other natural resources). In fact, the first proposition is unreal over the long term, and the second is no longer a sufficient view of what the parks can or should be. Many of the groups who have until recently argued most passionately to maintain the national park landscapes in their present form are now being asked to consider that these landscapes may need to change radically if the parks are to retain a value to future generations.

The governance implications

Difficult questions of governance lie behind these challenges to the local community and to the conservation movement. It may be that the present form of administration in the parks does not lend itself well to addressing the unprecedented challenges that will be brought about by a changed climate and economic outlook. Local interests are strongly represented, and are often parochial in outlook, while much outside lobbying tends to be against change.

Thus what is intended to be a new role for the parks based upon ecosystem services, could easily be characterised by critics as an attempt to impose a wilderness model designed to disempower— or even evict— current land managers. To overcome such resistance to change will call for a major effort in education and political leadership that will help communities in the national parks, and many conservationists, to cope constructively rather than defensively with the threats and pressures that lie ahead. But while the opposition might be tempered by paying a proper price for the range of ecosystem services that the upland land managers can provide, the likely resistance to change cannot be overemphasised.

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Indeed, at a deeper level, there is— in the author's view— a real challenge here to the emphasis on people's engagement and social equity in conservation that IUCN and many others have (rightly) espoused. The case for this approach is well put in WCPA guidelines:[3] "*underlying several elements of the changing perspective on protected areas is a new concern for social equity. This is driven by practical considerations (in many circumstances conservation cannot and will not happen without the support of the relevant communities), but also by more widely shared ethical and moral concerns*". In short, people must help determine the future of conservation policy and practice for both pragmatic and ethical reasons.

But what happens when the changes, such as those brought about by climate change, are so far reaching that they go beyond the knowledge systems of the local community— for example, what future is there for Inuit culture or conservation traditions when the ice melts? Or, in the UK context, what happens when future climate and economic forces undermine the very traditions that have created the national park landscapes that have been designated for protection?

What happens when future climate and economic forces undermine the very traditions that have created the national park landscapes that have been designated for protection?

In the author's view, there is a potentially exciting new role for the UK's national parks along the lines sketched out above, but bringing it about will be very difficult. For the reasons argued by IUCN, there is no question of reverting to a command and control form of conservation in which the present land owners and communities are disempowered; but, on the other hand, present institutions in the national parks do not themselves seem strong enough to drive through the necessary changes. It remains to be seen, therefore, if the new vision can generate sufficient support (backed by financial incentives) that it can be realised in face of the innate conservatism that surrounds much of the discourse on the UK national parks.

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Notes

1 See http://www.ukcip.org.uk/.

2 For more information, see the UK Climate Impacts Programme web site (www.ukcip.org.uk), and that of ENPAA (www.nationalparks.gov.uk).

3 Borrini-Feyerabend, *et al.*, 2004.

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The use of protected areas as tools to apply REDD carbon offset schemes

Nigel Dudley

Abstract. Protected areas have great potential to help reduce global greenhouse gas emissions and to benefit from the reduced emissions from deforestation and degradation (REDD) financial mechanisms being developed within formal and informal processes linked to the UN Framework Convention on Climate Change. REDD mechanisms aim to reduce emissions by providing compensation for "avoided deforestation", preservation of standing carbon stocks, and carbon sequestration through reforestation and afforestation.

Focusing these efforts on protected areas has distinct advantages and provides special opportunities, particularly in forest-rich countries with low deforestation. Well managed protected areas can offer relatively complete protection for forests and REDD payments would fit easily into existing legal frameworks. Most countries have protected area policies already established that could be used for REDD, along with trained protected areas staff. Protected areas have agreed systems for establishing and codifying land tenure agreements, and biodiversity conservation is prioritised. Many protected areas also provide social and economic values (*e.g.* water, cultural values etc). Techniques for assessing management effectiveness of protected areas are well advanced and gap analyses and other planning initiatives, provide information on likely sites of high conservation value.

However, protected areas also face the same constraints and threats as other potential REDD projects including illegal exploitation, poor governance and poor social standards leading to losses of livelihoods. Clear management standards need to be agreed and implemented.

Background

Forests in protected areas offer important benefits in terms of meeting the criteria for a "***reduced emissions from deforestation and forest degradation***" (REDD) mechanism being developed under the UN Framework Convention on Climate Change (UNFCCC). Under the UNFCCC Kyoto Process Clean Development Mechanism (CDM), only afforestation and reforestation projects are eligible to be used as offsets, meaning that protection of existing forests fall outside the mechanism. However, this is set to change. Agreement was reached at the 13th UNFCC Conference of Parties (COP), in Bali Indonesia in 2007, to develop a mechanism to compensate reduced emissions from avoided deforestation and degradation in the replacement to Kyoto. This would fall under a suite of actions called "Land Use, Land-Use Change and Forestry" (LULUCF). The details of what REDD will mean in practise are still to be worked out and will doubtless be subject to intense negotiation.

Many institutions already assume that protected areas will be a part of REDD[1] and the need for a global network of forest protected areas has been identified under the Convention on Biological Diversity (CBD).[2]

Both statutory and voluntary REDD schemes are proposed. This article argues for including protected areas within REDD and summarises the steps needed to ensure that this will be possible.

Pros and cons of REDD

Currently around a fifth of greenhouse gas emissions come from deforestation and forest degradation, which although it has slowed a little recently still continues apace in many countries. Reducing forest loss and degradation could play an important role in slowing and eventually reversing levels of greenhouse gases in the atmosphere. Although most discussions about REDD focus on the potential of sustainable forest management, and this is likely to be a major area of investment,[3] forests in protected areas also offer important options that could avoid some of the pitfalls of commercial or community forest management.

Reducing forest loss and degradation could play an important role in slowing and eventually reversing levels of greenhouse gases in the atmosphere.

The amount of money being discussed under REDD could increase conservation funding by an order of magnitude: figures of up to US$55 billion a year have been suggested[4] although there are major differences in predictions of the potential for storing carbon and the likely money available. The Stern report suggests that US$10 billion/year would be needed. REDD has the potential to address several critical issues within a single mechanism: mitigation of global warming, reduced land degradation, better biodiversity conservation and increased human well-being and poverty alleviation. Institutions such as the World Bank are investing in REDD projects, which will require capacity building and continuous, predictable and long-term funding.

REDD has the potential to address several critical issues within a single mechanism: mitigation of global warming, reduced land degradation, better biodiversity onservation and increased human well-being and poverty alleviation.

However there will be problems in implementing REDD in forest schemes. Much destructive forest loss and degradation is illegal and there is little reason to think that countries undergoing rapid deforestation have strong enough governance to address this problem.[5] REDD investments in areas that are later deforested illegally are wasted. Some analysts also fear that badly managed REDD projects will increase pressure on poor communities in terms of security of land tenure and access to resources:[6] a substantial proportion of forest loss is due to the actions of poor farmers and subsistence gatherers who will be left with few other options if these resources are locked up. Depending on how the details of the mechanism are worked out, these problems could encourage investors to put their REDD money into the safest options, which are usually not those forests facing the most acute problems. Some activist groups and indigenous peoples' organisations have stated opposition to REDD on the basis that it will rely on sacrifices made by the poorest people rather than cut energy and fossil fuel consumption by the world's rich.

Some activist groups and indigenous peoples' organisations have stated opposition to REDD on the basis that it will rely on sacrifices made by the poorest people rather than cut energy and fossil fuel consumption by the world's rich.

There are certainly potential benefits of a REDD mechanism but only if there are sufficient social and environmental safeguards in place to ensure that

REDD delivers real conservation and climate change benefits within a framework that maximises social benefits to the most in need. Stopping forest loss is the most urgent priority for REDD at present.[7]

Advantages of including protected areas in REDD programmes

One way of reducing forest loss and degradation is to set forests permanently aside from development— the philosophy of the REDD approach— and incorporating these into protected area networks is an obvious way of achieving this. Protected areas offer several advantages:

- Effectively managed protected areas usually offer complete protection for forests, maximising the climate benefits and making measurement and accounting relatively easy.
- Virtually every country has laws governing protected areas, so that protected areas funded under REDD would fit easily into an existing framework without long political and legal delays.
- Most countries already have an institutional framework, such as a protected area agency linked to a relevant ministry, agreed standards for protected areas and a staffing structure.
- Most countries also have a cadre of trained staff, plus capacity such as equipment, data management systems and consultation procedures, although improving this is a potential use for REDD funds). Many also have associated supportive NGO or civil society organisations.
- Protected areas usually have systems for establishing and codifying land tenure agreements.

Picture 1. The Grampians National Park, Australia. Large amount of carbon are stored in forests and a variety of protection regimes are being explored to ensure that these potential greenhouse gases remain locked up (*Courtesy Nigel Dudley, Equilibrium Research*)

- Biodiversity and conservation values are prioritised in protected areas.
- Carbon storage is likely to be particularly high in biodiversity-rich, tropical forests.[8]
- Many protected areas have additional social and economic values, such as: delivery of pure water;[9] soil stabilisation; provision of disaster mitigation[10] (*e.g.*, natural vegetation protecting coastlines); sanctuary for vulnerable human communities; preservation of sacred natural sites and other places of importance to faiths;[11] protection of agrobiodiversity;[12] and value for recreation and tourism. Many of these address issues relevant to poverty alleviation.[13]
- Techniques for monitoring management effectiveness of protected areas are already well advanced[14] and in many cases could be modified to include carbon accounting without the need to develop a whole new skill set— systems of certification are under development.[15]

- Protected areas include a wide range of management approaches, summarised in the six IUCN management categories,[16] and are thus a flexible tool adaptable to many different social and environmental conditions.
- There has also been a growth in recognition of different governance types in protected areas, including co-management approaches, community conserved areas and private protected areas.[17] This provides far greater room for innovative approaches such as company reserves; community owned and managed protected areas and other non-state options.
- Existing work, including ecoregional conservation plans, national and local level protected area gap analyses[18] and other broadscale planning initiatives, provide information on likely sites for new protected areas.
- Protected areas provide options for using REDD finance mechanisms in forest-rich countries with low deforestation to stabilise or maintain standing carbon stocks.
- Making protected areas eligible for REDD funding would help to increase synergy between Rio conventions and other international instruments,[19] by forming a direct link with *e.g.*, the CBD's *Programme of Work on Protected Areas*.

Protected areas also often face a shortfall in operational funds,[20] which puts their values including carbon sequestration at risk, meaning that any funding from REDD would be immediately useful.

Some potential limitations with using protected areas in REDD

Protected areas are not free from all the problems with hypothetical REDD projects identified by critics. Badly planned or implemented protected areas can increase poverty and reduce well-being as a result of forced relocations and denial of access to traditional resources.[21] Illegal logging or use of fire happens in protected areas as well as in the wider landscape. Protected areas are sometimes degazetted, although this is fairly rare and the extra security of a REDD agreement would make it even more unlikely. More commonly, protected areas remain unimplemented and their values continue to decline.[22] Tools, techniques and processes exist to address all these issues, but a well-managed REDD scheme will need to ensure that they are applied.

There may also be a specific REDD-related question relating to additionality— *i.e.* the level of greenhouse gas emission reductions generated by a carbon offset project *over and above* what would have occurred in the absence of the project. If protected areas are already in place, there may be little additional benefit in putting money into their protection. It is likely that REDD funding in protected areas may be applicable only in those situations where:

- The protected area is being newly created
- The protected area is under-resourced and losing forest cover or quality (determined by an independent assessment of management effectiveness as part of the project appraisal)
- There are no alternative, long-term funding sources to support the protected area

There are a number of issues relating to protected areas that are still to be worked out. Would "upgrading" of an area currently protecting a forest under a less rigorous scheme into a full protected area "count" under REDD?

Examples might be changing the status of forest reserves into protected areas. How would the offsets be calculated in the case of capacity building? Would REDD projects be confined to forests? Protection of other vegetation types, such as peat, might store as much or more carbon than a forest.

When REDD mechanisms were rejected at the time of the Kyoto Protocol, several reasons were given particular prominence,[23] including perceived problems with:

- Baseline setting and additionality
- Leakage
- None-permanence
- Scale
- Illegal logging
- Ownership of land
- Definition of degradation

The issue of additionality has been discussed. Protected areas address problems of permanence and very large protected areas exist, thus answering questions of scale. Mechanisms are needed to account for accidental forest loss, for instance through fire, by *e.g.* "pooling" several areas, but this is true for all forests. Illegal use can be a problem but there should at least be management systems and staff in place to address this. Most protected areas are state-owned or are voluntarily run by private trust and individuals or by communities. The question of leakage— the risk that protection in one place simply leads to more exploitation elsewhere— needs to be tackled during the planning of protected areas as it does in any other form of set aside. Use of landscape planning approaches could help to solve the potential problems of leakage.

Ensuring social equity and environmental success

The NGO WWF has identified a series of critical steps needed to ensure that potential REDD projects are both effective and socially equitable.[24] WWF considers the proper application of these to be a prerequisite of success and necessary to foster long-term public acceptance of REDD offset schemes. In the following table, these steps are listed and the implications for protected areas are discussed.

The NGO WWF has identified a series of critical steps needed to ensure that potential REDD projects are both effective and socially equitable.

Table 1. Comparison of elements in the WWF Meta-standard framework for carbon projects with likely conditions in protected areas

Issue	Details	Protected area implications
Carbon accounting	Additionality	REDD funding should only usually be applicable to new protected areas or to protected areas where independent assessment shows clearly that vegetation is being lost or degraded and where additional resources could reduce this.
	Leakage	Analysis will be needed in each case to ensure that establishment of a protected area does not simply move forest loss elsewhere, *i.e.* that any loss of resources to local communities is adequately compensated through *e.g.* establishment of timber plantations or other renewable energy sources.

	Permanence	Protected areas by their nature aim to protect native vegetation in perpetuity. This could be complicated in cases where some vegetation removal is part of the management regime: most usually where national fire control policies insist on prescribed burns to reduce fuel loads. This will only be applicable in some countries under certain circumstances (and in these cases would be applicable in any other forest management regime as well). Approaches exist for accounting for such losses.
Social and environmental impacts	Stakeholder consultation	Protected areas are increasingly required to have strong stakeholder processes— for example this is a requirement for new protected areas established under the CBD Programme of Work on Protected Areas. It is reflected in a growing number of self-declared protected areas by indigenous peoples' communities.
	Sustainable development	Protected areas increasingly have to adhere to rigorous social and environmental safeguards to ensure that protection of biodiversity does not undermine local livelihoods. Application of a range of management approaches and governance types can help to allow flexibility in this; for example IUCN Category VI extractive reserves frequently facilitate sustainable collection of valuable products (such as rubber, Brazil nuts or other non-timber forest products) whilst maintaining living trees: an ideal scenario for a REDD project.
	Identification of High Conservation Values	Protected areas are selected specifically for their value to conservation and an increasingly sophisticated set of tools are available to identify the most suitable sites.
	Assessment of environmental impacts	Similarly, the need to provide additional justification for protected areas has spurred the development of a range of methodologies for assessing the environmental benefits of protected areas in terms of *e.g.*, water supply, soil stabilisation or protection of communities from climatic extremes.
	Long-term viability	The IUCN definition of a protected area stresses the long-term nature of protection as a key feature that distinguishes protected areas from other forms of sustainable and nature-friendly land use.
Validation and certification	Validation	Protected area authorities, NGOs and researchers have been developing methodologies for monitoring and assessing management effectiveness of protected areas over the past few years and several thousand have already been applied around the world. These vary from simple schemes to complex monitoring systems. Some already address many issues relating to carbon (for example monitoring of forest cover through remote sensing) and it would be relatively easy to integrate carbon accounting into existing schemes.
	Certification	Some certification schemes already exist for protected areas, such as the Pan Parks verification scheme in Europe and some green ecotourism schemes; others are under development. In addition, some protected areas with a particular interest in the status of their forests use adapted forms of existing forest certification schemes, such as the one run by the Forest Stewardship Council, to certify forests within protected areas. Either approach could be applied to carbon accounting under REDD.

Note that some purely technical issues common to all carbon offset projects— such as avoidance of double counting, proper registration procedures and issuance and tracking are not discussed in this table.

Potential gains in terms of climate change will vary depending on the type of forest, its age and associated soils and vegetation. Forests that would be particularly valuable include those with the highest levels of biomass, such as the peat forests of south-east Asia where carbon in living trees is dwarfed by carbon stored below-ground[25] and other forests of the tropics. Conversely, forests that experience frequent fires may be less suitable. Plantations are not usually a suitable land use in protected areas.

As a matter of urgency, a clear explanation of the role of protected areas in REDD needs to be produced by the IUCN World Commission on Protected Areas (WCPA) and partners, ideally in association with the CBD's Programme of Work on Protected Areas and the UNEP World Conservation Monitoring Centre.

Developing a strategy for making protected areas eligible for future REDD funding

The Subsidiary Body for Scientific and Technological Advice (SBSTA) of UNFCCC will be discussing the mechanisms for REDD in the near future. As a matter of urgency, a clear explanation of the role of protected areas in REDD needs to be produced by the IUCN World Commission on Protected Areas (WCPA) and partners, ideally in association with the CBD's Programme of Work on Protected Areas and the UNEP World Conservation Monitoring Centre.

A three-stage process is suggested:

1. A small workshop should be convened under the auspices of IUCN-WCPA to identify key elements to be addressed in any protected areas-REDD strategy. The workshop should include WCPA, the CBD, UNFCCC and The World Bank; NGOs active in the CBD and UNFCCC such as WWF and The Nature Conservancy; and representatives of governments that have been promoting REDD such as Costa Rica and Indonesia. The workshop should focus on addressing unanswered questions relating to REDD and protected areas and providing clear strategy guidance.
2. A peer-reviewed paper should summarise the results of the workshop and any follow-up research in a succinct analysis and strategy. Peer reviewers should include representatives of the institutions listed above along with companies involved in carbon trading and experts in social and environmental safeguards of carbon trading. It will be important to liaise closely with relevant people in UNFCCC during this process.
3. The finalised paper should be printed as a contribution to SBSTA-28; a version should also be published as a journal paper.

Picture 2. Bach Ma National Park, near Hue Vietnam. It is hoped that REDD funds could help to support protected areas, particularly in countries that are struggling to find resources for conservation (*Courtesy Nigel Dudley, Equilibrium Research*)

Amongst the key questions that still need to be answered are the following:

- Additionality— spelling out clearly how additionality can be assured in protected area projects and what would count as additionality in terms of protected area creation and management, including methodologies for calculating offsets in different projects
- Leakage— describing mechanisms to avoid leakage through implementation of landscape planning approaches and methodologies for measuring landscape level forest area and quality to check against leakage[26]
- Permanence— mechanisms for improving guarantees of permanence in non-state protected areas, including in company reserves and community conserved areas
- Stakeholder consultation— outlining mechanisms and minimum standards for stakeholder consultation in REDD projects associated with protected areas
- Sustainable development— describing standards for integration of poverty reduction and other social issues relevant to human well-being
- Identification of High Conservation Values— in particular whether non-forested vegetation types with high carbon storage potential might be suitable for REDD funding within protected areas, including peat, some grassland habitats and tundra
- Assessment of environmental impacts— outline of methods used in assessing additional benefits from REDD projects in terms of environmental services
- Validation— description of how carbon accounting could be integrated into existing management effectiveness assessments along with a description of the methodologies needed for carbon accounting and the likely costs
- Certification— outline of existing certification processes and how they could either be adapted for protected areas or, in the case of those already used in protected areas, how they could be modified to include carbon accounting
- Opportunity— a brief overview of the potential scale of additional carbon sequestration potential from protected areas

The paper should also contain some case studies of actual or potential offset projects involving protected areas. Protected areas will in most cases be one element in a landscape approach to carbon sequestration, specialist involved in carbon sequestration through sustainable forest management should also be consulted.

In addition, organisations interested in protected areas should engage with some of the major voluntary schemes, both to promote the potential of protected areas under REDD type mechanisms and to strengthen standards to ensure conservation and social benefits accrue equitably from such schemes. The use of management effectiveness assessment could be a major tool in assuring such gains.

Nigel Dudley is a member of CEESP and WCPA and has worked as a consultant to WWF for many years.

An earlier version of this paper was released as the CBD SBSTTA meeting in Germany in 2008.

Notes

1 See for instance Dutschke and Wolf, 2007.
2 Pistorius *et al.* 2008.
3 See for example Maginnis and Bishop 2008.
4 Saunders, and Nussbaum 2008.
5 Ibid.
6 Mehta and Kill 2007.
7 WWF, 2008.
8 Brown University 2008.

9 Dudley and Stolton 2003.
10 Stolton *et al.* 2008.
11 Dudley *et al.* 2006.
12 Stolton *et al.* 2006.
13 Dudley *et al.* 2008.
14 Hockings *et al.* 2006.
15 Dudley 2004.
16 IUCN, 1994.
17 Borrini-Feyerabend *et al.* 2004.
18 Dudley and Parrish 2006.
19 Kapos *et al.* 2007.
20 Mansourian and Dudley 2008.
21 Colchester 2003.
22 Carey *et al.* 2000.
23 Sanz 2007.
24 Ruddell (forthcoming).
25 Swallow *et al.* 2007.
26 Dudley *et al.* 2006a.

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Requiem for the Zambezi Valley? Conservation and protected areas under climate change

David McDermott Hughes

Abstract. A truly sustainable energy policy— one that limits the effects of global warming— will use enormous land resources. Hydropower, solar panels, wind turbines, biomass farms, carbon sequestering forests, etc. will occupy a much larger footprint than the current, coal- and petroleum-based industries, which mostly transport carbon vertically from the lithosphere to the atmosphere. How will this shift affect land-based conservation initiatives, such as protected areas? This article conducts a 'thought experiment' for the Zambezi Valley, which runs its 2,500km course from Central Africa to the Indian Ocean. The author asks, how in the future will the need to increase hydroelectric capacity be reconciled with the region's (potentially flooded) protected areas? How would this radical environmental change affect tourism and air travel in Southern Africa and beyond? Are governments prepared to sacrifice the 'wilderness' tourist trade for carbon-neutral power generation? This article poses fundamental questions that still lie on the margins of the main conservationist debates. Perhaps, these issues are too broad for conventional policies. For those who dare, the author challenges, climate change presents an opportunity to jump scale and think big.

Changing policies for a changing world

Conservation policy has yet to come to grips with climate change. At current rates, the emission of carbon will push ecosystems beyond the breaking point. And what about species? More than a decade ago, Louis Pitelka and the Plant Migration Workshop Group raised the specter of widespread extinctions.[1] Recent research suggests that a profound and rapid reconfiguring of regional climates is already underway.[2] If this continues, such processes will render protected areas moot. More optimistically— one might anticipate - industrial societies will shortly embark on an emergency programme of climate stabilisation. Scientific consensus now suggests that an 80 per cent global cut in carbon emissions by 2050 may keep average surface temperatures at 2ºC above pre-industrial levels. Such a contained warming would avert planet-level catastrophe but still modify ecosystems everywhere. It would also overturn many of conservation's successes, including the protected areas network. The global parks estate has relied upon a hidden fossil fuel subsidy. Coal- and petroleum-based industries transport carbon from the lithosphere to the atmosphere, occupying virtually no space on the planet's surface. In other words, Shell, ExxonMobil, and so on free up land for conservation. A more sustainable energy system, however, would begin and end at ground level. Solar panels, wind turbines, and biomass farms— as well as carbon sequestering forests— would blanket landscapes. This widening platform of energy sources and carbon sinks could crowd out protected areas. Local-level conservation, some will surely argue, is a luxury the world can no longer afford. But a more multi-scale conservation could both contribute to climate stabilisation and blunt its secondary effects.

The Zambezi Valley

This paper conducts a thought experiment for the Zambezi Valley. On its 2,500km-course from Central Africa to the Indian Ocean, the Zambezi touches or passes through six national parks and numerous lesser protected areas (Figure 1). Three parks cluster just upstream of Victoria Falls, in what is known as the Four Corners Transboundary Conservation Area. Downstream, Matusadona National Park abuts the Lake Kariba reservoir, and two more national parks— Mana Pools and Lower Zambezi flank the river before it empties into Mozambique's Cahora Bassa reservoir. This entire complex has enjoyed enormous attention and protection on the part of public and private conservation agencies. Now, however, mitigating climate change may require the valley's transformation. Installations at Kariba and Cahora Bassa already generate hydropower, and, if necessary they could generate more. Raising these dams or building more will flood the protected areas. Indeed, engineers would like to convert the entire middle section of the river into reservoirs. Thus far, conservationists have mostly opposed them. Will the urgent need for sustainable energy change their minds? Perhaps it will, and conditions may require a further sacrifice: of the tourism industry. Possibly the world's least sustainable sector, mass air travel cannot persist under an emergency programme of cutting carbon emissions. Grounding planes would remove from the Zambezi Valley its chief source of formal employment. This economic disruption, in turn, would undercut protected areas politically. Especially in Africa, where governments budget for biodiversity in proportion to its generation of foreign exchange,[3] nature has had to pay for itself, even in carbon-intensive ways. A shift to sustainability, therefore, threatens both the land base and revenue stream of organised conservation. To survive— and remain relevant— the movement may be forced to reset priorities and relinquish treasured goals.

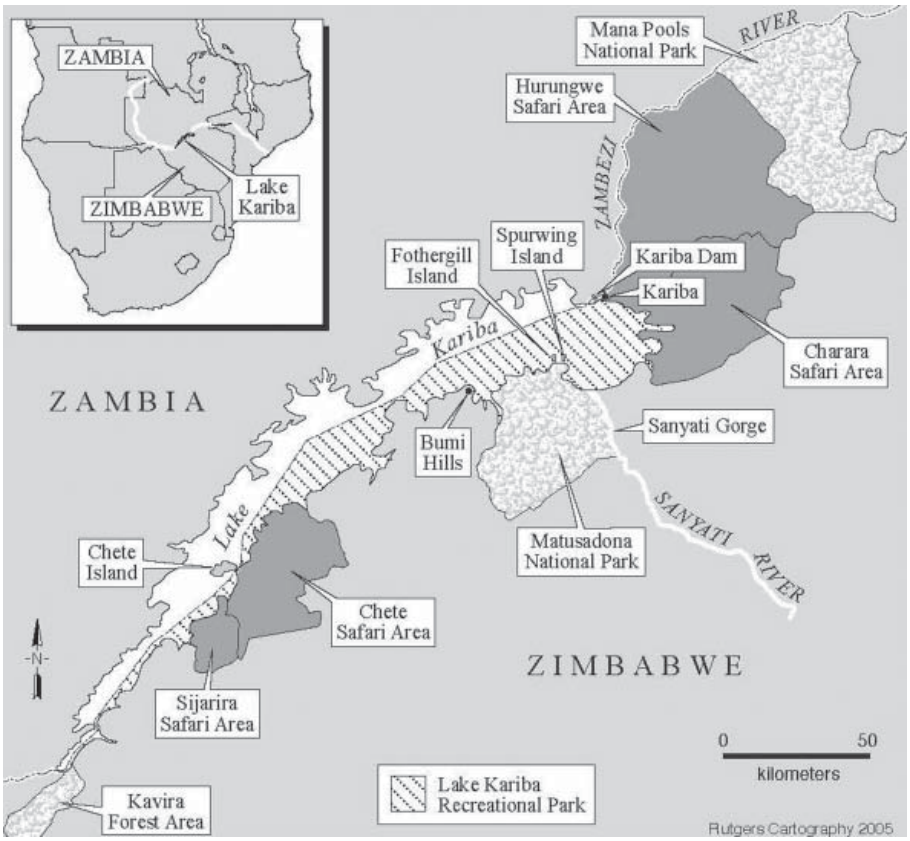

Figure 1. Map of the Zambezi Valley

Possibly the world's least sustainable sector, mass air travel cannot persist under an emergency programme of cutting carbon emissions.

The agroecology of the Zambezi basin is changing dramatically and disastrously.

Coping with Climate Change

In Southern Africa, climate change is dispensing drought and flood simultaneously. The region depends on a weather pattern known as the Intertropical Convergence Zones under which moist air from the Indian Ocean travels southwest towards the Cape of Good Hope and then returns. Until recently, rain fell in the Zambezi basin over a five-month season, from October-November to March-April. Lately, the Convergence Zone has been arriving late and leaving early. The wet season has shrunk to four months and is heading towards a mere three months. Nonetheless, annual total precipitation— while varying more and more— appears likely to decline by only 10 to 20 per cent.[4] That degree of continuity gives less solace than one might think. Compressed into a shorter interval, this rainfall should contribute to increasingly severe storms and floods. In short, the agroecology of the Zambezi basin is changing dramatically and disastrously.

Picture 1. The African elephant (*Loxodonta africana*) (*Courtesy Sue Stolton, Equilibrium Research*)

Such environmental insults will surely undermine the fragile alliance between local communities and conservation agencies. Where it exists at all, the compromise of community-based natural resources management relies upon local people's ability to live with within a narrow geographical range. Zimbabwe's CAMPFIRE, for instance, succeeded when people withdrew from national parks— as hunters and herders. In some cases, income from tourism was to offset this loss of strategies and resources. Mostly though, agriculture in confined pastures and fields had to bear the full load of household survival and reproduction. Critical research suggests that agriculture did not bear the load alone. Peasants have continued to hunt and graze, if with greater stealth. In Zambia, for instance, residents of the Luangwa Valley traded the gun for the snare.[5] Even where the compact still holds climate change will undo it. As maize harvest fall, smallholders *must* revert to tried-and-true strategies.[6] Like any investor, they will distribute risk across ecological zones, land designations, and political jurisdictions.[7] Zimbabwe provides a dramatic case in point. Since 2000, the Government has dismantled the economy while climate change has undercut one in three rainy seasons. In response, people have squatted in protected areas, established a thriving market in poached meat, and sought work in South Africa in unprecedented numbers. Local, legal livelihoods have been reduced to polite fictions.

At root, climate change jumps scales in a fashion that overturns all community-based approaches. Combating, coopting, and/or compensating local human populations has formed the central project of most conservation agencies.[8] All three tactics assume that rural Africans, Asians, and Latin

Where will ecological refugees go, and how will conservation agencies facilitate, regulate, or impede their movement?

Americans invest intensively in communities of place.[9] If it ever did, that assumption no longer holds. Poor Africans, in particular, are increasingly exchanging this local dream of progress for a more extensive dream of egress.[10] Analyses of the increasingly desperate flight from the Global South to the Global North do not isolate climate change, drought, and so on as variables. Yet, surely they play a role. If so, then, perhaps one can anticipate an extension of what one might call *the Tuvalu appeal*. Doomed to inundation as sea level rises, Tuvalu is attempting to resettle its entire population in Australia or New Zealand. So far unsuccessful, this effort relies upon international, rather than community-based, institutions and global, rather than local, forms of governance. In Africa and the Zambezi Valley, climate is changing more insidiously, and no one has suggested a coordinated boatlift. Rather, as is already happening, people will survive (or not) through over-taxing the increasingly fragile ecosystems in which they live and then abandoning them.[11] Where will ecological refugees go, and how will conservation agencies facilitate, regulate, or impede their movement? Such legal and moral questions lie well outside the scale and scope of present-day conservation. Especially in North American and Europe— as well as in Australia and New Zealand— agencies might prefer to ignore climate-induced immigration. But for those who dare, climate change presents an opportunity to jump scale and think big.

Coping with Sustainability

Sustainability in respect of energy is both essential and— one can expect— profoundly disruptive. Indeed, in this unprecedented application, the very notion of sustainability requires translation. Industrial societies have been managing the carbon cycle *de facto*, shaping photosynthesis, respiration, decay, and other processes throughout the biosphere. But they have regulated this exchange so clumsily that it has ceased to function as a cycle. The problem lies in an additional, entirely artificial process— the combustion of fossil fuels— which imports carbon from the lithosphere into the biosphere. Except over geological time, that transfer is irreversible. Engineers and entrepreneurs have proposed to inject CO2 underground, but no such technology seems capable of sequestering large volumes in perpetuity. Similarly, afforestation only sequesters carbon in the short term. Unmanaged forests reach a biomass climax, where they fix roughly (although sometimes stochastically) as much carbon as they release. Plantations also fail to keep carbon in a solid state. How will climate managers prevent gargantuan harvest of pine— far in excess of timber demand— from simply rotting? In short, no method can compensate for or undo the artificial uplift of ancient carbon deposits. Sustainability, therefore, requires that industrial societies cease burning fossil fuels. Consequently, it also demands that they develop alternative sources of energy.[12] This responsibility will fall first and most severely on the Global North. Proposals for "climate justice" grant the South, and

Decarbonizing industry in the North Atlantic will hit the tourism sector hardest— and, in so doing, throw conservation policy into crisis.

Africa in particular, a substantial grace period for their business-as-usual.[13] Still, the economic trickle-down from European energy policy may well cause the Zambezi Valley to catch cold.

Decarbonizing industy in the North Atlantic will hit the tourism sector hardest— and, in so doing, throw conservation policy into crisis. Leisure travel unavoidably leaves a large ecological footprint. Despite its disarming prefix, *eco*-tourism frequently pollutes as or nearly as much in carbon terms.[14] Jet fuel is the great equaliser and will surely be regulated more strictly in the future. Any robust climate regime would dissuade people from burning carbon merely for the sake of leisure. Indeed, public opinion in some countries is already shifting in this direction. Although environmentalists suffered defeat, the recent debate regarding Heathrow's Terminal 5 marks a watershed in Europe.[15] Flying is no longer "green." These political undercurrents should concern conservationists as well as businessmen far to the south. In the 1990s, many proponents of protected areas in Africa linked their fate to that of tourism and airlines.[16] Arguably, there was no alternative. Independent Zimbabwe, Zambia, and Mozambique would not maintain protected areas— and tolerate the continued displacement of smallholder communities— unless they enriched the nation materially, immediately, and directly. Elite, camera-toting Europeans and North Americans offered such quick cash. Soon— if climate is to be stabilised— they will recreate by rail. Will governments then protect unvisited, unremunerative landscapes? Probably not: the poached, paper parks of current Zimbabwe, Zambia in the 1990s, and Mozambique in the 1980s provide a bleak model of the future.

Or conservationists may craft a different model of wildlife-related benefits and of wildlife itself. The "myth of wild Africa"— as Jonathan Adams and Thomas McShane (1992) famously termed it— removes much of the continent from productive, local use. The most naïve conservationists imagine the Zambezi Valley and much of Africa as a Pleistocene remnant, empty of people but abundant in nonhuman biodiversity.[17] If they are correct, "the bush" logically belongs to the spectator, the same Euro-American jet-setter who so damages the atmosphere. The wilderness myth, in other words, facilitates a dangerous— one may soon say, reprehensible - activity in the name of a misanthropic fantasy. Clearly, this notion of nature has outlived its usefulness. In its place, some have suggested a diametrically opposed approach to nature: domestication. Such an intervention would seem to surpass or violate nature. Indeed, conservation groups, like tourists largely disavow the tame in the tropics. But the tame survives. Asian elephants, *Elephas maximus*, frequently provide direct, material, and immediate benefits— not by browsing photogenically— but by moving timber and other loads. Such beasts of burden actually *work* for people, proving their value everyday. Such labour is the best anti-poaching method, a guarantee against extinction. With a similar eye towards labour, Zimbabwean ranchers have experimentally domesticated the African elephant, *Loxodonta africana*. On commercial farms in the 1990s, *Loxodonta*

The wilderness myth, in other words, facilitates a dangerous— one may soon say, reprehensible - activity in the name of a misanthropic fantasy. Clearly, this notion of nature has outlived its usefulness.

proved capable of plowing fields and transporting fence posts.[18] These skills may save the Zambezi's elephants from pressures sure to come as tourism collapses and agriculture declines. A drought-tolerant, low-expense workhorse capable of tilling large hectarages could also conceivably save rural communities. At the landscape level, as well, Pat Kareiva of the Nature Conservancy has recently suggested a "science of domestication," whereby policy-makers would consider the trade-offs among ecosystem services.[19] However imperfectly, domestication— rather than protection— may better preserve aspects of nature and humanity at the same time.

Picture 2. Kariba Dam, viewed from the downstream side
(*Courtesy David McDermott Hughes*)

Less hypothetically, policy-makers would like to invest in carbon-friendly sources of energy. The Zambezi countries have advanced farther along this path than most— far enough to imperil their protected areas. Gorges and gradients give the river enormous potential for hydropower. To the frustration of the Zambezi River Authority— the engineering body in charge of hydropower - only Kariba, Cahora Bassa, and small station at Victoria Falls— currently draw power from the river. For economic rather than ecological reasons, the Authority has long hoped to insert more impoundments upstream and downstream. Indeed, its grandest design would leave scarcely a kilometre of wild river between Victoria Falls and Tete, in central Mozambique. More modestly, in the 1980s, the Authority proposed two dams, both of which alarmed conservationists in the region. Most Zimbabwean organisations eventually accepted the Batoka Gorge Dam: a run-of-river barrage that would have filled a narrow, mostly unvegetated chasm upstream of Kariba. The second proposal— for a Mupata Gorge Dam below Kariba— provoked lasting furore. Although the reservoir would not displace large human populations, it would inundate large swathes of Mana Pools and Lower Zambezi National Parks. Under threat, conservationists manned their barricades. "Lake Mupata," wrote Raoul du Toit in 1984, "… would have very adverse impacts on wildlife resources of international significance…".[20] He could not have anticipated then that the dam might have a *beneficial* impact on *atmospheric* resources of an equally international significance (The flooding a dense forest, as in the Amazon Basin, might exert less positive, or even negative, effect, due to the release of methane from submerged, decaying vegetation).[21] In the event, Zimbabwe's economic and political collapse has postponed both projects indefinitely— perhaps long enough for regional conservationists to think through the trade-offs. Meanwhile, the shortened wet season may well decrease Kariba's generating wattage. According to one model, the reservoir lacks capacity to store water during a repeatedly prolonged dry season.

It might essentially empty out before the replenishing floods. Increasingly variable rains might exacerbate this possibility. In order to guarantee constant electric generation, therefore, the Zambezi River Authority will need to raise Kariba's dam wall and enlarge the reservoir.[22] Such flooding— over a mostly flat shoreline— will surely destroy large portions of the seven protected areas on Kariba's littoral, including Matusadona national park. As we know it today, conservation in the Zambezi Valley will not survive sustainable energy.

A thousands-strong network of protected areas rings the globe. But this does constitute a broader framework for planning and adjudication. Because the parts sum to less than the whole, protected areas do not guarantee general environmental security.

To conclude

These preliminary speculations suggest a need for new thinking and new scales of thinking. Conservation has long defended the local. Winning battles over myriad habitats, one assumed, would protect the Earth. Now, a thousands-strong network of protected areas rings the globe. But this does constitute a broader framework for planning and adjudication. Because the parts sum to *less* than the whole, protected areas do not guarantee general environmental security. This planetary-scale policy deficit drags official conservation into contradictions. Witness much of the movement's embrace of ecotourism, what one might call the Kruger-KLM axis. Also in Southern Africa, parochial loyalty sets conservationists against hydropower. The US— where bird-lovers oppose wind turbines— suffers from even greater provincialism. A more geographically nimble conservation would grapple with larger scales and with the trade-offs between scales. It would attempt to balance the incommensurables of large local benefits and small global damages or of large local damages and small global benefits? This is difficult work, not entirely resolved by the notion of the Earth as a protected area. Perhaps, one should settle for a domesticated Earth, but questions still abound. How would institutions govern planetary decisions with respect to jet fuel, sustainable energy, migration, and a host of other intercontinental issues? These are, at least, the right questions to ask. *By* asking them, conservationists will increasingly become part of the solution in mitigating climate change.

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Notes

1 Pitelka, *et al.*, 1997.
2 Williams, *et al.,* 2007.
3 Gibson, 1999.
4 Arnell, *et al.*, 2003.
5 Marks, 1999.
6 Jones and Thornton, 2003.
7 Scoones, *et al.*, 1996.
8 *e.g.* Agrawal and Redford, 2007; Terborgh, 1999.
9 Hughes 2005; 2006a:194.
10 Ferguson, 2006.
11 Magadza, 2000.
12 Pacala and Socolow, 2004.
13 Baer, *et al.*, 2007.
14 Gössling, *el al*, 2002.
15 Friends of the Earth, 2008.
16 Oates, 1999.
17 Hughes, 2006b; Schroeder, 1999.

18 Interview with Gary Hensman, Harare, 14 April 2003 (cf. McNabb 2000)..

19 Kareiva, *et al.*, 2007; cf. Ellis and Ramankutty, 2008.

20 du Toit, 1984:4.

21 Fearnside, 1995.

22 Salewicz, 1996:319-20.

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Integrating climate change into the ecological gap assessment process

Jamison Ervin

Abstract. Gap analysis is now seen as a critical part of protected area design and is increasingly being used by governments and NGOs. Climate change will necessitate major changes in the design and management of protected areas, including responses in spatial planning. The following paper looks at the five key steps in gap analysis— preparation of the team; assessing biodiversity status; assessing protection status; analysing results; and taking action— and suggests additional elements needed in each to integrate climate planning.

The Convention on Biological Diversity's *Programme of Work on Protected Areas* suggests that countries should carry out ecological gap assessments to ensure that protected area networks capture the full range of biodiversity within a country. Potential expansions to the network are based on a comparison between the biodiversity within the existing network, and the biodiversity across the country as a whole. This emerging science now has to address issues of climate change; there is little point in designating and financing a protected area network if the ecosystems that it is protecting will have shifted geographically or disappeared in a few years due to shifts in the climate.

Picture 1. Gap analysis can identify potential protected areas at any scale. Here conservation areas are being identified in a planned plantation in Brazil (*Courtesy Nigel Dudley, Equilibrium Research*)

Ideal gap assessments include a series of steps:

- ▷ Preparation (building the team)
- ▷ Assessing biodiversity status
- ▷ Assessing protection status
- ▷ Analysing results
- ▷ Taking action

The following model suggests a series of steps to integrate climate change adaptation into the model:

Steps in ecological gap analysis	Climate change integration steps
Step 1: Preparation	
Assembling the team, engaging stakeholders and partners: ▷ Strong, focused leadership ▷ Clear roles and responsibilities, adequate skills and expertise ▷ Organisational charter ▷ Stakeholders are engaged from the beginning ▷ Collaborative approach with stakeholders	▷ Ensure climate change experts are included in gap assessment team or subcommittees (*e.g.*, marine reef resilience experts, climate change researchers)
Developing and managing data systems ▷ Data collection and data sharing agreements in place ▷ Clear data management strategy, sound metadata collection ▷ Appropriate systems and software in place	▷ Identify relevant data and bioclimatic models (*e.g.*, sea level rise, shifting habitats, predicted species distribution shifts)
Step 2: Assessing biodiversity status	
Selecting biodiversity targets ▷ Consider multiple biodiversity and spatial scales ▷ Identify coarse filter targets (ecosystems) ▷ Identify fine-filter targets (species) ▷ Identify other important targets (*e.g.* keystone, wide-ranging) ▷ Map distribution of all targets	▷ Include targets that are sensitive to climate change impacts (*e.g.*, range-restricted, sensitive to temperature change) ▷ Include shifting habitat models based on predicted climate change when mapping target distribution
Assessing threats ▷ Identify a wide range of threats to biodiversity ▷ Assess distribution and severity of threats	▷ Include climate change as one of the layers in the threat assessment ▷ Explore relationships between climate change and other threats, (especially fire, invasive species and land use change) and their likely impact on targets
Assessing viability ▷ Assess size, condition and landscape context of targets	▷ Ensure viability rankings include aspects of climate change (*e.g.*, landscape context accounts for potential shifts in habitat, condition of target is robust enough to sustain climate change impacts)
Setting goals ▷ Identify abundance, distribution and design goals for targets ▷ Identify specific protection/conservation goals for targets	▷ Ensure numeric goals account for loss of habitat or range from climate change ▷ Ensure distribution and design goals account for shifts in habitats and species ranges resulting from climate change

Step 3: Assessing protection status	
Mapping protected areas ▷ Mapping protected area shape files ▷ Mapping protected areas by IUCN and governance types	▷ Create maps that show which protected areas are most likely to be affected by climate change ▷ Identify areas where management capacity to mitigate climate change impacts is weakest
Mapping results of management effectiveness ▷ Map results of any management effectiveness assessments	
Step 4: Analysing results	
Identifying protected area biases ▷ Clearly identify which targets are most under-represented	▷ Identify which targets are most likely to be under-protected in the future, given various bioclimatic scenarios
Identifying biodiversity at risk ▷ Clearly identify which targets are furthest from their ecological and conservation goals	▷ Identify which targets are most vulnerable to predicted climate change impacts
Identifying urgent spatial priorities ▷ Clearly identify which areas are most urgent priorities	▷ Identify areas where large numbers of targets are most likely to be at risk Identify areas where climate-related actions are most likely to have a high impact on biodiversity protection
Step 5: Taking action	
Identifying and prioritizing strategies for filling gaps ▷ Identify and prioritise multiple strategies: ▷ Revising PA designation ▷ Exploring alternative governance ▷ Encouraging 'other conserved areas' ▷ Expanding existing protected areas ▷ Creating ecological corridors ▷ Creating new protected areas ▷ Restoring existing protected areas	▷ Identify areas where "advance" restoration is possible (*e.g.*, planting mangroves on degraded wetlands in advance of rising sea levels) ▷ Identify areas where restoration will improve resilience (*e.g.*, reef restoration) ▷ Ensure that new areas (including corridors, new protected areas and expansions to existing areas) include overlaps between present and predicted future species ranges and habitats ▷ Locate corridors that will allow shifts between elevation and other types of gradients
Communicating results ▷ Written communication strategy ▷ Well-written, well-designed products	▷ Include messages about the importance of a robust protected area system design in mitigating impacts from climate change

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Protected Areas and Climate Turnaround strategy (PACT)— an insurance policy for the world's greatest risk

Trevor Sandwith

Abstract. There is a potential win-win-win for biodiversity, community and economy, as the role of protected areas and protected areas systems to mitigate global climate change and to support climate adaptation is increasingly being recognised. There are several opportunities currently available, particularly in view of the attention that decision-makers are likely to place on achieving solutions to the threats posed by progressive climate change. The challenge of developing win-win-win solutions and the opportunities potentially on offer are elaborated in this article and some suggestions are made for a new collaborative platform for future implementation.

Background

The conservation community is becoming increasingly aware of the potential impact of climate change on the global system of protected areas and on biodiversity in general. There is also a growing recognition of the importance of protected areas for sequestering and retaining carbon, and thus buffering the impacts of climate change. The world's nationally designated protected areas, now numbering 106,000 have an extent of 18,000,000 km^2 (11.63 per cent of the world's land surface) and if all forms of protected area governance are included, this proportion could be much higher (possibly in excess of 20 per cent).[1]

Investments in strategies to mitigate global climate change and to support climate adaptation could provide a source of finance to manage protected areas effectively.

Well-managed protected areas and protected area systems, while providing essential ecosystem services can also buffer associated production landscapes and communities from the negative impacts of climate change. Furthermore, investments in strategies to mitigate global climate change and to support climate adaptation could provide a source of finance to manage protected areas effectively; and unlock this potential in ways that fully engage, and are respectful of the rights of, local communities and indigenous peoples.[2]

A number of organisations and initiatives are currently planning activities to take advantage this nexus of issues, which has the potential for a win-win-win for biodiversity, community and economy. However, lack of co-operation and collaboration could result in a confusing message that undermines this opportunity, both for influencing global protected areas and climate policy and for successful implementation and impact at the local level.

There are many questions regarding the functional relationship of protected area systems and climate change adaptation/mitigation, of measurement and monitoring, of the costs and flows of benefits, of the institutional and governance mechanisms for increasing protected areas and their effective management,

Picture 1. There is increasing expertise in the assessment of the management effectiveness of protected areas (*Courtesy Marc Hockings*)

and of co-operatively managing funding derived from climate change mitigation and adaptation mechanisms. There are also many opportunities, particularly in view of the attention that decision-makers are likely to place on achieving solutions to the threats posed by progressive climate change. Elements of this challenge and the opportunities it offers are elaborated in this article and some suggestions are made for a new collaborative platform for future implementation. Firstly, it is useful to establish some foundational perspectives.

Systematic conservation planning

Based on reported progress on meeting the Millennium Development Goals and the targets in the Convention on Biological Diversity's Programme of Work on Protected Areas, the existing global system of protected areas falls short of meeting goals of biodiversity representation and persistence.[3] Many ecosystems are currently woefully under-represented within the system. Persistence targets rely on the inclusion of spatially referenced ecosystem processes, such as migration, streamflow, erosion and sedimentation etc in the system of protected areas at the scale of the regional landscape/seascape. Land-use changes, over-utilisation and fragmentation continue to reduce connectivity in marine, freshwater and terrestrial ecosystems, with consequences that include genetic isolation and loss of species and processes.

Nature conservation agencies and international organisations have refined methods for the systematic analysis of the protection targets for both biodiversity pattern and process, and are largely able to define priorities at a range of scales from global to local. This information is invaluable in guiding conservation action, including where to promote the designation of new protected areas and how to interact with land-use and development planning decision-making processes to maintain sufficient connectivity.[4]

This systematic approach is motivated by the objective of maintaining the robustness and resilience of ecosystems in the long term and of enabling evolutionary processes to operate without interference. The impact of accelerated climate change is to make this goal more immediate and urgent. The risk of extinction in rapidly changing environments is heightened by the short time scales (no time to adjust) and the inability of species populations to move into transformed or inhospitable habitat (nowhere to go).

Benefits of protected areas in the face of global change

Protected areas are established to maintain biodiversity and cultural resources, but essentially provide a range of services to humanity in addition to their intrinsic existence value. These services include conservation of biodiversity and therefore the variety of life on earth, provisioning of essential ecosystem

services, including pollination, energy and nutrient recycling, food resources, materials resources and water supplies, and also maintenance of spiritual and cultural values, opportunities for scientific research and investigation, and increasing outdoor recreation and nature-based tourism among others.

This is particularly important for indigenous peoples and local communities living in and around protected areas, where there is greater dependence on the natural ecosystems for local livelihoods. The loss of protected areas and the services they provide will negatively impact many communities globally, especially in the face of declining natural ecosystems as a result of agricultural and urban expansion elsewhere.[5]

They are also an important repository of the earth's biomass, including biomass-rich forests, peatlands and marine environments. Fully functioning ecosystems contained in protected areas can continue to sequester carbon and therefore both store and prevent the release of carbon into the atmosphere. Well-managed protected areas will continually decrease the amount of carbon in the atmosphere.

Protected areas are threatened by humanity's increasing need for resources, driving people to invade and over-utilise protected areas, especially through forest degradation, but also through mismanagement, such as inadequate or inappropriate fire management. Efforts to improve the effectiveness of protected area management have made huge strides, yet it is rare that adequate financial resources are available for effective protected area management, let alone in the face of the increasing risk and uncertainty posed by climate change.

The opportunity

The predicted progressive negative impacts of climate change is spurring action on the global development and policy agenda, and mechanisms are being sought to both mitigate the human induced accelerated processes leading to climate change, and also to enable rapid adaptation to the change that is inevitable.

Protected areas offer prospective solutions in a number of ways, to contribute to:

1. Mitigation through preventing the loss of carbon, where deforestation (including any form of carbon release from natural ecosystems in protected areas) would otherwise take place
2. Additional carbon sequestration through restoration and other carbon storage mechanisms
3. Adaptation in the wider regional landscape by providing a robust and connected system of protected areas that maintains essential ecosystem processes and benefits, especially for vulnerable communities, and that reduces direct pressure on the protected areas.

Carbon markets and voluntary payments have been identified as a highly possible source of financing for activities that result in a measurable retention of carbon through avoided deforestation and degradation at a national scale. In general, this requires the identification of carbon-rich areas, and especially forests, where management regimes can be instituted to avoid loss of forest carbon, and where the owners/managers of these forests can be compensated for undertaking this management. There are many policy and practical implications of such arrangements that are currently a focus of debate.

Protected areas have not been explicitly considered as they are assumed to be already protected and therefore will not increase the carbon under effective management. Yet, recent data on management effectiveness of protected areas[6] suggest that 38 per cent of the protected areas have barely acceptable management and 14 per cent have clearly inadequate management. There is indeed scope to involve national governments in an effort to improve management effectiveness and therefore avoid the risk of continued loss of carbon from protected areas. If national governments cannot achieve this in the protected area system, then it is highly unlikely that maintenance of carbon stocks through other forms of land management will be risk-free. All of these potentials rely on clearly defined policies, and mechanisms to quantify and reward those activities that avoid loss of carbon or that encourage natural restoration/regeneration.

Enabling conditions and gaps

Making the link between protected areas and climate change on the one hand, and with global climate related financing mechanisms on the other, is a complex undertaking. However, it is possible to break down the issues, and to examine each in turn, "taking stock" of what we know and what we need to know.

Conservation science

Conservation agencies and international organisations have refined techniques for conservation planning that provide an accurate means of asserting priorities for protection. Climate change prediction models, at least in some parts of the world, offer scenarios against which existing and new conservation plans can be evaluated, and alternative protection methods determined. Several organisation are developing revised standardised assessment tools to ensure that conservation plans and priorities factor in modelled predictions of climate change. This is likely to result in a new generation of climate-change adapted conservation plans, and therefore a revised set of priorities for conservation action.

Monitoring of protected area status and management effectiveness

The IUCN World Commission on Protected Areas, together with international conservation organisations, has refined techniques for assessing the effectiveness of protected area management and the UNEP World Conservation Monitoring Centre has expanded its capability to accurately monitor the state of the world's protected areas in relation to biodiversity conservation goals.[7] This monitoring needs to be extended to all protected area types, including protected areas that span national boundaries (transboundary protected areas). There is also a need to include in these assessments an analysis of their effectiveness for maintaining carbon, and as a result to institute programmes to reverse degradation and restore carbon-rich habitats. A related goal is to ensure that conservation managers are able to manage for the increased levels of risk and uncertainty posed by climate change, *e.g.* accelerated invasions by alien species and the increased frequency and intensity of fires.[8]

Protected area governance

Element 2 of the CBD *Programme of Work on Protected Areas* sets explicit direction for countries to employ a full range of governance types for protected areas including state, co-managed, community-conserved and private protected areas. IUCN, through WPCA and CEESP, is working on a number of themes related to Indigenous and Local Communities and Protected Areas, as well as Governance, Equity and Rights,

and has provided technical guidance on this subject.[9] Civil society groupings involved in the CBD processes have expressed encouragement and support for full and informed prior consent and involvement of communities in processes that lead to enhanced establishment and governance of protected areas. Although indigenous peoples and local communities have concerns regarding the manner in which climate change related funding might be used to secure and maintain forest carbon, there is no doubt that, if implemented in ways that are respectful of the rights of indigenous peoples and local communities, that these funds could support and enhance governance arrangements for these areas, maintain essential ecosystem services and compensate communities for their investment. In particular, there is an opportunity to recognise and value the contribution that indigenous and community conserved areas are playing in the matrix of protected areas that maintains connectivity across the landscape for climate change adaptation, and in the maintenance of carbon-rich ecosystems, irrespective of whether a climate change funding mechanism is invoked.

IUCN had identified climate change as the most significant threat to biodiversity on earth, and protected areas as the most important in situ mechanism for conservation.

Climate change funding mechanisms

There is no doubt that protected areas store carbon in a variety of vegetation types including above-ground, wetland and below-ground storage. Quantification of carbon stored, and measurement of changes in stored carbon in protected areas over time is an essential precondition for tapping into climate funding mechanisms. The Nature Conservancy and UNEP-WCMC is undertaking a preliminary analysis of carbon currently stored in protected areas, and this analysis needs to be extended to understanding current rates of loss of carbon from protected areas, compared with the surrounding landscapes. The application of acceptable measurement techniques is crucial for modelling the contribution to avoided carbon loss that will be made by consolidating or expanding the protected area system through corridors in the regional landscape. For climate change adaptation, a priority is to establish where corridors should be in relation to predicted climate change and how effective these networks will be in maintaining essential ecosystem services and related livelihoods in the face of climate change. Also required is an analysis of the costs of ensuring adequate levels of management effectiveness and governance to achieve these objectives in relation to the net value of the carbon retained. A means must be established to ensure that funding flows are channelled into effective management and local community participation/benefit.

Biodiversity and protected areas are currently not the focus of concern in the climate negotiations, either for mitigation, where the focus is on forest carbon, and not on biodiversity per se, or for adaptation where the focus may not explicitly include nature-based adaptation.

Advocacy and fund-raising

At the recent meeting to review the progress of the *Durban Action Plan* (crafted at the Vth World Parks Congress in 2003), it was noted that IUCN had identified climate change as the most significant threat to biodiversity on earth, and protected areas as the most important *in situ* mechanism

Picture 2. Discussion with local communities near Morondava, Madagascar about a proposed protected area (*Courtesy Nigel Dudley, Equilibrium Research*)

for conservation. Although the context is alarming, it can also be said that environmental issues have never been higher on the agenda of national governments than in relation to climate change. This has to be an opportunity that the biodiversity sector must take advantage of, not only because of the nature of the threats, but because of the opportunity that presents itself for protected areas to be positioned as part of the solution to the problem. The need for collaboration to achieve a critical mass of activity must be elevated above institutional and sectarian interests. This is particularly important since biodiversity and protected areas are currently not the focus of concern in the climate negotiations, either for mitigation, where the focus is on forest carbon, and not on biodiversity *per se*, or for adaptation where the focus may not explicitly include nature-based adaptation.

Challenges to establishing financial mechanisms

There remain logical, information and technical gaps, as well as co-ordination gaps that translate into needs and requirements for a programme linking climate mitigation and adaptation and protected area establishment and management. Necessary actions include:

1. Reaching consensus across governmental and non-governmental organisations globally and nationally on spatially explicit global conservation priorities.
2. Information regarding the ownership and tenure of resources contained in this future "protected area footprint" and therefore the range of institutions and communities that must be included in the strategy.
3. Information on the extent to which the existing protected area estate is threatened by deforestation/loss of carbon, and when and where this is likely to occur if left unmanaged.
4. Information at the national and local level regarding the predicted rate of land-use change that would affect the remnant ecosystems targeted for inclusion in the protected area system.
5. Information on the volume of carbon contained within ecosystems of various types and how changes are likely to be monitored over time.
6. Determination of an explicit relationship between measures of management effectiveness of protected areas and their state of forestation/deforestation.
7. Mechanisms to co-ordinate approaches internationally and nationally and/or alternatively to

Several commentators have made the point that a competitive scramble for resources will undermine the case and will in all likelihood not achieve the required synergy.

avoid inefficient competition and overlap, and to make best use of the opportunity presented by voluntary markets, REDD and other financing mechanisms.

8. Mechanisms to recognise the rights and duties of stakeholders, and in particular of indigenous peoples and local communities whose territories may be identified as a focus of mitigation or adaptation alternatives, encompassing a suite of costs and benefits.
9. Institutional mechanisms at the national scale to implement programmes that employ climate related funding mechanisms for enhanced protected area programmes.
10. Institutional mechanisms at a local scale (protected area scale) to involve protected area managers and/or indigenous and local communities (who may be protected area managers) in implementation and benefit sharing.
11. Capacity at all levels in the value chain to implement a complex function at scale.

Likely partners in developing a suite of interventions at national and global scales

Initial consultations have indicated a broad-based interest and willingness among organisations to become involved in forging a stronger, complementary alliance to take advantage of the opportunities. Several commentators have made the point that a competitive scramble for resources will undermine the case and will in all likelihood not achieve the required synergy. There are intersecting sets of issues that require separate analysis and integrated implementation:

- Making the case for effectively managing and expanding the protected area estate to address biodiversity priorities and the maintenance of carbon;
- Making the case for participation by a range of territories and protected area governance arrangements including indigenous peoples, local communities and the private sector;
- Making the case for fund-based voluntary payments or carbon credits to finance the expansion and effective management of the protected area estate, and the participation of indigenous peoples and local communities;
- Developing the institutional mechanisms to co-ordinate these elements together at national and local levels.

Some of the organisations that have leading and complementary roles to play in this (in no particular order) are: IUCN-WCPA, IUCN-CEESP and especially TILCEPA, UNEP-WCMC, IUCN Secretariat and thematic programmes, CARE International, The Nature Conservancy, Conservation International, WWF, Wildlife Conservation Society, Birdlife International, The Wild Foundation, the Climate, Community and Biodiversity Initiative, UNEP, UNDP, The World Bank, the Global Environmental Facility and representative organisations of indigenous peoples and local communities.

Assisting countries to establish climate change adaptation strategies that fully incorporate revised priorities for biodiversity and the recognition of the rights and opportunities for involvement of indigenous peoples and local communities.

It is proposed that these organisations co-operate to establish a common platform for collaboration at a number of levels, including:

- ▷ Reviewing conservation planning, management effectiveness assessment and governance mechanisms in light of predicted climate change.
- ▷ Finding common ground on issues of the use of climate-related funding that would compensate countries and communities alike for committing priority areas into a system of protected areas that would maintain and continue to sequester carbon.
- ▷ Advocating the recognition that biodiversity and protected areas have a significant contribution to make to climate change adaptation in international policy negotiations in both the CBD and UNFCCC policy arenas.
- ▷ Assisting countries to establish climate change adaptation strategies that fully incorporate revised priorities for biodiversity and the recognition of the rights and opportunities for involvement of indigenous peoples and local communities.
- ▷ Further research and knowledge sharing that would generate new insight as a basis for ongoing adaptive management.

A programme of activities spanning the next five years is possible and desirable to influence the protected areas agenda, and to secure synergy among the complementary goals of the UN Convention on Biological Diversity (CBD) and the UN Framework Convention on Climate Change (UNFCCC). It remains to be seen whether there is the will and capacity for nations, the conservation community and indigenous and community organisations to seek this common ground and to make the most of this opportunity.

Notes

1 Data from the World Database on Protected Areas–UNEP-World Conservation Monitoring Centre.

2 Galvin and Haller 2008.

3 Ervin, *et al.* 2008.

4 Sakar *et al*. 2006.

5 Sukhdev 2008.

6 Leverington *et al*. 2008.

7 Hockings, *et al.* 2006.

8 Dunlop and Brown, 2008.

9 Borrini-Feyerabend, *et al.* 2004.

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