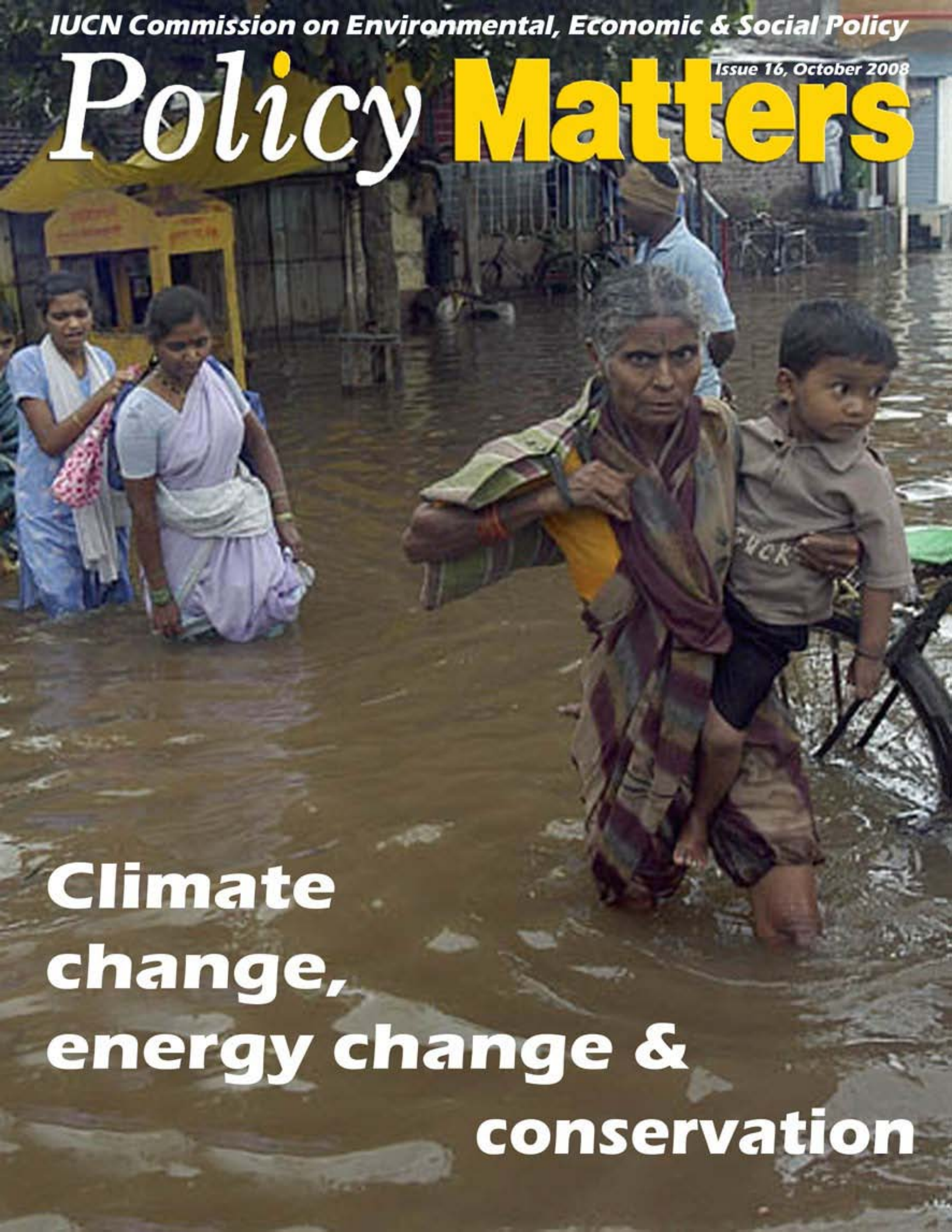
IUCN Commission on Environmental, Economic & Social Policy

Policy Matters

Issue 16, October 2008



Climate change, energy change & conservation

Indigenous & Community Conserved Areas (ICCAs)

ICCAs are natural and/or modified ecosystems containing significant biodiversity values, ecological services and cultural values, voluntarily conserved by indigenous peoples and local communities– both sedentary and mobile– through customary laws or other effective means.

ICCAs can include ecosystems with minimum to substantial human influence as well as cases of continuation, revival or modification of traditional practices or new initiatives, including restoration initiatives, taken up by communities in the face of new threats or opportunities. Several of them are inviolate zones with no or little human use, while others have various kinds of restricted uses, ranging from very small to large stretches of land and waterscapes.

Three features are important:

- One or more communities closely relate to the ecosystems and species culturally and/or because of survival and dependence for livelihood.
- The communities are the major players in decision-making and implementation regarding the management of the site, implying that community institutions have the de facto and/or the *de jure* capacity to enforce regulations. Often there are other stakeholders in collaboration or partnership, and in several cases the land is officially owned by the state; in all cases, however, the decisions and management efforts of the communities are essential.
- The community management decisions & efforts lead to the conservation of habitats, species, ecological services & associated cultural values, although the conscious objective of management may be different than conservation of biodiversity alone or *per se* (*e.g.*, it may be livelihood, water security, safeguarding of places important for cultural & spiritual reasons,

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LETTER FROM THE CHAIR OF CEESP

Dear CEESP members and partners,

I am particularly proud to introduce to you this timely and controversial issue of our Journal on "Climate change, energy change and conservation", for which I would like to commend all the members and partners who have produced the engrossing papers collected here and in particular the main Editor of the issue— Nigel Dudley— and his collaborators. As our affectionate readers know, our Journal is a forum where we explore and debate a variety of subjects of relevance to conservation. At times— like when we dedicated an issue to "History, culture and conservation" these subjects are important but subtle. At other times, like in the case of this issue, they are budding— if not exploding in our face— every way we look.

The industrial revolution ushered a time of enormous sacrifice and enormous prosperity.... But most such sacrifice— including today's most imminent threats from global warming— is made by the people who don't receive the benefits... and much of the benefits are received by people who make no sacrifice. It is as if our planet is being "disturbed" by this gross injustice, as if it was reacting to it....

Climate change is occurring: we see the impacts on species, ecosystems, glaciers, low-lying countries, the new Northwest Passage, and other climate related disasters.... Climate change is the strongest force we have ever fought in our pursuit of conservation. It is wiping out entire habitats, debilitating species, and disrupting the lives of people and their capacity to be effective managers of their lands. The poor and those without a strong enough voice (including wild species) lose out disproportionately. They are the ones who cannot buffer themselves against drought years, who have to settle in flood plains, live in cheap buildings that collapse, fall prey to new diseases…. Clearly, we need to respond, but we should be afraid of two types of responses: 1) meek, insufficient, politically timid responses, and 2) panic-motivated and hastily thought-out responses that do not touch the heart of the problem.

Charcoal making is a toiling activity, in Cambodia as in many other countries. (*Courtesy Grazia Borrini-Feyerabend*)

What is the heart of the problem? Well, all around it, like the layers of skin of an onion, there are the many layers of complexities that the articles collected in this issue have talked about…. It is indeed most important to understand and evaluate such complexities and thus avoid hastily thought-through solutions. But if we go a lot deeper, at the very core we find a flagrant lack of justice and retribution. The industrial revolution ushered a time of enormous sacrifice and enormous prosperity…. But most such sacrifice— including today's most imminent threats from global warming— is made by the people who don't receive the benefits… and much of the benefits are received by people who make no sacrifice. It is as if our planet is being "disturbed" by this gross injustice, as if it was reacting and letting us know.

This issue of *Policy Matters* points to complex solutions. Many of the solutions call for working with indigenous peoples and local communities and draw from both the best of new technology and the wisest of traditional knowledge. These solutions are crucial, but are not enough. We need also concerted action by governments, including focused solutions backed by major funding— as many Green New Deals as we can!

Policy Matters 16 is prepared for the Fourth World Conservation Congress in Barcelona (Spain) October 2008, where I will be passing on to a new Chair the tasks, preoccupations and sheer satisfaction of being the Chair of this great IUCN Commission. It offers me a chance to leave on paper some of my parting messages and I will do it with gusto, and with an eye to brevity as it is a letter and not a paper. I will leave you, dear members, and my beloved IUCN, with three recommendations:

- Remember that we can understand everything about a habitat, a species or a protected area and still be unable to do anything about saving it— conservation must go **beyond understanding into active care for the diversity of life and the governance of change**.
- **Seek the company of indigenous peoples and local communities more than the company of corporate lawyers and CEOs**—the latter may be economically powerful, but the former are the salt of the Earth and the hands and heart of conservation.
- Remember that we are about a "just" world that values and conserves nature— **striving for justice is the heart of all real solutions**, for problems that rise among people as well as for problems, such as global warming, that rise between people and nature.

Passing on the care of the land from a generation to the next: agroforestry in the Bijagos archipelago of Guinea Bissau. (*Courtesy Mariana Oliveira*)

CEESP has stood the test of time, and has shown great resilience. Let us remember that a previous Council killed our Commission by failing to send a mandate to Congress for its approval…. yet she was revived from its ashes—phoenix-like— by the passionate support of IUCN's Members in the Congress of 2000, at the very time when I was asked to become the Chair. CEESP has survived detractors, lack of financial support and attempts at diminishing our standing within the Union. I am leaving to the next Chair a vibrant organisation, strengthened by the conscience and commitment of hundreds of active members, many of whom represent the weakened of this world who have, through the Commission, managed to have a very audible voice within the Union.

We called attention to a power that is infinitely stronger and an infinitely better ally to conservation than the new imperialism and the greed of profit blinded corporations. We called attention to the silent and capillary conservation power of cultures and communities, a power that comes from the history of our species as part of nature.

Most importantly, CEESP managed to take a few small but clear strides for the cause of equity, the rights of indigenous peoples and local communities, and the recognition and support to their contribution to conserving and valuing nature. We called attention to a power that is infinitely stronger, and an infinitely better ally to conservation, than the new imperialism and the greed of profit blinded corporations. We called attention to the silent and capillary conservation power of cultures and communities, a power that comes from the history of our species as part of nature. May that power thrive!

Dear members, thank you very much for the great journey together, and let us keep going!

M. Taghi Farvar,
Chair, IUCN Commission on Environmental, Economic and Social Policy (CEESP)

PS*: For members who have not seen it before, this is the letter exchange we had with the IUCN DG regarding the partnership with Shell.*

http://cmsdata.iucn.org/downloads/letter_exchange_shell_agreement_iucn_dg_and_ceesp_chair.doc

EDITORIAL

Climate change, energy change and conservation—preparing for the long haul

Nigel Dudley

with Clive Wicks and Grazia Borrini-Feyerabend

The point of departure for this issue of *Policy Matters* is that the evidence for serious climate change is very strong, although the extent or timing of many of the impacts are still not yet precisely known. But the threats are not so overwhelming as to be hopeless. If we really thought the situation was without hope we would be concentrating on enjoying ourselves as the ship sailed on towards the edge of the world, rather than wasting time trying to solve the problems… Furthermore, while CEESP has argued strongly that IUCN should address climate change as a central part of its mission, we are also aware that a sudden rush of concern about climate should not blind us to other pressing problems; when nations start to panic the solutions they propose are seldom either very effective or very equitable. We can see a classical example unfolding in front of us at the moment in the rush to develop bio fuels without considering the impact on biodiversity or food production. Now is an important time to hold our collective nerve as well as pushing hard for some solutions.

Addressing climate change means embracing energy change: the two issues are intricately and profoundly related. Since the industrial revolution, the world has been increasingly addicted to fossil fuels; an addiction that is still accelerating today. The huge political and economic stake in these finite and polluting sources of energy has a colossal influence on events throughout the world, building or collapsing economies, fomenting wars and revolution and making or breaking leaders and politicians. Despite their huge profits and their acknowledged role in stimulating potentially catastrophic climate change, fossil fuel companies all too often enjoy subsidies, tax-breaks and political support on a scale that less damaging energy sources can only dream about. Moving away from fossil fuels, something that we have had the technical capability to do for decades in respect to many of their uses, is proving enormously difficult. Managing this transition in a way that does not create social collapse is perhaps the greatest geopolitical challenge humanity is facing at the moment.

Despite their huge profits and their acknowledged role in stimulating potentially catastrophic climate change, fossil fuel companies all too often enjoy subsidies, tax-breaks and political support on a scale that less damaging energy sources can only dream about.

But responding to climate change is not just about political or personal energy choices. Climate change is already with us, and whatever we do to reduce emissions of greenhouses gases over the next few years, we are faced with the need to respond positively and effectively to the problems that are already with us and will remain for a long time. The

papers collected here provide a stimulating array of responses from many countries to mitigate the consequences of climate change and some of CEESP's long-standing areas of interest, including community approaches to conservation and the importance of traditional agricultural and lifestyle patterns, have much to teach us.

High technology and low technology

Unfortunately, proposals for "solutions" to climate change are sometimes as divisive as the opinions about its essence. At the risk of simplification, they might be placed into two broad camps: low technology and high technology

At the low technology end, proponents argue that we need to transform our lifestyles at a fundamental and radical level; for instance virtually abandoning air travel and private motorised transport, pulling food production back to nearby sources, everyone lending a hand with food growing, recycling and small-scale energy production systems. A "transformation" movement is spreading through cities, towns and villages throughout Europe. The low technologists look to carbon sequestration and climate change mitigation from natural systems, to a worldwide switch to organic food production and a dramatic decrease in meat consumption: more generally to a switch from globalisation to localisation.

The high technologists on the other hand are more bullish about maintaining current lifestyles and look to nuclear power including nuclear fusion as an alternative electricity source, carbon capture technologies such as ocean fertilisation and genetically engineered trees, tapping of geothermal energy on a large scale, major solar electricity generation and other ways of engineering our way out of problems.

We need to rediscover the concept of "appropriate technology": choosing the best solution for the task while looking at the consequences that that solution has upon society as a whole and not just on the problem at hand.

To be realistic, we will probably need a mixture of low and high tech solutions, and it would be presumptuous to ignore any options for reasons of lifestyle choice or ideology. However, there is already today much we can do to reduce our greenhouse gas emissions through a mixture of energy savings, low technology and high technology. And we need to rediscover the concept of "appropriate technology": choosing the best solution for the task while looking at the consequences that that solution has upon society as a whole and not just on the problem at hand. In a world of vested interests and resistance to change, this is a tough political task indeed.

Picture 1. Alternative energy production has a proven record of success (*Courtesy Sue Stolton, Equilibrium Research*)

No free lunch

Unfortunately, many of the "solutions" to climate change carry some major costs of their own and create ethical problems for those trying to reduce their carbon footprint. Articles in the current issues of *Policy Matters* look amongst other such issues at questions of fair trade and air miles, of protected areas and human rights and at the worrying fact that virtually all viable energy sources currently have environmental groups campaigning against them, effectively neutralising each other's environmental voice. There are many such paradoxes. Should conservationists still fly around the world to do our work? Does carbon sequestration work or is it simply a way of "buying indulgences", offsetting nothing more than our own consciences? We still don't have the answer to many of these questions, but posing these questions as clearly as we can is a step in the right direction.

Following a decade where the concept of leadership by government has fallen out of fashion in some parts of the world, there is a need for strong and conscious recognition of the role of governments in combating climate change.

Who should be involved?

The majority of the problems have been created by a minority of the world's population: wealthy people in rich countries. The main burden of addressing the problems should fall on these people and particularly on a genuine application of the "polluter pays" principle. Most of us will only take the responsibility if we are pushed. For example, while it is undoubtedly true that some sections of industry have made a positive contribution to addressing climate change (and other environmental issues), relying solely on the market to solve climate change and energy issues through its own innate magic is too big a gamble; many of the changes that are becoming increasingly necessary demand pretty much the opposite of the usual corporate marketing plans. Non-governmental organisations are also constrained. They can help, agitate, lead by example and provide inspiration but can not and should not hold together national and international strategies on their own. Many hard decisions will therefore need to be made by responsible, elected governments, steered by the representative institutions of the international community, such as United Nations Agencies, international agreements and other global bodies with a democratic structure. Following a decade where the concept of leadership by government has fallen out of fashion in some parts of the world, there is a need for strong and conscious recognition of the role of governments in combating climate change.

Selling bad news

Whatever mixture appeals, the solutions to climate change all share some common problems for people interested in the intersection of environment and society. First, many of them (and almost all the low technology approaches) are not particularly appealing: indeed they represent an advertising executive's nightmare. Try as we can to make the idea of a lower consumption lifestyle sound attractive, promoting the idea of making do with less is hard to sell: less food variety, less foreign travel, less new clothes, less consumer goods are all ideas that many professional environmentalists find hard to follow through

in practice, let alone less concerned and more sceptical people. Many people around the world still aspire to join the consumption lifestyle lived by the minority (including of course most of the people reading this journal). And even more still need to take care of the basic necessities of life. For them, there is simply no chance of diminishing consumption, as they are already on the brink of survival.

The challenge of selling bad news will be made more acute when the current flurry of interest in climate change dies away. Which it probably will; the rush of books, articles and television shows on the environment is uncomfortably similar to those in the mid 1970s during the last oil shock and in the early 1990s during the Earth Summit. Next year, unless something dramatic happens, climate change may be way down many people's agendas again for a while...

What should IUCN be doing?

This leads us to the question of strategy. IUCN is about to start a new quadrennial programme that puts a high emphasis on climate change. But the organisation has little institutional history on this issue. What should be the priorities? For the sake of stimulating debate, we identify five key themes.

The first is to galvanise and ramp up the heartlands of the union: conservation and particularly species conservation and the role of protected areas as critical tools for conservation. Deforestation and uncontrolled forest fires still need to be stopped and forest conservation measures vastly increased. In the enthusiasm to build new partnerships and explore new territories there is sometimes a tendency to ignore what the world already knows us for and instinctively looks to us for advice. Developing and implementing effective species survival strategies and strengthening and providing advice on the rapid expansion of global protected area networks should be our first and most concrete contributions.

Deforestation and uncontrolled forest fires still need to be stopped and forest conservation measures vastly increased...

Second, amongst the plethora of proposals for addressing climate change, those involving indigenous peoples and local communities are appearing with increasing frequency; several are written about here. Many of these people are those already suffering from the impacts of climate change and environmental destruction. IUCN has built a solid body of experience in addressing issues of localising governance in various ways, notably relating to protected areas but with ideas applicable much further afield as well. It is time to both celebrate and further build on these successes. Appropriate recognition and support to indigenous peoples managing their own territories in customary ways and communities conserving natural resources for a variety of purposes should become central to IUCN's responses to climate change as well.

...recognition and support to indigenous peoples managing their own territories in customary ways and communities conserving natural resources for a variety of purposes should become central to IUCN's responses to climate change....

Picture 2. Commuters in Hanoi, Vietnam—many developing countries are seeing their energy use rise rapidly. (*Courtesy Nigel Dudley, Equilibrium Research*)

Third, we must strengthen IUCN's unparalleled cooperation with governments. IUCN is almost unique in the environmental field in having both governmental and non-governmental members, providing a rare "demilitarised zone" in which governments can meet each other and their own and other NGO members on neutral ground and hopefully with mutual respect. It is important that these meetings are not confined to occasional massive conferences such as the World Conservation Congress but that IUCN continues to facilitate hard and necessary debate about responses to climate change, while upholding the values of conservation with equity, and the respect of human rights.

Fourth if, as is intended, IUCN engages more fully in climate and energy policy over the next few years, it should do so in the context of promoting a genuine and radical change to energy supply: a veritable Energy Revolution, replacing fossil fuels with renewable energy sources and, as a precursor to that, replacing the current vast subsidies for fossil fuels with similar levels of support to help build genuine energy alternatives. The article by SEAPRISE in this issue of the journal lays out a clear and compelling strategic direction.

Next and perhaps most difficult, IUCN has also been building increasing links with industry and sees partnerships with both individual companies and corporate bodies as critical to its mission. We agree on the necessity of working with the industry sector and of IUCN's important role here, but recommend that IUCN should consider a careful review of both its existing relationships and any others that are in the planning stage. There are genuine worries amongst many IUCN members, including some government members, about the institutional framework for partnerships with industry (the very word "partner" is problematic as it assumes an equal relationship). Has IUCN been successful

Working with industry is indeed essential (and IUCN is in a very strong position to do it) but the Union should argue from a position of strength and not be afraid to disengage if this seems justified.

in promoting genuine change or is the Union simply overseeing some "green-washing"?

Overall, is our relationship with any given business playing a positive, neutral or negative role vis-à-vis climate change? If the role of an industry partner is inherently negative in terms of, for instance, producing greenhouses gases, are there real, on-the-ground changes and substantial policy changes that we can point at to justify the relationship with our Union? Are the partners supporting or undermining relevant IUCN Resolutions, such as the Amman 2000 Resolution asking that oil and gas exploration should not take place in category I-IV protected areas? Any kind of partnership is difficult; it implies some give and take, and some trade-offs as with every relationship; but we hear increasing concern about whether or not the current balance is right. Failing concrete signs of progress over time, it will be very difficult to justify our "partnerships" and "alliances" with business. In other words, working with industry is indeed essential (and IUCN is in a very strong position to do it) but the Union should argue from a position of strength and not be afraid to disengage if this seems justified. We are convinced that even industry, in the long run, will benefit from and will be grateful about such as a principled stand.

The concept of a Green New Deal is floated here, and we are confident it would repay careful consideration.

All the changes we are suggesting as necessary will cost money. But money is available. If the current massive subsidies to fossil fuels were shifted, even gradually, towards renewable sources and energy saving technologies, we would go a long way to addressing the shortfall. Even better, additional money could be found if polluting industries would pay a more realistic contribution to funding the solutions.

...promoting a genuine and radical change to energy supply: a veritable Energy Revolution, replacing fossil fuels with renewable energy sources.

In this light, and in the light of current enormous profits of some companies, the argument for a carbon tax is simply compelling. At a time of jitters about a global recession, the idea of governments taking a hand at addressing the problems by creating new and sustainable jobs through a large scale change in energy technologies becomes increasingly attractive. The concept of a Green New Deal is floated here, and we are confident it would repay careful consideration.

Nigel Dudley, the editor of this issue of Policy Matters, can be reached at equilibrium@compuserve.com. Nigel is a consultant and a member of CEESP and WCPA. He would like to express his thanks to the many people who wrote excellent and thoughtful articles, often at short notice. Particular thanks to Sue Stolton for devoting several days to helping finalise the text and artwork and to Grazia Borrini-Feyerabend for wise advice and support. Many thanks also to Jeyran Farvar (jeyran@cenesta.org) who has kindly taken care of art work and lay out.

Climate change and the energy crisis

Alleviating climate change

Robert Goodland and Simon Counsell

Abstract. Addressing climate change will require dramatic policy shifts in the fields of energy, livestock production and forest management. The following paper summarises where we are now and what we need to do, with an emphasis on how multilateral organisations like The World Bank can help to address the challenges ahead.

Forty-six nations and 2.6 billion people are now at risk of being overwhelmed by armed conflict and war related to climate change. A further fifty-six countries face political destabilisation, affecting another 1.2 billion individuals.[1] Climate change is today's biggest threat to international security and will intensify North-South tensions.[2] The world has to end growth in greenhouse gas (GHG) emissions within seven years (by 2015) and reduce emissions by about 80 percent by 2050. At least two-thirds of energy demand over the next twenty-five years will come from developing countries. The world must reduce annual carbon emissions from today's 8 billion tons down to about 2 billion tons to balance the assimilation capacity of the world's carbon sinks (such as oceans, forests, and other biomass).

Climate change is today's biggest threat to international security and will intensify North-South tensions.

The Energy Sector

The energy industry calculates that several thousand billion tons of coal remain in the ground - 150 years' worth at current extraction rates. It is therefore clear that most of the remaining coal has to stay in the ground if we are to avoid climate catastrophe. Three-quarters of coal reserves are in five nations: the United States, Russia, China,

Thus the fate of human civilisation probably hinges on the coal decisions of six nations and on preventing extensive forest fires in three others.

India, and Australia. Canada should be added to the list of critical nations because of the scale of its Athabasca tar sands and boreal peat deposits. Thus the fate of human civilisation probably hinges on the coal decisions of six nations and on preventing extensive forest fires in three others (Brazil, Indonesia, and Congo).

Picture 1. (*Courtesy Nigel Dudley, Equilibrium Research*)

The polluters, the historic emitters of GHG, must pay developing countries to leave coal and oil in the ground, leave their forests intact, and plant trees. In 2007 the World Bank proposed a new fund (the Forest Carbon Partnership Facility, FCPF) that might in principle serve to do that. At the time of writing, however, the details had still not been worked out, and Bank staff have so far refused to rule out that industrial logging in tropical forests will be eligible for FCPF funds. The International GHG Treaty should ban all subsidies to fossil fuels immediately and insist on full-cost pricing for all energy production. The $250Bn in subsidies currently allocated to fossil fuels and nuclear energy should be switched to renewable energy.

Over-reliance on efficiency and carbon trading is a monumental error.

Lighting accounts for 20 percent of global energy use. Over the past decades voluntary switching from 5 percent efficient incandescent light bulbs to 15 percent efficient fluorescents has not worked; incandescents must be banned outright. More efficient and with much longer lives? than compact fluorescents, LEDs (Light Emitting Diodes) are already available. The even newer Ceravision lamp has no electrodes, is 50 percent efficient, and does not wear out. Pricing, codes, and policies are all needed to accelerate uptake of efficient technologies.

Energy efficiency

Over-reliance on efficiency and carbon trading is a monumental error. Neither reduces the causes of climate change or the amount of GHG emitted. The term "carbon trading" conflates "cap-give-away quotas-and trade" with "cap-auction-trade." In both cases the cap is to the good, but giving away the rights to historical polluters means blessing the existing theft of the commons and letting scarcity rents go to private corporations rather than capturing them for public revenue. Trading at the national level, and maybe at a regulated international level, may be useful. Carbon emitters have to pay a higher price more commensurate with their pollution, and trading opens up a source of funds to transfer to the poor. A global carbon tax might do all this better.[3] A policy of sustainability first, leading to efficiency second, should be the first design principle for energy and climate policy.

The entire world demand for electricity could be met from 254 x 254 km of Sahara desert.

Ecological tax reform is a big part of the solution: a stiff severance tax on carbon levied at the wellhead and mine mouth, accompanied by equalizing tariffs on carbon-intensive imports and rebating the revenues by abolishing regressive taxes on low incomes. Such a policy would reduce carbon use, spur the development of less carbon-intensive technologies, and redistribute income progressively. Higher input price (on fossil fuels or carbon content) induces efficiency at all subsequent stages of the production process, and limiting depletion ultimately limits pollution.[4]

The transition to renewable energy should be accelerated as urgently as possible. Although most (such as geothermal) is site-specific, the potential is limitless. For example it has been calculated that wind energy in the Dakotas could supply adequate electricity to the whole USA. The entire world demand for electricity could be met from 254 x 254 km of Sahara desert. Desertic nations should be financially encouraged to export solar electricity and eventually hydrogen from water. Offshore wind, wave, current, and tidal power could become the backbone of the UK's electricity.[5]

No reliance should be placed on "clean coal" because it does not yet exist.

Coal

There is increasing support for banning all new coal-fired power plants that do not have provisions for CO_2 capture and sequestration. Since wind-generated electricity is already economic relative to coal with sequestration, there is no reason to allow the building of new power plants that would emit large amounts of CO_2 for decades.[6] Care must be taken to ensure that all former coal industry employees are retrained for sustainable jobs or fully compensated. Boosting efficiency by retrofitting existing coal power plants should be accelerated, as should phase-out of the dirtiest coal plants.

Clean Coal

No reliance should be placed on "clean coal" because it does not yet exist. It could become available after 2020, too late for the climate crisis. In any event, if clean coal is achieved, it will be about 25 percent more expensive and nearly impossible to monitor. Carbon capture and sequestration (CCS) technology is being experimented with, but on 30 January 2008, the US government cancelled its first pilot CCS project (FutureGen in Matoon, Illinois) after five years of costly delays. No replacement plans have been announced.

The era of cheap oil is already over; exploration for new deposits should be discouraged.

The intense focus of institutions such as The World Bank on coal efficiency and clean coal prevents developing countries from leap-frogging past the dirty energy phase of development, a mistake industrial countries are paying for dearly. China looks set to surpass the United States to become the world's largest energy consumer after 2010. China opens more than two new 600MW coal-fired power plants a week;[7] not one is capable of being readily retrofitted with future carbon sequestration technology. Each new coal plant emits about 15,000 metric tons of CO_2 per day. Coal accounts for more than 80 percent of China's carbon emissions.

Carbon sequestration

There is scope for carbon sequestration by reducing deforestation, planting trees and managing land on a global

scale. However, extreme caution is needed to ensure that such plantation schemes do not undermine the rights or livelihoods of poor people living in what are sometimes viewed as "degraded" forest environments, but which actually comprise occupied subsistence farmland. In addition, micro-algae have been demonstrated to sequester more than 80 percent of daytime CO_2 emissions from power plants and can be used to produce up to 10,000 gallons of liquid fuel per acre per year.[8]

Oil

It seems likely that the world cannot afford to burn its remaining oil. The era of cheap oil is already over; exploration for new deposits should be discouraged. Canadian tar sands should be left in place and re-vegetated.

Natural Gas

Natural gas is 'cleaner' than coal: It contains 70 percent less carbon per unit of energy than coal. As the transition to renewables will be wrenching, natural gas will have a role as a bridging fuel. But gas leaks are inevitable, it (methane) is 21 times more climate forcing than CO_2, and liquefaction, transport and regasification emit substantial quantities of GHG, so the gains are limited and temporary.

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Nuclear Energy

Nuclear energy is not a panacea. Full environmental and social costing, including the risk of terrorism and accidents and the diversion of radioactive materials to weaponry, must be mandated. The industry must pay for permanent storage of nuclear wastes. All waste storage and insurance against accidents must be the responsibility of the nuclear industry from now on. All subsidies to the nuclear industry must cease and preferably be reallocated to renewable forms of energy.

Hydroprojects

Reservoirs are the largest single source of anthropogenic methane emissions, contributing around a quarter of these emissions, or more than 4 percent of global GHG emissions. The recommendations of the World Commission on Dams[9] should be followed. In particular, hydroelectric projects likely to emit substantial amounts of GHG should be banned. Carbon emissions from any dam should be subject to the proposed global carbon tax.

Hydrogen fuel cells to promote the "hydrogen economy" may prove to be among the best bets for temporary subsidies.

Hydrogen

Generating hydrogen from fully renewable energy systems (such as solar and wind) by electrolyzing water (even sea water) seems hopeful. This is one of the main technologies for research. Hydrogen fuel cells to promote the "hydrogen economy" may prove to be among the best bets for temporary subsidies.

Caveat on Carbon Trading

The *International Carbon Procurement Vehicles Investor's Guide* (2007)[10] notes that more than 50 carbon funds exist and nearly €6 billion of capital has already been invested in them. They offer investors a diverse menu of opportunities for participating in the carbon market. However, analysts argue that conclude that the carbon trading approach to the problem of rapid climate change is fraught at present and ineffective.[11]

Box 1. Contraction and Convergence

Contraction and Convergence (C&C) is a global framework for reducing GHG emissions to a safe level. C&C was designed by the Global Commons Institute for the Intergovernmental Panel on Climate Change and the UN Framework Convention on Climate Change.[12] Longtime industrialised countries, which have produced the bulk of greenhouse gases, bear a much larger burden in preventing climate change; therefore they will have to play a leadership role, both regarding drastic emissions reduction and development of low- or no-carbon technologies to provide room to poor developing countries for economic development within the boundaries of a global carbon regime.

C&C is based on the science of limits and the principle of carbon justice, striving for convergence to equal-per-capita emissions rights, assisted by a medium-term, multistage approach accounting for differentiated national capacities. "Contraction" means global emissions are reduced in total over time so the concentration of greenhouse gas in the atmosphere stabilises at a level low enough and soon enough to prevent dangerous rates of climate change from taking hold. "Convergence" means that subject to this global limit, initial entitlements to emit carbon are distributed to all the countries or regions of the world with an agreed process of convergence to equalise per capita emissions entitlements across the planet.

During contraction and convergence, entitlements are assumed to be tradable and hence must be capped, with quotas initially distributed to the government, which then auctions them to users who are allowed to re-sell them. C&C also could work using the carbon tax rather than cap and auction-and-trade.

Caveat on Cap-and-Trade Schemes

Cap-and-trade schemes do not reduce GHG emissions; they merely allocate emissions costs, depending on where the cap is set. Clearly the cap could and should be set well below current usage. Cap-and-trade history shows that allowances are perversely handed out to major carbon emitters, who can use them or sell them at market rates. A growing consensus warns that carbon trading, and in particular the idea of offsetting carbon emissions, may be hurting, not helping, efforts to ensure a safe climate future. Cap-and-trade proponents argue that trading the right to emit CO_2 allows firms and nations to decide whether they should spend money on cutting pollution or on buying the right to pollute by paying someone else to cut back.

Most of the carbon credits being sold to industrialised countries come from polluting projects. Projects should be net reducers of carbon to have a credit to sell. Burning methane from coal mines or waste dumps for energy does little to wean the world from fossil fuels, but do such activities result in reduction of GHG? The forestry and carbon sink projects proposed for inclusion in the Clean Development Mechanism are a way for industrialised countries, responsible for 75 percent of greenhouse gas emissions, to obtain access to cheap ways of buying emission rights without committing themselves to reducing their emissions. At least they have to pay more to emit, and what they pay goes to a country that has not used its quota. GHG emission reductions must become the overriding priority and are achieved by a low cap, not by trading. Almost all such reductions must come from the polluters, namely the industrial nations.

Climate Geo-engineering

Schemes to increase the earth's albedo to reflect more sunlight back into space would need thorough environmental assessments well beforehand. For a life form that lives on solar radiation to block more of it from the earth to permit more rapid consumption of nonrenewable energy seems perverse. The hope that iron fertilisation of oceans will boost C-sink capacity seems risky. None of these ideas seems at all attractive to date and may postpone reductions in GHG emissions.

Box 2. Sector Solutions to Reduce Climate Risks

Transportation: Pedestrianism (including moving walkways) and non-motorised transport (such as bicycles) must become the priority. Transportation will become almost entirely electricity-driven. Mopeds and other electric and fuel-cell vehicles should become common and feasible through urban planning. Mass transit (electric) systems should become the norm; modal shifts to inter- and intra-city (electric) rail, and water transport should be encouraged. New highways are problematic. Air transport is likely to decline until renewable low- or zero-carbon fuels (such as solar hydrogen) become available.

Buildings: Changes include rehabilitation of existing building stock, insulation, solar windows with high insulation (which reflect heat in the hot season and absorb heat in the cold season), new lighting technology (compact fluorescents, LED bulbs), efficiency standards for water heating, refrigeration and other appliances, rooftop and parking-lot solar systems.

Industry: The most energy-intensive industries should be phased down. Combined heat and power systems will become commonplace. Industry must facilitate recyclability of its products. Industry should progress toward closed-loop manufacturing in which there is no waste. Wastes and waste disposal should be taxed to provide incentives for industry to recycle.

Urban and Municipal Authorities: Telecommuting should become the norm; working from home would reduce congestion and transport costs. Urban design should prioritise pedestrianism and facilitate bicycles. Other developments include solar-roofed parking lots, district heating systems, combined heat and power, efficient street lighting, efficient water pumping, waterless composting sanitation (with no new water-based sewage systems), recycling of water, collection of rain, composting of all organics.

Agricultural: Innovations include efficient solar and wind irrigation pumps, solar and wind-powered desalination, rainwater harvesting, water conservation, trickle irrigation, irrigation of food crops only, with none for fodder or livestock. There may be a role for the lowest-impact irrigation reservoirs.

Agrifuels produce more GHG than the fossil fuel they displace. If all costs are internalised, agrifuels will become uneconomic.[13] Diversion of crops to fuel reduces food availability, the prices of which are therefore soaring worldwide. In addition, 9,000 liters of water are needed to produce about one liter of agrifuel. There may be some benefit in the future from cellulosic and algal fuels, but they are still experimental. Livestock contribute more to GHG emissions than any other form of agriculture, and forests are often burned or destroyed to make room for ranches. Livestock constitute the least efficient form of producing human food and consume more water than any other product.

Livestock

The agriculture sector is generally agreed to account for one-quarter of GHG emissions, of which deforestation and livestock are the main elements. One journal estimated that 23

Picture 2. (*Courtesy Nigel Dudley, Equilibrium Research*)

percent of global carbon emissions derive merely from keeping livestock alive.[14] The FAO[15] provided a lower but still startlingly high estimate of 18 percent of GHGs attributable to the raising, processing, and transportation of livestock and their products. A 2006 Sierra Club report[16] estimated that the proportion of GHGs attributable to livestock may be 40 percent or higher.

However, the Food and Agricultural Organisation projects a doubling of livestock numbers in the next few decades. Reducing livestock consumption should be a key aim of greenhouse reduction policies.[17]

Commendably the World Bank published a Livestock Strategy in 2001, stating that the Bank would "avoid funding large-scale commercial, grain-fed feedlot systems and industrial milk, pork, and poultry production except to improve the public good areas of environment and food safety." Since then the International Bank for Reconciliation and Development (IBRD) and International Development Agency (IDA) branches of the Bank Group have not funded a single large-scale livestock project. However the International Finance Corporation (IFC) has stated that it need not abide by the World Bank's livestock strategy, and since the strategy appeared in 2001, IFC has invested US$732M to promote twenty-two livestock production projects, dwarfing and undermining IBRD/IDA's comparatively modest financing to reduce deforestation and GHG emissions. Almost all of IFC's projects involve precisely the type of livestock system that the World Bank's livestock strategy seeks to avoid: large integrated producers rather than small mixed farmers.

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Better results for the food industry—including producers (especially family farmers)— and consumers, nutrition, public health, and the environment, have clearly been seen when financial resources have been provided, both to producers to provide and market healthy products and to public health groups to conduct public-awareness campaigns.

Scarce agricultural development resources are more economically allocated to promoting increased accessibility by the poor to healthful foods, because such foods provide lower risks and impacts for the environment and public health, are more efficient in resource use, and are more equitable to poor farmers. Since most meat and dairy products are now available in soy-based versions, this alternative

would not require lowering nutritional standards; on the contrary, it would improve them.[18]

Forest Policy

More than 35 million acres of tropical forests are destroyed annually (particularly in developing countries), releasing more than 1.5 billion metric tons of CO_2, methane, and NOx into the atmosphere every year. Climate change is intensifying drought and the risk of forest fires. In some years, like the 1997-1998 El Niño year when fires released some 2 billion tons of carbon from peat swamps alone in Indonesia, emissions are more than twice that.

Serious technical challenges remain to the inclusion of forest carbon issues in any binding agreement on climate, not least because monitoring of carbon balances and flux from forests is practically difficult and poorly developed.

The omission of avoided deforestation from the Kyoto treaty resulted from concerns about the environmental effectiveness of the process, particularly since it would be difficult to enforce agreements by developing nations. Some environmentalists fear nations might sign up to secure one area, shifting deforestation elsewhere but bringing no net gain. Serious technical challenges remain to the inclusion of forest carbon issues in any binding agreement on climate, not least because monitoring of carbon balances and flux from forests is practically difficult and poorly developed.[19]

The World Bank reports that deforestation accounts for about 20 percent of global carbon emissions, mainly from fires set to clear land. In 2007 the Bank established a US$250m Forest Carbon Partnership Facility (FCPF), which aims to establish pilot activities to enable tropical countries to prepare for the inclusion of "avoided deforestation" in a post-Kyoto agreement in 2012. At the time of writing the FCPF had received the backing of the G8 and sign-off from the board, although many important details of the initiative are still under development. The Bank's BioCarbon Fund finances projects that sequester or conserve greenhouse gases in forest, agro, and other ecosystems. BioCarbon Fund projects have to fulfill criteria to ensure that the fund meets its own targets in the areas of climate and environment, poverty alleviation, project management and learning, and portfolio balance. Each BioCarbon Fund project is expected to deliver between 400,000 and 800,000 tons of CO_2 equivalents (CO_2e) over a period of ten to fifteen years. In return a typical project will receive about US$2-3 million in payments (US$3-4 per ton CO_2.[20] It is still too soon to judge the extent to which this can reduce atmospheric GHG.

However, the Bank's own policies sometimes seem to be at odds. The US$80m Amazon Region Protected Areas Project expands Brazil's protected areas system in the Amazon region as a first phase alone. But this is undermined by IFC's Bertin cattle-ranching projects in the Amazon forest region. The issue of the IFC undercutting other Bank policy calls for more explanation as they are theoretically governed by the same board. Similar IBRD projects finance forest conservation in Mexico (US$45M), Costa Rica (US$32M), and Peru (US$23M). Such initiatives need to be monitored, revised, and

Photo 3. (*Courtesy Nigel Dudley, Equilibrium Research*)

ramped up. In 2007 the Bank's former chief economist and vice president, Lord Nicholas Stern, urged the Bank to desist from financing deforestation as the biggest and most immediate contribution it could make to reducing GHG emissions. However, the Bank has a long track record of funding industrialisation of natural forest areas in the tropics and, more recently, in the former communist countries.[21]

Outright conversion or fragmentation of natural forests for any purpose, such as oil palm plantations, cattle ranching, soy, logging, and mangrove shrimp ponds should cease immediately.

More than 2.5 million acres of Indonesian rainforests are cleared for oil palm plantations, and 3.5 million acres of Amazonian rainforest are cleared every year, primarily for enormous soy fields and cattle ranching.[22] IFC finances oil palm, soy, and cattle ranching in tropical rainforest regions and shrimp cultivation in mangrove forests. For IFC, destruction of tropical rainforest in general is insufficient reason for an Environmental Assessment (EA) Category "A." For example, IFC's US$80 million finance of Indonesia's Wilmar Oil Palm Project in 2006 is EA Category "C." IFC justifies this by writing, "It is anticipated that this project will have minimal or no direct, adverse social or environmental impacts." IFC omits emissions of greenhouse gas, risks to indigenous peoples, and loss of biodiversity.[23]

Outright conversion or fragmentation of natural forests for any purpose, such as oil palm plantations, cattle ranching, soy, logging, and mangrove shrimp ponds should cease immediately. Conservation of forests, prevention of forest burning, remote-sensing detection of logging and fires, and enforcement of laws should be emphasised. The In addition, the G8/World Bank BioCarbon Fund should increase by orders of magnitude from today's few million dollars to several billion dollars within a very few years, especially in the Congo and Central Africa, Indonesia, Malaysia, Papua New Guinea, Cambodia, Laos, and the Amazon forest nations.

The risks are that incorporating forests into the carbon market would simply guarantee their passing into the hands of big private interests.

The Forest Carbon Partnership Facility should not directly or indirectly fund any activities connected to industrial forestry in any natural or semi-natural forests. It also should not necessarily focus on preparation of avoided-deforestation programs for entry into future forest carbon markets. Instead it should explore and support investigation of the most cost-effective means of protecting forests, particularly through changes to land-tenure and resource-access regimes. It should support the development of Fund-based forest carbon-financing mechanisms instead of only trading mechanisms. The risks are first that incorporating forests into the carbon market would simply guarantee their passing into the hands of big private interests. Second, such funds could trigger further displacement, conflict, and violence to Indigenous Peoples. As forests themselves increase in value, they might perversely be declared off limits' to communities that live in them or depend on them for their livelihoods.

Assist developing countries to plan for and implement a prompt and orderly transition to renewable energy and GHG reduction.

Key Recommendations

The following recommendations are offered to help alleviate climate risks. These roughly ranked recommendations strongly support and are generally consistent with those offered by seven major recent international studies.[24] IEA concludes, "Vigorous, immediate, and collective policy action by all governments is essential to move the world onto a more sustainable energy path."

"Prevention first by reducing GHG emissions; adaptation second"

1. ***Forest Conservation:*** Switch from current financing of industrial logging and forest destruction to support strengthening of tenure rights of forest-based communities, community-based forest management, and more conservation, reforestation, and afforestation for carbon sequestration. This is the most cost-effective GHG measure, according to Lord Nicholas Stern.

2. ***Comply with World Bank Group (WBG) Livestock and Nutrition Rules:*** Instruct IFC to follow all WBG policies and strategies, especially: (a) the Livestock Strategy (no more financing for industrial livestock production), and (b) the Nutrition Strategy, which does not recommend meat consumption. This would be the second most cost-effective method, according to FAO.

3. ***Renewable Energy:*** Switch from current massive financing of fossil fuels rapidly toward renewable energy (solar, wind, wave, tidal, micro-hydro) with conservation and energy efficiency, and especially decentralised systems for the poor. Eliminate all subsidies for fossil fuels. Assist developing countries to plan for and implement a prompt and orderly transition to renewable energy and GHG reduction.
   - ▷ **Get the Price Right:** Promote all nations' adoption of clear price signals, such as a global carbon tax to be used as each

nation sees fit. The C-tax must be revenue neutral for the poor.

- **Contraction and Convergence:** Finance, advise on and otherwise encourage contraction and convergence to reduce GHG emissions. Persuade borrowing member nations to adopt that principle. Support a physical limit (hard cap) that declines to zero before the threshold 2°C rise in temperature occurs.
- **International Agreements**: Vigorously support the process for the comprehensive post-Kyoto international agreement under the auspices of UN FCCC.
- **Stringent Energy Standards:** Accelerate improvement of end-use standards commensurate with evolving science for vehicles, lighting, building codes, electric motors, and appliances.
- **GHG Sources and Sinks:** Monitor GHG emissions and carbon-sink capacities, including oceanic (marine acidification). Implement agreements on deforestation and livestock.

4. ***Prioritise Poverty Reduction:*** Reinvigorate meeting the Millennium Development Goals as the WBG's top priority to reduce poverty and to assist the poor in becoming more resilient to withstand climate impacts. Ramp up direct funding for poverty reduction, job creation, nutrition, education, and health. Move away from indirect and inefficient trickle-down economics.
   - **Adaptation to climate change:** Assist developing countries to adapt to climate change, starting with vulnerability assessments of small island nation states such as the Maldives and deltaic countries such as Bangladesh.

Acknowledgments
We offer sincere thanks for the contributions to this paper from Herman Daly, especially his 2008 paper on the monumental blunder of pursuing efficiency in coal-powered electricity generation before sustainability. Aubrey Meyer kindly helped us with 'Contraction and Convergence'.

Robert Goodland is former chief ecologist at The World Bank. Simon Counsell is director of The Rainforest Foundation in London

Notes

1 Smith 2007.
2 Campbell *et al.* 2007.
3 Daly 2007a.
4 Daly 2007b.
5 Helweg-Larsen and Bull 2007.
6 Wheeler 2008.
7 Martinot and Junfeng 2007.
8 Makhijani 2007.
9 World Commission on Dams 2000.
10 *International Carbon Procurement Vehicles Investor's Guide* 2007.
11 Lohmann *et al.* 2006, Leach 2008.
12 www.gci.org.uk/briefings/ICE.pdf
13 Smolker *et al.* 2007, Searchinger 2008.
14 Calverd 2005.
15 FAO 2006.
16 Sierra Club 2006.
17 Goodland 1998.
18 Chopra *et al.* 2007.
19 Counsell *et al.* 2007.
20 Bosquet 2006.
21 Stern 2007.
22 Bickel 2003, Caruso 2005, Chomitz *et al.* 2007, Dros 2004, Kaimowitz *et al.* 2004, Lilley 2004.
23 Greenpeace 2007.
24 Helweg-Larsen and Bull 2007, GLCA 2007, InterAcademy Council 2007, Makhijani 2008, Practical Action 2007, Wheeler 2008.

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Nuclear power, global warming and uranium supplies

David Fleming

Abstract. The world's endowment of uranium ore is now so depleted that shortages of uranium— and the lack of realistic alternatives— could lead to interruptions in supply from the middle years of the decade 2010-2019, and will be expected to deepen thereafter. Every stage in the nuclear process, except fission, produces carbon dioxide. As the richest ores are used up, emissions will rise.

Greenhouse gases

Every stage in the life-cycle of nuclear fission uses energy, and most of this energy is derived from fossil fuels. Nuclear power is therefore a substantial source of greenhouse gases. The delivery of electricity into the grid from nuclear power produces, at present, roughly one third as much carbon dioxide as the delivery of the same quantity of electricity from natural gas....[1]

... or, rather, it *would* do so, if the full energy cost of producing electricity from uranium were counted in— including the energy cost of all the waste-disposal commitments. Unfortunately (in part because of the need to allow high-level waste to cool off) that is not the case. Nuclear waste-disposal is being postponed until a later date. This means that the carbon emissions associated with nuclear energy look rather good at the moment: at about 60 grams per kWh they are approximately 16 per cent of the emissions produced by gas-powered electricity generation.[2] The catch is that this figure roughly doubles when the energy-cost of waste-disposal is taken into account, and it grows relentlessly as the industry is forced to turn to lower-grade ores. What lies ahead is the prospect of the remaining ores being of such poor quality that the gas and other fossil fuels used in the nuclear life-cycle would produce less carbon dioxide per kilowatt-hour if they were used directly as fuels to generate electricity.[3]

Carbon dioxide is not the only greenhouse gas released by the nuclear industry. The conversion of one tonne of uranium into an enriched form requires the addition of about half a tonne of fluorine, producing uranium hexafluoride gas (hex) to be used in the centrifuge process. At the end of the process, only the enriched fraction of the gas is actually used in the reactor: the remainder, depleted hex, is left as waste. Not all of this gas can by any means be prevented from escaping into the atmosphere, and most of it will eventually do so unless it is packed into secure containers and finally buried in deep repositories.[4] Hex is a halogenated compound (HC), one of several that are used at various stages of the cycle. HCs are potent greenhouse gases. The global warming potential of freon-114, for instance, is nearly 10,000 times greater than that of the same mass of carbon dioxide.[5] There is no published data on releases of HCs from nuclear energy. A reliable study of all releases of greenhouse gases from the nuclear fuel cycle, and their effect on the atmosphere, were commissioned and published without delay.

The gas and other fossil fuels used in the nuclear life-cycle would produce less carbon dioxide per kilowatt-hour if they were used directly as fuels to generate electricity.

Ore quality

Both the quantity of greenhouse gases

released by nuclear energy per kilowatt hour and the net energy return of the nuclear industry are determined primarily by the quality (grade) of uranium ore being used. The lower the grade of ore, the more energy is needed to mine and mill it and to deal with the larger quantity of tailings. The limit, in theory, is reached with an ore grade of about 0.01 percent for soft rocks such as sandstone, and 0.02 percent for hard rocks such as granite. If grades lower than those limits were to be used, more carbon dioxide per kilowatt hour would be produced by the nuclear cycle than by the same amount of energy produced from gas. The energy return on energy invested (EREI) would be less than the energy return you would get if you generated the electricity directly in a gas turbine.[6]

But these are only "theoretical" limits, because in practice the turning-point to a negative energy return may be substantially sooner. There are five key reasons why ore which is theoretically rich enough to give a positive EREI may in fact not be rich enough to justify exploitation: to yield a *practical* return on energy investment (PREI): increasingly deep deposits; problems with water; difficulties in raising investments for what may be a long payback; local geological conditions; and the relatively small energy contribution from the ore

Where, then, does the practical turning point lie, below which the ore quality is too poor to be useful? We know that this varies with local conditions; but for a worldwide average above which uranium ore can still provide a positive PREI, a suggested guideline is *no lower than 0.1 percent.*[7]

Uranium supply

So— how much uranium ore with a positive PREI do we have left? The "Red Book" is the most authoritative source on the quantity and quality of the remaining uranium ore, and of future prospects for production. It is prepared by the OECD Nuclear Energy Agency (NEA) in partnership with the International Atomic Energy Agency (IAEA), and the 2005 edition was published in June 2006.[8] In its discussion of the availability of usable uranium ore, it suggests that there is 70 years' supply at the current price.[9] It adds, however, that, when "prognosticated and speculative" resources are added in, there is enough to maintain current output for a further 270 years.[10] The figure of 70 years is not dissimilar to that of independent analysts Storm van Leeuwen and Smith, who suggest 60 years.[11] However, the NEA/IAEA expects its prognosticated and speculative reserves to last 270 years. Prognosticated and speculative reserves, if they exist, will be deep below the surface, requiring very large investments of time, capital and energy before they can be exploited. Those speculative resources— which the NEA hopes will one day becomes usable reserves— will need to be remarkably rich, relative to the vast deposits of very low-grade and useless ore of which we are already aware.

There is a widely-shared recognition that there will be a severe shortage of uranium around 2013.

Furthermore, both the NEA and the Storm van Leeuwen and Smith estimates contain assumptions which tend to exaggerate the time remaining before depletion. First, both estimates are "reserves-to-production ratios", which gives the misleading impression that production can continue at a constant rate before coming to an abrupt stop. In fact, it is well understood that production of a resource in its latter years takes its time to decline towards zero; it is in the years *closely following the peak* that the trouble starts. Secondly, the growth in demand for uranium which the nuclear industry seems to expect would, in any case, foreshorten the whole sequence a likely cut-off point on the assumption of increasing demand

is probably closer to 35 years. Thirdly, both estimates are of the TREI limits, not the much earlier turning-point to negative PREI. These three factors bring forward the period during which deep deficits in uranium supply can be expected, to the decade 2011-2020.

Supply crunch

And, indeed, there is a widely-shared recognition that there will be a severe shortage of uranium around 2013. This is frankly acknowledged by the NEA itself, and set in context by the First Uranium Corporation.[12]

At present, about 65,000 tonnes of natural uranium are consumed each year in nuclear reactors worldwide.[13] The number of reactors in existence in 2013 will be the product of (1) retirements of old reactors and (2) start-ups of new ones. There is no basis for a reliable estimate of what that net number will be, so we will assume that there is no change from the present.

About 40,000 tonnes of this total demand of 65,000 tonnes are supplied from uranium mines, which leave the remaining 25,000 tonnes to be supplied from other sources.[14] 10,000 tonnes comes from "military uranium"— that is, from the highly-enriched uranium salvaged from nuclear weapons, chiefly from the arsenal which the Soviet Union built up during the Cold War, and which is now being dismantled with the help of subsidies from the United States. The remaining 15,000 tonnes comes from a range of "secondary supplies", consisting of inventories of uranium fuel that have been built up in the past, together with recycled mine tailings and some mixed-oxide fuel (MOX), a mixture of recycled plutonium and depleted uranium.[15] The expectation is that neither of these crucial supplements have much longer to last. Military uranium is being depleted rapidly Russia is getting towards to the end of her supply of obsolete nuclear warheads. There is no chance of the contract being renewed beyond 2013.[16]

Secondary supplies are also in decline. The inventories are approaching exhaustion, and this has been one of the drivers of the recent sharp rise in the price of uranium.[17] The amount of uranium derived from tailings has been falling, and it has been calculated that the scale of the task of increasing production of uranium-235 now would require arrays of continuously-operating gas centrifuge plants running into the millions.[18] The supply of MOX fuel, derived from a reprocessing which is already at its practical limits, is not expected to increase.

2013, the year in which the contract for military uranium expires, can be taken to be a crucial date for uranium prospects. Unless the production of mined uranium can be increased by some 22,000 tonnes per annum, there will be a 35 per cent deficit in uranium supply. So, the question is whether the production of mined uranium can rise to compensate.

Box 1. Dealing with waste

The nuclear industry also has a major problem with the disposal of its own waste products; itself a massively energy intensive process. Unless it starts directing almost the whole of its net energy output to clearing up its own waste in the very near future, the nuclear industry will never produce the energy needed to do so. The planet will be left with leaking, burning and flooding high level waste-dumps in perpetuity. It would be helpful if this task were done before rising sea levels reach the coastal nuclear reactors and the waste dumps in their back gardens.

Can uranium production increase to fill the gap?

Although several of the medium-sised producers have in recent years roughly maintained their output, or slightly increased it— notably Kazakhstan, Namibia, Niger and Russia— the world's two largest producers— Canada and Australia— both show some evidence of being in recent decline, with uranium production falling by (respectively), 15 and 20 percent in 2005-2006.[19]

In both cases, hopes for expanding production have been pinned on major new projects— the new Cigar Lake mine in Canada, and the expansion of Olympic Dam in Australia. Cigar Lake is designed to produce nearly 7,000 tonnes per annum, and it was due to start in 2007. However, in October 2006, it flooded; the probable way of containing the water in the sandstone above the workings is by refrigeration, which will require large inputs of energy even before work can begin. It is now uncertain whether, even after long past and future delays, Cigar Lake will ever be a substantial source of uranium.[20]

Far from expanding in order to sustain the flow of energy following the oil peak, the nuclear industry could indeed begin to falter during the decade 2010-2019

The contribution of Olympic Dam is in some ways even more dubious. At present, it is an underground mine well past its maturity, and the management, BHP Billiton, is considering whether to move to an adjacent ore body with an open pit mine on a massive scale. The problem is that the uranium ore is very low-grade— only 0.06 percent and less, with an average of 0.029 percent, so that it would be uneconomic in money terms if it were not for the copper, gold and silver which the rock also contains. But that itself is a mixed blessing because it means that the copper is contaminated with small quantities of uranium, which has to be removed in a smelter constructed in the Australian desert, adding even greater energy-costs to the final energy yield.[21]

Lovelock's argument is persuasive. But there are three grounds on which it is open to criticism.

On this evidence is seems probable that, far from expanding in order to sustain the flow of energy following the oil peak, the nuclear industry could indeed begin to falter during the decade 2010-2019, with some nuclear reactors being closed down for lack of fuel, and some of the reactors now in the planning stage and under construction remaining unused indefinitely. In the light of this, a judgment has to be made as to whether hopes of a revival of uranium supply are a sufficiently realistic foundation on which to base expectations that the nuclear industry has a long term future as a major energy provider

Alternative uranium sources

Finally, we should consider James Lovelock's robust dismissal of the idea that the growth of nuclear power is likely to be constrained by depletion of its raw material. This is how he deals with it:

"Another flawed idea now circulating is that the world supply of uranium is so small that its use for energy would last only a few years. It is true that if the whole world chose to use uranium as its sole fuel, supplies of easily-mined uranium would soon be exhausted. But there is a superabundance of low-grade uranium ore: most granite, for example, contains enough uranium to make its fuel capacity five times that of an equal mass of coal. India is already preparing to use its abundant supplies

of thorium, an alternative fuel, in place of uranium."[22]

Lovelock urges that we have a readily-available stock of fuel in the plutonium that has been accumulated from the reactors that are shortly to be decommissioned. And he might have added that other candidates as sources of nuclear fuel are seawater and phosphates. So, if we put the supposed alternatives to uranium ore in order, this is what we have: (1) granite; (2) fast-breeder reactors using (a) plutonium and (b) thorium; (3) seawater; and (4) phosphates.

Lovelock's argument is persuasive. But there are three grounds on which it is open to criticism.

1. The nuclear fuel cycle

Uranium depletion is not a "flawed idea"; it is a reality that is just a little way ahead. Uranium ore is in increasingly short supply. Sources from granite or seawater are too inefficient to make practical sense. Phosphates might be possible but world production is already struggling to keep up with agricultural requirements. Fast breeder reactors have failed to live up to their promise and widely abandoned; it is highly unlikely that they can be developed quickly enough to address the immediate problems of global warming

The nuclear energy industry is small, providing a mere 2.5 per cent of the world's final energy demand.

2. Alternative energy strategies

Lovelock may underestimate the potential of the fourfold strategy which can be described as "Lean Energy":

1. Energy efficiency: to achieve the decisive improvements in the efficiency of energy-services made possible by the conservation and energy-saving technologies.
2. The proximity principle: to develop the potential for local provision of energy, goods and services. Deep reductions in travel and transport can be expected to come about rapidly and brutally as the oil market breaks down.
3. Renewable energy: to design and build renewable energy systems to match the needs and resources of the particular place and site.
4. Tradable Energy Quotas (TEQs): to define a secure energy budget for the whole economy, involving every energy-user in the common purpose of achieving deep reductions in energy demand.[23]

It cannot be expected that this strategy will fill the energy gap completely, or neatly, or in time, but nor is Lovelock suggesting that nuclear energy could do so. Even if there were neither a uranium-supply problem to restrain the use of nuclear energy, nor a waste-problem, and even if it were the overriding priority for governments around the world, nuclear energy would still fall far short of filling the gap. There are good reasons to believe that Lean Energy could do better. It would start to get results immediately. Per unit of energy-services produced, it would be about ten times cheaper.

3. The oil peak

Lovelock does not give enough weight to the significance of the oil peak. As this weighs in, it will establish conditions in which there is no choice but to conserve energy, whether the urgency of climate change is recognised or not.

Conclusion

The priority for the nuclear industry now should be to use the electricity generated by nuclear power to clean up its own pollution and to phase itself out before events force it to close down abruptly. Contrary to what you might think, given the huge scale of its problems and its supposed status as a fall-back position which could solve our energy problems the nuclear energy industry is small, providing a mere 2.5 per cent of the

world's final energy demand.[24] Nuclear power is not a solution to the energy famine brought on by the decline of oil and gas. Nor is it a means of reducing emissions of greenhouse gases. It cannot provide energy solutions, however much we may want it to do so.

David Fleming (fleming@theleaneconomyconnection.net) is director of the Lean Economy Connection and a researcher and writer on energy and the environment, based in London. He is a former chair of the Soil Association.

Notes

1 Storm van Leeuwen and Smith 2006.
2 Storm van Leeuwen 2006a.
3 Oxford Research Group 2006a and 2006b.
4 Storm van Leeuwen 2006c.
5 Nuclear Fuel Energy Balance Calculator 2007.
6 SLS; Storm van Leeuwen 2006b.
7 Note that Rio Tinto (2005) announced a "cut-off grade" of 0.08 per cent for its existing stocks of ore at its Ranger mine in Namibia.
8 NEA/IAEA 2006.
9 Nuclear Energy Agency 2006; The World Nuclear Association 2007b.
10 Nuclear Energy Agency 2006.
11 Oxford Research Group 2006a.
12 Nuclear Energy Agency 2006; First Uranium Corporation 2007.
13 World Nuclear Association 2007b.
14 World Nuclear Association 2007c.
15 Dzhakishev 2004.
16 Bunn 2003.
17 Collell 2005; Zittel and Schindler 2006.
18 Busby 2007a.
19 World Nuclear Association 2007c.
20 Zittel and Schindler 2006.
21 Australia Uranium Association 2007; BHP Billiton 2007; Busby 2007b.
22 Lovelock 2006.
23 Fleming 2007; Womack and Jones 2003.
24 IEA 2007; Boyle 2004.

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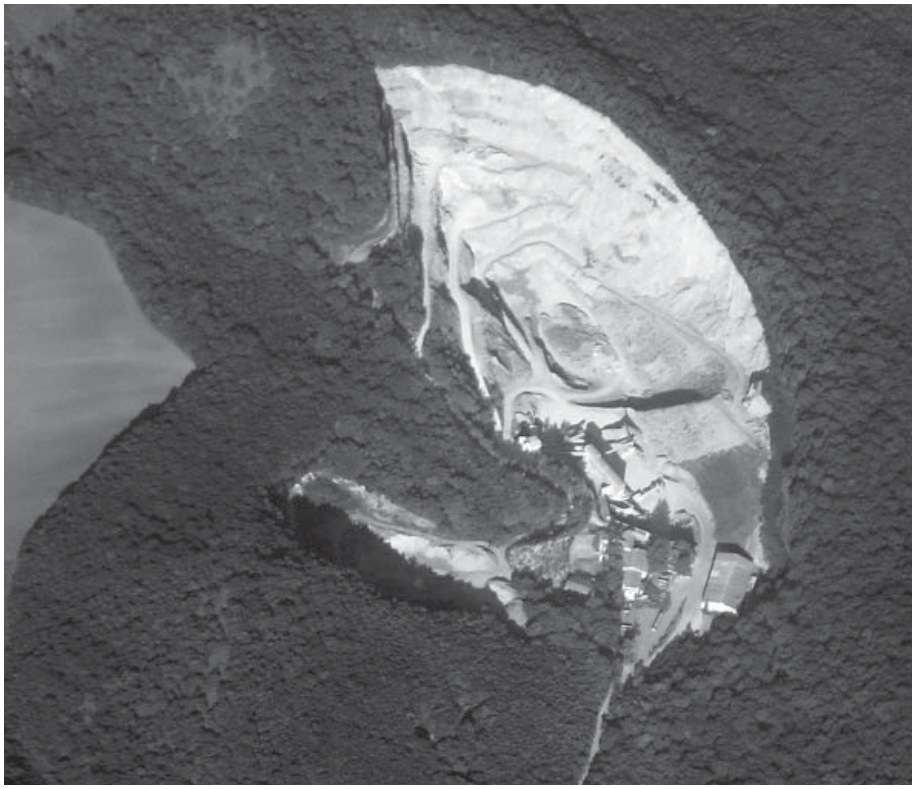
The differences between biotic and mineral resources and their implications for the conservation-climate debate

Rolf Steppacher and Pascal van Griethuysen

Résumé. Toute tentative de relier les enjeux de la conservation à la question climatique devrait partir d'une distinction préalable entre les ressources biotiques et les ressources minérales sur la base de leurs caractéristiques écologiques et économiques. Les ressources biotiques peuvent être utilisées de manière soutenable mais ne peuvent alimenter un processus de croissance économique exponentielle. Les ressources minérales (et en particulier les combustibles fossiles) permettent d'alimenter une croissance économique exponentielle, mais seulement pendant une période historiquement limitée et au prix de graves conséquences écologiques.



Picture 1. Resource use in France (*Courtesy Nigel Dudley, Equilibrium Research*)

Introduction

When jointly addressing issues such as natural resources, conservation or climate change, economic questions are prevalent. The manner in which these questions are formulated, presented and organised, depends on the preconceptions of economic theory, its cultural, philosophical and methodological foundations. This is the case with natural resources: while conventional economics tries to approach natural resources through their monetary counterpart,[1] ecological economics stresses the need to make the biogeochemical characteristics of these resources explicit. This allows distinguishing between the ecological and economic potential of resources, beginning with their differing capacity to meet social objectives such as economic growth and ecological sustainability. Given their radically different ecological and economic characteristics, erroneous conclusions tend to be drawn as the wide variety of natural processes is simplified down to an undifferentiated notion of natural resources. This article aims to help avoiding such erroneous approaches in the conservation-climate debate.

Distinguishing ecological characteristics of different kinds of natural resources

The main lesson of ecological economics concerns the biogeochemical nature of the economic process. It reminds us of the fact that economic processes are subject to the laws of thermodynamics, particularly the law of entropy[2]. In accordance with this law, economic activities (production, consumption, distribution) require high quality energy-matter resources (low entropy), that are qualitatively degraded in the economic transformation process. With production and services inevitably go together low quality energy-matter waste and dissipated energy-matter (high entropy).[3]

Such a perspective allows economic analysis to consider the biogeochemical preconditions and limitations of economic activities such as the unavoidable degradation of natural resources, the limited capacity of natural resources for renewal, and the fact that this limited capacity only relates to certain resources (so-called renewable resources). Proposing a classification that is valid both for economic and ecological analysis, Georgescu-Roegen and modern ecological economics define four analytical categories in order to take account of the potentials and limitations of natural resources: funds, services, stocks and flows[4]. *Ecological funds,* built up and maintained by solar radiation are able to renew themselves and provide both *ecological and economic services,* as long as the conditions necessary for their renewal are met.[5] *Stocks* constitute limited reservoirs of organised matter and mineralised energy resulting from biogeochemical processes on a geological and not a historical time scale, but from which it is possible to extract an energy-matter *flow*[6]. This flow can thus only be exploited for a relatively short period of human history, leaving stocks depleted and the environment degraded by its dissipated energy-matter.[7]

Distinguishing unequal economic potentials of different natural resources[8]

Natural resources can also be distinguished according to their economic potentials, starting with their capacity to respond to the imperative of economic growth. The growth potential of living or *biotic resources* is naturally limited[9] and therefore cannot fuel exponential economic growth.[10] However, the limited capacity of biotic resources to supply economic growth[11] is compensated by the different quality of being renewable. The lesson is: limited growth yet possible sustainability.

The case of non-renewable *mineral resources* is quite different. Since the time of thermo-industrial revolution mineral resources are capable of inducing a process of exponential growth: the stocked energy-matter can be used to develop machines and motors that allow an even quicker exploitation of the stocks. The process is therefore circular and cumulative. However, as the process quickens, stocks get irreversibly depleted at an increasing pace while the natural assimilation capacities are altered by the ever increasing of entropic degradation. Fuelled by a limited stock of mineral resources and taking place in a limited natural environment, such exponential economic growth is thus inexorably *limited to a given historical period*. The lesson is: exponential growth yet no sustainability. Table 1 illustrates the radically different potentials of biotic and mineral resources.

Table 1. Biotic and mineral resources*:* radically different potentials

		Potential	
		sustainable use	**exponential growth**
Resources	biotic	yes	no
	mineral	no	yes

To distinguish between services of funds and flows of stocks makes us aware also that different natural resources have specific *temporal characteristics*. Given that biotic resources depend on ecological reproductive cycles, the availability of their services is subject to the natural calendar. Therefore, they do not allow for the continuous use of economic production funds (land, labour and equipment) *i.e.* exploit them to their full capacity.[12] That is why economic activities in agrarian economies are diversified and organised in accordance with the cyclical rhythms of nature. On the other hand, the flow of mineral resources from stocks allows an industrial organisation of production *in line*, which makes it possible to use economic production funds at their *full capacity.*[13] This characteristic reduces costs and makes specialisation possible, which along with the continuity of economic activity, is an essential element of industrial production.[14]

Given their radically different ecological and economic characteristics, erroneous perceptions, illusions, economic myths and biased conclusions may occur when the wide variety of natural processes are simplified down to the undifferentiated notion of natural resources.

Given their radically different ecological and economic characteristics, erroneous perceptions, illusions, economic myths and biased conclusions may occur when the wide variety of natural processes are simplified down to the undifferentiated notion of natural resources. This is the case, for instance, when attempts are made to maintain the illusion that it is possible to fuel an exponential growth process through the sustainable exploitation of biotic resources, or that the substitution of non-renewable by renewable resources would be as feasible as the inverse case. In fact, given the limited growth potential of living resources, only an exploitation of the services of these resources at a rate beyond the capacity for renewal of the funds providing them (fields, forests, lakes, seas) is able to fuel an albeit short time exponential growth process.[15]

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Given the institutionalised growth dependency of western civilisation[16] it is not surprising therefore that nearly all technological progress over the last 150 years has been based on the substitution from renewable to

non-renewable resources, in industry, agriculture and services alike. In such a context, an undifferentiated concept of natural resources is highly problematical also due to the fact that the per capita consumption of mineral resources is very unequally distributed. It hides the economic privilege that goes with a high per capita consumption of mineral resources as well as the particular difficulties that are inherent in the use of biotic and other renewable resources, particularly in combination with high population growth.

Conservation of living resources and exploitation of mineral resources

Bearing in mind the radical economic and ecological differences between mineral and biotic natural resources as conditions to be considered in respect to any reasoned decision of resource utilisation, it is equally important to insist on the close links that further exist between the exploitation of mineral resources (required for the growth of the global industrial structure) and any effort in favour of the conservation of biotic resources. Given the two basic types of biotic and mineral natural resources, any realistic conservation strategy of living resources (flora and fauna) needs to consider two complementary phenomena: overexploitation and disruption.

1. Overexploitation is a complex notion due to the fact that an ecological fund consists of a constellation of biotic resources (*e.g.* a forest) providing multifunctional economic and ecological services. Overexploitation often means harvesting *economic* services (wood or minor forest products) at a rate beyond their sustainable yield. Such economic overexploitation may reduce the capacity of the fund to provide *ecological* services, and may lead to the weakening of the ecosystem's resilience and capacity for renewal.
2. Disruption of the multifunctional serviceability of ecological funds may also be a indirect result of *mineral* resources consumption, particularly the use of fossil fuels which affect ecological funds at both local and global scale. Local waste rejection, local pollution beyond the assimilation capacity of specific local ecosystems and global CO_2 emissions beyond the assimilation capacity of the Biosphere are often as dangerous as local direct overexploitation. Climate change mainly due to excessive per capita consumption of fossil fuels in industrial societies may reduce biodiversity as much or more than local ecosystem destruction by societies not privileged to the same availability of mineral resources.

Both direct overexploitation and indirect disruption reinforce each other in a circular and cumulative causation path, and this causal interdependence is the main reason why conservation cannot only concern itself with contexts characterised by local overexploitation of biotic resources, but needs to consider environmental degradation induced by the exploitation of mineral resources as well.

Making the ecological sustainability imperative explicit

The distinction made by Georgescu-Roegen between stocks and flows, funds and services, sheds light on the notions of conservation and sustainability and their practical applications. According to this analysis, the preservationist approach to conservation corresponds to applying to biotic resources the mineral resources rationale, *i.e.* specified in terms of stocks

Picture 2. Quarry in a forest reserve in Senegal (*Courtesy Nigel Dudley, Equilibrium Research*)

and flows, where only the non-use will allow the maintenance of existing stocks. The contemporary approach to conservation— which focuses on the preservation of the regenerative capacities of natural ecosystems and the sustainable use of living resources—[17] corresponds to applying to biotic resources an approach that is adapted to their specific characteristics, *i.e.* specified in terms of environmental funds and multifunctional services. The new concept is thus a progress. At least the days are gone when scientists and politicians from industrial countries, living mainly from mineral resources (and therefore more easily able to protect their own biotic resources), directed people living mainly from biotic resources *not* to use their *only* available resources.

However, the progress is only partial. "Modern" conservation projects are often unable to provide enough employment to compensate for the loss of activities imposed by the project. In addition, biotic resources alone cannot provide the necessary economic services to growing populations. Moreover, such projects address neither the unequal per capita consumption of mineral resources nor its global ecological consequences that both remain unresolved. Understanding the economic and ecological differences between the two categories of natural resources and their reciprocal interaction is therefore no more than a preliminary requisite for any future conservation strategy.

The terminology developed by Georgescu-Roegen allows us to address these issues by making it possible to *formulate ecological sustainability imperatives* in a concise and coherent manner. According to this approach, three imperatives must be guaranteed simultaneously in order to ensure that the natural environment has the capacity to sustain human activities:[18]

1. The *preservation of the renewal capacity of multifunctional ecological funds* (forests, lakes, oceans, atmosphere, the Biosphere). This is the essence of conservation.
2. *A sustainable exploitation of economic services provided by the funds of biotic resources,* meaning that they do not endanger the reproduction of economic *and* ecological services of the same funds. This is the *sustainable use* defined in *Caring for the Earth,*[19] an understanding of natural resource use familiar to most traditional societies including the eighteenth century forestry science under the concept of *sustained yield.*[20]
3. *A more or less sustainable management of ecological stocks* (minerals, fossil energy

The goals of conservation and sustainable use of biotic resources have little hope of being reached unless complementary and priority actions are specifically aimed at reducing the consumption of mineral resources in countries with high per capita consumption.

sources), *i.e.* in such a manner that the flows extracted from the stocks and rejected in degraded form to the environment do not exceed the assimilation capacity of the global natural environment. This imperative can logically not be dissociated from conservation.

The issue of *climate change* illustrates how interdependent these three imperatives are. Induced by industrial development, human-induced climate alterations are not due to the over-exploitation of the "climatic services" but rather to anthropic disturbances in biogeochemical cycles caused by intensive exploitation of mineralised energy stocks.[21] Social and environmental repercussions induced by this perturbation, uncertain as they may be, endanger the capacity for renewal of many ecological funds and threaten the survival of many species. In such a context, the goals of conservation and sustainable use of biotic resources have little hope of being reached unless complementary and priority actions are specifically aimed at reducing the consumption of mineral resources in countries with high per capita consumption. This interaction is recognised by the conservation community, who points out that "*[a]ddressing the problem of climate change is central to efforts to conserve the integrity and diversity of nature and to ensure that natural resources are used equitably and sustainably".*[22]

Theoretical attempts to assign quantifiable monetary values to biological and cultural diversity.

How to satisfy the needs of poor populations through the sustainable use of biotic resources?

In an effort to conciliate ecological sustainability and social equity, recent approaches to conservation advocate for the granting and reinforcing of resources rights to local populations.[23] Apart from different institutional issues that cannot be addressed here,[24] such approaches should not overlook the essential fact that a sustainable use of biotic resources alone can be quite insufficient to cover basic needs of a growing population, even at a low level of *per capita* consumption.

come up with virtual values and are therefore purely fictive. They can neither be invested in the formation of productive capital nor be used as payment for import or debt service.

Development options within the limits of biotic resources are often disappointing from even essential economic and social point of views: Strategies of external aid (material and/or financial), more commercial exploitation of biotic resources, valuing traditional knowledge, tourist exploitation of "traditional" ways of life or whatever else are in reality often far more limited in economic returns than assumed. At the same time experience shows that they may create problems in terms of cultural identity, loss of autonomy and of distribution of economic return. Theoretical attempts to assign quantifiable monetary values to biological and cultural diversity (often in an effort to convince political decision-makers of the value of protecting nature) come up with virtual values and are therefore purely fictive. They can neither be invested in the formation of productive capital nor be used as payment for import or debt service.

Following industrial countries' development path of focussing on mineral resources is an alternative that allows, for some time, an autonomous process of economic growth and the satisfaction of the basic needs of poor populations. But such a path depends not

only on the possibility to get access to mineral resources for the most impoverished; it also requires that they be granted the right to emit into the environment the inevitable wastes generated by a process of economic growth based on mineral resources. The political and institutional requirements and implications of this alternative on a global scale are considerable. In order not to overstretch global ecological limits, any increase in consumption of mineral resources by poor populations would have to be compensated by a drastic reduction of this consumption by the wealthiest.[25] The state of international negotiations on energy and climate illustrates how far away we are from such a world development.

Differentiating clearly between ecological and economic qualities (potentials and limits) of stocks and flows of mineral resources, and funds and multifunctional services of biotic resources is an imperative in order to understand the multiple double-binds and path dependencies of our actual conservation and sustainability crisis. Not to consider these differences does not only lead to erroneous perceptions or biased conclusions, it also means implicitly pursuing the economic interests of societies with the highest per capita consumption of mineral resources and actively ignoring those of less privileged societies.

Rolf Steppacher (Rolf.Steppacher@graduateinstitute.ch) and **Pascal van Griethuysen** (Pascal.vangriethuysen@graduateinstitute.ch) are senior lecturers at the Graduate Institute of International and Development Studies in Geneva, Switzerland.

Notes

1 The development of methods to define monetary counterparts to environmental goods and services is an essential element of environmental economics. The best known are the contingent valuation method, the hedonic price method and the travel cost method (Baumol & Oates, 1975; Turner *et al.*, 1994).

2 The first law of thermodynamics, the law of conservation of energy, establishes that the quantity of energy-matter in an isolated system (with no exchange of energy-matter with its environment) remains constant; the second law, the law of qualitative degradation of energy or *entropy law*, states that the quality of energy-matter in all isolated systems is irreparably degraded over time. Open systems, such as economies, which exchange energy and matter with their environment, depend for the maintenance on a throughput of energy-matter that degrades in the process and leaves the environment qualitatively degraded (Georgescu-Roegen, 1971).

3 Georgescu-Roegen 1971.

4 Georgescu-Roegen 1966, 1971.

5 Ecosystems such as forests and lakes but also the global ecosystem, which constitutes the Biosphere, thus enter into the category of ecological funds.

6 Fossil fuel reserves stored in the lithosphere are the typical example of ecological stocks.

7 See Georgescu-Roegen (1971:209ss) for a more detailed analysis.

8 This section is based on Steppacher & Griethuysen 2002.

9 Beyond a certain development threshold, every biotic resource stops growing, unless it has an abnormal growth pattern (of a cancerous nature), the outcome of which is most often fatal.

10 Affecting some of the limiting factors (fertilising, irrigation) is often possible, but biotic production remains subject to overall limits.

11 Such a growth potential reflects progress in know-how and techniques.

12 Georgescu-Roegen 1965.

13 Georgescu-Roegen 1965.

14 For more details see Bieri, Moser & Steppacher 1999 and Steppacher & Griethuysen 2002.

15 This situation, which corresponds to the application of the stock rationale to ecological funds, is characteristic of debtor economies trying to pay for imports or debt service by exporting agricultural resources. Advocating for a rigidly preservationist approach to conservation (where no exploitation of biotic resources is allowed), a perspective that has until recently been common among conservationists (Fisher *et al.*, 2005), is another example of an erroneous application of a stock rationale to ecological funds.

16 See Bieri, Moser & Steppacher 1999, Steppacher & Griethuysen 2002 and Steppacher 2007.

17 IUCN/WWF/UNEP 1980, IUCN/UNEP/WWF 1991.

18 Based on a different terminology and enumeration of facts, these imperatives correspond to the three priority conditions identified in the World Conservation Strategy: maintenance of essential ecological processes, preservation of genetic diversity, sustainable use of species and ecosystems (IUCN/WWF/UNEP, 1980).

19 *Caring for the Earth* defines sustainable use as "*use of an organism, ecosystem or other renewable resource at a rate within its capacity for renewal."* (IUCN/UNEP/WWF, 1991:211).

20 See Prodan 1977.

21 As already recognised in the first report of the Intergovernmental Panel on Climate Change (IPCC, 1990).

22 UICN 1999:11.

23 See particularly Borrini-Feyerabend, Kothari & Oviedo 2004, Borrini-Feyerabend, Pimbert, Farvar, Kothari & Renard 2004, Fisher *et al.* 2005.

24 Some of those issues are dealt with in Griethuysen 2006.

25 Bund & Misereor 1996.

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Back to the energy crisis— the need for a coherent policy towards energy systems

Nigel Dudley

Abstract. The modern environmental movement has been highly influenced by concerns about energy supplies and the need for a coherent energy policy. However, consensus amongst NGOs has recently disappeared and it is possible to find mainstream environmental groups opposed to *every* realistic energy source. This creates strategic dangers and weakens the environmental position in future debates about energy supply. The article argues for the development of a strategy and an NGO agreement.

Picture 1. The Severn Estuary between England and Wales, UK (*Courtesy Nigel Dudley, Equilibrium Research*)

Introduction

Thirty-five years ago, a perceived "energy crisis" was one of the driving forces behind the modern environmental movement. Friends of the Earth and Greenpeace were both established in 1973, after a sudden oil price rise and growing concern about the expansion of nuclear power. For several years there were attempts to develop a coherent policy towards energy supply, based around opposition to nuclear power, promotion of renewable sources and energy conservation and, until evidence emerged about the seriousness of the greenhouse effect, support for coal.[1] While there were certainly voices raised in opposition,[2] the mass of opinion within the NGO sector, and within virtually all environmental organisations, was aligned and provided a powerful lobby.

The immediate energy crisis did not materialise, in part because of the existence of far larger stocks of oil than had previously been recognised.[3] However, the problem of declining fossil fuel sources has been deferred rather than eliminated. Indeed to some extent the situation today is more serious, because knowledge about the greenhouse effect has increased arguments against fossil fuel use and a mixture of safety concerns and poor economic performance has led to a significant downturn in the world's nuclear industry. The peak oil theory has gained widespread credence.[4] However it has also generated some opposition[5] and there are few signs that governments are taking a likely energy shortage very seriously; recent falls in oil prices will continue to foster a sense of complacency.

Unfortunately, just at the time when the need for a coherent NGO response to energy policy is probably greater than at any time for the last 30 years, there has also been a virtual collapse of the consensus once shared amongst environmental groups about future energy scenarios.

Today it is possible to find mainstream environmental organisations opposed to virtually all energy sources, including almost all renewable sources. Table 1 provides a brief summary and some examples. Any energy proposal is likely to have environmental groups opposing it; and these are not just front groups set up by the traditional energy industries (although these certainly exist)[6] but mainstream and genuine environmental organisations. This situation seriously weakens any chance of environmental NGOs making a coherent case for a particular energy strategy.

Table 1. Opposition to energy sources from NGOs: some examples

Energy source	Opposition from environmental NGOs
Nuclear power	Virtually all green organisations, many groups established purely to oppose nuclear power. Conversely some well established conservation organisations have now explicitly expressed guarded support for nuclear power either because of concerns about the alternatives or because it is seen as a viable option for reducing global warming[7]
Oil	Campaign against oil run by Greenpeace,[8] also NGOs such as Oilwatch and Rainforest Action Network.
Gas	Greenpeace is campaigning against expansion of gas drilling in the North Sea; there are also local opposition campaigns in many other parts of the world.
Coal	Coal burning has been seriously criticised because of the greenhouse effect and acid rain by, for example, WWF, Friends of the Earth and the Swedish NGO Secretariat on Acid Rain.[9]
Wind power	Opposition is increasing. For example several long-established UK groups oppose onshore wind farms, including the Campaign for the Protection of Rural Wales and the Ramblers Association and there is also local opposition to offshore wind installation.[10]
Hydro-power	Many NGOs oppose large HEP systems including the International Rivers Network. Support for HEP by the Swedish Society for Nature Conservation almost caused a permanent organisational split. Even small-scale hydropower schemes are frequently opposed by nature conservation bodies.
Tidal power	Friends of the Earth[11] is one of a number of organisations that oppose the construction of a tidal barrage in the UK's Severn Estuary, which has the world's second highest tidal reach.
Solar	Several building conservation bodies in Europe oppose solar panels on the roofs of houses for aesthetic reasons.
Biomass	The World Rainforest Movement is one of many groups that campaign against any large-scale tree plantations.[12] Opposition to biofuels has increased dramatically in the last 5 years as land has been set aside from food growing to produce liquid fuels.

At present there seems to be little opposition to solar cells being placed in desert areas or to passive solar heating or to fuel cells. But no-one is suggesting that these alone will solve the energy shortfall or address the problems of global warming.

Biomass for energy

The issue of biofuels has become central to the debate and needs to be considered in slightly more detail. Wood is already the major energy source for almost half the world's population, where it is usually burnt in open fires and simple stoves. However, biomass from woody and other plants could provide significant amounts of energy for the richer countries as well, especially if it is converted into gaseous or liquid fuels, as outlined in Table 2 overleaf. Direct conversion of biomass to energy has for many years been seen as a long-term alternative to fossil fuel production. It is argued that biomass energy would be roughly carbon-neutral in terms of the release of greenhouse gases, because carbon would be quickly recaptured again in the next crop, and that tree plantations would be renewable over the long term.

biomass from woody and other plants could provide significant amounts of energy for the richer countries as well, especially if it is converted into gaseous or liquid fuels

Table 2. Biomass for energy

Method	Notes
Combustion	Efficiency depends on type of biomass used, water content and methods of combustion. Energy efficiencies range from 18.6-20.9 MJ/kg dry weight for **wood chips** to *e.g.* 9.5 MJ/kg for **sugar cane bagasse**. Open fires are amongst the least efficient forms of combustion.
Pyrolysis	Heating biomass in the near-absence of oxygen. Used in the production of **charcoal**, which has the advantage of being light and clean, but is wasteful of energy in conversion.
Gasification	Heating biomass at a higher temperature than in pyrolysis, with limited oxygen, creating a **producer gas** mixture. Can be followed by: condensation to produce **methanol**; production of **methane**; further conversion to **ammonia**, or for electricity generation.
Hydrogasification	Conversion of biomass to **methane** or **ethane** by reduction with hydrogen at high temperatures and pressure.
Anaerobic digestion	Breakdown of wet biomass (often manures) in the absence of oxygen by anaerobic bacteria, releasing **methane** gas as a by-product. Not usually from wood.
Fermentation	Fermentation of biomass to alcohol in the absence of oxygen, achieved by use of yeasts. The most common end product is **ethanol**. Again not from wood.
Reduction	Reduction of aqueous biomass to produce a range of fuel oils.

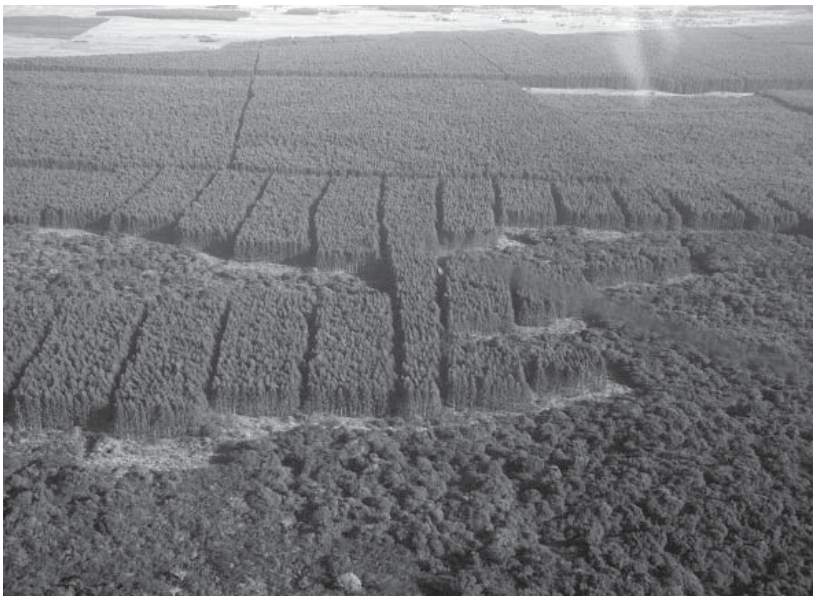
However, there are serious implications for land-use and forest management:

- Very large land areas would be required to supply even a small proportion of the energy requirements of an industrialised country;
- The most efficient type of biomass production for energy is from short-term rotations, so that large areas of forest or agricultural land could be turned over to intensive production of this type;

- Exotic or genetically manipulated trees, chosen for maximum biomass gain in a given period, would become widespread;
- Such plantations would require substantial inputs in terms of fertilisers, pesticides and herbicides to maintain such high levels of production.

At the moment, the global environmental movement (if such a thing exists) is in serious danger of arguing against every form of energy and therefore, by tacit implication, excluding itself from the debate.

Such changes could undermine many of the gains made in terms of forest management. We might see, for example, governments arguing that such energy plantations were agricultural crops rather than forests and thus exempt from any controls or guidelines that have developed over forest management. If future energy supplies were seen to be in serious question, such arguments would become compelling. The impacts of biofuels have already been exhaustively assessed by activist groups.[13]



Picture 2. Eucalypt plantations in South Africa (*Courtesy Marc Hockings*)

But what are the alternatives?

At the moment, the global environmental movement (if such a thing exists) is in serious danger of arguing against every form of energy and therefore, by tacit implication, excluding itself from the debate.

There are very few totally "clean" supplies, so that support for one over another will be a matter of careful judgement and some trade-offs.

The nuclear industry has been quite successful in claiming itself as the environmentally acceptable alternative to coal and oil and the potential saviour in terms of climate change. Large-scale biomass use would fit the aspirations of the transnational companies that currently control the world's energy supply and is already being presented as a clean and renewable resource.

Opposition to everything is pointless and self-defeating. As fuel prices increase, the pressure to exploit alternatives— such as coal shales, Arctic oil reserves, nuclear technology and large-scale biomass plantations— will grow. The conservation movement has regularly failed to halt such developments and there is little reason to think that the situation will change. There is an urgent need for research, debate and policy development that could lead to a consensus about future energy supplies, at least in the beginning amongst NGOs.

This will not be easy. There are very few totally "clean" supplies, so that support for one over another will be a matter of careful judgement and some trade-offs.

The overall impacts of most will depend to a large extent on how they are applied, on what social and environmental safeguards can and will be attached, whether these will actually be applied and on the aspirations of the majority. What might seem an impossible compromise to environmental and social activist groups may not elicit the same response from other people. Sacrificing the Amazon rainforest for cheap fuel would be a done deal for many of today's drivers. The energy industry will be able to draw on powerful and apocalyptic images to make its case. If NGOs are going to oppose the worst excesses of the energy industry with any hope of success we will need to speak with one voice and be clear about the sacrifices as well as the potential gains.

IUCN could play an important facilitating role in this process. It will not be easy, because positions are in many cases already entrenched and time is short. But the current state of chaos will simply lead to lack of effective opposition against any energy supply, however damaging this might be.

Nigel Dudley (equilibrium@compuserve.com) is a member of WCPA and CEESP and works mainly on issues related to protected areas and forest conservation. At one time he lived and worked at the Centre for Alternative Technology in Wales, researching the practical application of renewable energy systems.

Notes

1 Lovins 1973; Commoner 1976; Todd and Alty 1976; Leach 1979; Olivier *et al.* 1983.
2 Beckmann 1979.
3 Odell 1970.
4 Leggett 2005.
5 Clarke 2007.
6 Rowell 1996.
7 Ramblers Association 2007.
8 Greenpeace 1993, and many other documents.
9 Lundberg 2003 and many other documents.
10 Ramblers Association 2007.
11 Friends of the Earth Cymru 2007.
12 Carrere 1999.
13 Smolkar *et al.* 2008.

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Energy— a great deal of hot air and little sense

Roger Crofts

Abstract. Countries need to make rational choices about future energy supply. Scotland is a country that has recently gained greater autonomy from the UK and is in a stronger position to decide its own energy policies. A recent study by the Royal Society of Edinburgh looked at some of the myths and realities relating to energy policy and sought input from the public, explicitly including school students, to build a picture of what the Scottish public was looking for in terms of energy supply and where there was and was not a degree of consensus about future steps. The following paper summarises the results.

Energy is one of the great debating subjects of the decade. And it is likely to remain so for some time. But are we really making progress in resolving some of the critical issues, or are we really just on an increasingly polarised course between different interests who are implacably opposed to entering into dialogue? I fear so if the situation in the small country of Scotland is anything to go by. Nuclear generation for electricity is a 'no no' and renewables especially wind are the saviour according to the so-called environmental groups. Industrialists, economists and industry experts talk about security of supply and worry about price escalation and the instability of governments in major energy supply countries. And the consumer is increasingly concerned that the lights may go out, that prices will rise and they will not be able to afford well heated houses and the normal range of consumer goods requiring energy to operate them. As a result, politicians have a field day by trying to drive the agenda in a direction which suits them. All of this is most unsatisfactory and is damaging to society, to the economy and to the environment. So what is the solution? There is not a simple answer to this vitally important question.

Three key aspects of energy: what a nation should achieve, what are the objective realities and the unsupported myths, and how to stimulate reasoned debate to provoke the necessary action.

It was for this reason that a number of experts on various aspects of energy, along with economists and environmental specialists, formed a committee under the aegis of the Royal Society of Edinburgh (Scotland's national academy of science, technology, humanities and the arts) to inquire into energy issues for Scotland. The reports from the study and from a subsequent round of public debates are available on the Society's web site www.royalsoced.org.uk.[1]

I shall focus on three key aspects of energy: what a nation should achieve, what are the objective realities and the unsupported myths, and how to stimulate reasoned debate to provoke the necessary action.

Energy strategy

What most of the debates seem to ignore is the need for an overall energy policy with a clearly defined set of aims and objectives and means of measuring their achievement. This is not an arid exercise as until all stakeholders have a common view of why we need energy and the consequences of potential shortage of supplies, of over consumption, of price inelasticity, of the social, economic and environmental effects

Scotland should think in a global context and act locally using natural resources at its disposal to provide social, economic and environmental benefits.

of different approaches, then little or no progress can be made. It is very obvious to those like myself who have worked on energy, economic development and environment that a range of objectives needs to be satisfied through the types and rates of energy we consume as a society. Energy is needed to sustain existing economic activity and to stimulate new activity. Energy is needed for human survival and should have an aim of reducing poverty (and specially fuel poverty) and seeking to attain greater social harmony and the removal of social disparities. And energy must be obtained from sources and used in ways which will have the least damage to environmental systems and processes on land, in the air and at sea. These are not mutually exclusive and should not be traded one against the other.

In our Scottish study, we concluded that "Scotland should think in a global context and act locally using natural resources at its disposal to provide social, economic and environmental benefits". Following from this statement, guided by the Brundtland commission's enduring statements of almost two decades ago; we determined that the strategic aim should be "a secure, competitive, socially equitable and low carbon emission supply of energy". Our interpretation of these elements was as follows:

- 'Secure': means having sufficiency of supply from a diversity of fuel types and geographical sources using a variety of technologies, encouraging new technological development to marketability and having the appropriate government framework and instruments.
- 'Competitive': means that the cost of energy will not result in Scotland being uncompetitive in world markets and will also be competitive in the use of technology and innovation.
- 'Socially equitable': means that all sectors of society should have access to energy at a price which they can afford, implying that some economically and socially poorer sections of society will be aided to rise out of 'fuel poverty'.
- 'Low carbon emissions': mean that throughout their lifecycle, technologies should produce the lowest possible levels of greenhouse gas emissions, bearing in mind that there are no technologies or energy sources that have no emissions during their lifecycle.

It is pointless having clear goals and aims without defining a clear set of objectives. In the light of our comprehensive aim we determined the following four objectives:

1. To encourage energy efficiency to benefit economic development;
2. To ensure that energy availability contributes to improvements in social benefits;
3. To minimise environmental effects globally and locally; and
4. To capitalise on natural energy resources in economically viable and environmentally sensitive way.

The debate is about the energy sources for future electricity generation, whereas heating and transport are by far the largest energy consumers compared with electricity production.

Myths and realities

The second step in formulating energy policy to achieve multiple benefits is to assess the factual material about supply and demand, consumption and the use

of different energy sources and technologies as a basis for informing debate on realities and challenging many strongly held views and opinions which frequently have no factual basis. This is important for a number of reasons. In Scotland, and in the UK as a whole, for example most of the debate is about the energy sources for future electricity generation, whereas heating and transport are by far the largest energy consumers compared with electricity production. Analysis of energy flow statistics also reveals that a great deal of energy is lost at varying stages: in production of especially at large generating stations, and in energy loss from domestic premises. Hence energy savings and energy efficiency measures are widely regarded as the most crucial first step in dealing with the imbalance between supply and demand, and also helping to deal with the high costs of energy by reducing consumption. Public attitudes towards energy consumption and especially savings are increasingly important in post industrialised countries. Only with very large increases in energy costs that are sustained over long periods of time is there likely to be a reduction in use of energy especially in domestic households.

Energy use is highly variable during the day due to social habits and economic activity, and also through the year due to the obvious seasonality factors of the weather. These variations have to be taken into account in developing reliable and robust energy supply schemes and ensuring that there is an adequate stockpile of energy resources.

It is also important to gather objective information on the source of energy raw materials used, including the type of energy material, and its geographical provenance, and on the technology used, including its reliability to transform it into consumable energy.

Picture 1. Scotland already derives much of its electricity supply from hydro sources (*Courtesy Nigel Dudley, Equilibrium Research*)

There are also, at least in the part of the world where I live, many **energy myths**. On the supply side those who are convinced that we have passed the point of 'peak oil' but ignore the as yet undiscovered hydrocarbon reserves on the ocean shelves, ignore the new technologies which result in a greater proportion of the resource being extracted and significantly ignore human ingenuity in finding energy sources that previous generations had missed. Those who continue to claim that there is no link between emissions to the atmosphere of greenhouse gases from the use of fossil fuels and climate change are ignoring virtually all of the scientific evidence. Indeed, those who claim that the conclusions of the scientists within the Intergovernmental Panel on Climate Change are gagged and neutered by governments seem to live in some cloud cuckoo land of their own making. Others consider that renewable resources are infinite. This is true as we can reasonably assume, for example, that solar energy resources and tidal energy resources will last until such time as the relationship between the earth and the other planets is fundamentally different. I know of no geological predictions that these relationships will change in even

hundreds of millions of years. However, we cannot assume that exploitation of these renewable resources is entirely environmentally benign. Tidal barrages have a significant effect on terrestrial and near shore hydrology and biodiversity. Wave devices for example will affect society's perception of the coastal environment, and potentially have an effect on inshore fisheries. Onshore wind devises can have a very significant effect on landscape and society's perception of its attractiveness, as well as on the diurnal migration pattern of certain bird species. Hydro-electric power significantly changes the hydrological and sedimentation system and can result in high risk to communities downstream. And all technologies, whether relying on non-renewable or renewable energy resources consume energy in their construction and emplacement and in their decommissioning.

In our present situation, it is difficult to see how supplies of electricity to meet the variable daily and seasonal demands can be met without use of large scale generating stations.

In the UK, there has been an assumption that the market has the solution to satisfy society's energy needs. There is patently not true as, for example, there remains an imbalance between the profits of the privatised industry and the escalating costs which the consumer has to pay.

In our Scottish study, it also became clear that there were a number of other widely held beliefs on energy. For example, it is stated frequently that renewable sources can meet the energy gap once the large scale coal, gas and nuclear powered generating stations are closed. Yet this views fails to recognise the variability of the supply sources over which we have little control, that we had as yet not cracked the means of long term storage of energy (except though pumped storage schemes), and that the means of gathering electricity from a wide range of episodic sources and delivering supply to consumers at some distance from the generation point is technologically possible in theory, but in practice is very difficult to achieve with the present grid transmission system. Also on electricity, there is a widely held view that wind generated electricity can replace nuclear generated electricity. This is nonsense. Nuclear generation provides base load electricity supply, *i.e.* what we need every day of the year, whereas wind can only provide episodically the top up. In our present situation, it is difficult to see how supplies of electricity to meet the variable daily and seasonal demands can be met without use of large scale generating stations. The problem then is to find the most environmentally benign technologies. Although there are many on the drawing board, such as clean coal and carbon sequestration technologies, they are still a long way off full scale commercial operation.

Finally in relation to energy myths, we have to realise that consumer behaviour is an important factor. Will consumers change their behaviour and reduce their energy consumption? There is no clear evidence of this occurring and economists consider that prices will have to be sustained at a very high level for a long time for them to have real impact on consumption. In a curious way, opinion surveys suggest that people are prepared to pay more for energy, but the level of complaint about rising prices seems to be contrary to this expectation. The fact of the matter is that in countries like the UK energy prices have been low for many years and the recent price escalation was to be expected at some stage.

From the analysis of energy data there are what I would call a number of **energy truths**. Although many of these are disputed by some commentators, there is a high degree of scientific consensus about their veracity. So for the sake of stimulating debate we must be sure that we have the factual basis behind statements. Those we have used in these circumstances in Scotland are as follows. There is substantive evidence to link global climate change with the increase in the emission of greenhouse gases in the atmosphere arising from human activities in recent centuries. Despite technological advancement, as identified above, fossil fuel supplies in are decline. Estimates of the time scale of the decline vary. The best evidence we gathered in our Inquiry suggested that oil supplies can last for at least another 30 to 40 years, gas 70 years and coal 250 years at present rates of consumption. Nevertheless, as recent experience has shown, prices are volatile and security of supply uncertain due to a range of geopolitical factors which make predications difficult. And at the same time in the UK and in many other post industrial countries, consumption is rising; and, in addition, in industrialising countries the rise is at a very high rate. At the same time, many post industrialised countries, and most certainly the UK, have a poor record is energy savings and energy efficiency.

Stimulating debate

Given the vital importance of energy to our societal well being and economic progress and the impact that its exploitation and use has on the environment, there is a need to stimulate debate on energy futures. In Scotland, we determined at the end of the formal energy inquiry that stimulating debate within civil society was a necessary next step.[2] This was unusual for the Royal Society of Edinburgh, especially as it tends to hold most of its events in Edinburgh. We agreed to hold a series of debates around Scotland. We chose the main population centres to host evening public discussion forums. In total over six locations we had 455 participants. In addition, we decided that the views of the younger generation were essential and would likely give a different perspective. We engaged with 407 students in the 15 to 17 age range in 14 schools around Scotland.

Given the vital importance of energy to our societal well being and economic progress and the impact that its exploitation and use has on the environment, there is a need to stimulate debate on energy futures.

In order to stimulate debate we identified in opening presentations a range of issues. We sought to steer the debates in to the wider energy issues rather than focus on the specificities of the electricity debate (nuclear versus renewables, onshore wind versus offshore sources). But such was the strength of opinion and knowledge that, inevitably, these were the most debated topics and the ones on which there was no consensus.

From all of these sessions we identified areas of general consensus and areas of continuing debate, identified issues which varied by location and specifically recorded the perspectives of the younger generation. The points of general consensus arising from the public sessions were as follows:

1. Recognition of the link between emissions from fossil fuels and global climate change.
2. Agreement that renewable sources of energy are a key contributor to energy supply needs because of their low greenhouse gas emissions, the abundance of the Scottish resource, and the need to encourage technologies other than onshore wind, for example tidal, wave, solar, biomass, and offshore wind.

3. Recognition of the need for energy savings to preserve supplies and to reduce environmental effects, and especially the need to reduce the waste of energy, coupled with more effective instruments for encouraging energy saving.
4. Recognition of the technological expertise on energy based in Scotland and the need for further support for technological development.
5. A call for new thinking on the way energy is supplied to the consumers, especially through distributed systems and micro approaches.
6. A call for new fuels provided they are economic and environmentally neutral.
7. Recognition of the need for action at political, industry and societal (including personal levels) following proper debate.

There was a lack of consensus on many issues as follows:

1. The key objectives of public policy: greenhouse gas emission reduction, and/or security of supply. Balancing the benefits and costs to the environment was considered to be very difficult.
2. Ethics was a major issue, specifically whether Scotland, as a small country with low emissions in total in global terms, should do anything at all or whether it should be an exemplar to other countries.
3. There was unresolved debate on whether renewable sources bring real economic, social and environmental benefits to Scotland. There are many concerns that one solution was being over promoted, often termed 'the dash for wind', and that other solutions were being given less prominence.
4. Energy price trends are not clear and it is debatable whether the consumer is prepared to pay more. Only consistently much higher prices might change behaviour in favour of greater savings and efficiency, but is this ethically defensible?
5. On alternative sources of supply, there was no consensus on the immediate solutions, such as renewables versus new large generating plant for electricity, and the unresolved arguments about whether supply should be from the source nearest to the consumer or at the most advantageous point of high energy resource. Also the debate on the balance between fossil fuels and renewables is unresolved.
6. The greatest disagreements consistently were on the technologies for electricity generation. The polarities are:
   - ▷ nuclear has to be key part of shorter term solution given the improved technology and costs, and the excellent safety and delivery records of existing civil nuclear reactors, or there should never be any more nuclear powered electricity generating stations in Scotland because of the lack of action on storage of high level radioactive waste and concerns about the military use of fuel;
   - ▷ onshore wind has been given too much prominence compared to other renewable technologies;
   - ▷ there remains large resources of fossil fuels for decades (oil and gas) and for centuries (coal and uranium);
   - ▷ there is no consensus on the need for and effect of transmission lines on the environment and on nearby communities and options for under-grounding or for offshore routes; and
   - ▷ there are doubts about the practically of some new technologies, such as carbon sequestration in clean coal technology.

Picture 2. Scotland (*Courtesy Nigel Dudley, Equilibrium Research*)

In the schools discussions, there was a much greater degree of optimism. There was always a clear view that 'the lights will not go out' within a decade because of human ingenuity and a mixture of existing and new technologies being available. Furthermore, the polarities which existed in the public sessions with regard to technologies for electricity generation were much less evident in the school discussions. There was a strong view that a change in culture was needed to wean society off its dependency on fossil fuels. Alongside this, was an appreciation of the need for energy savings and greater information on what can be done to achieve these savings, and the need for alternative fuels for transport and heating. Most students recognised the link between global climate change and the use of fossil fuels and therefore the need for precautionary action to mitigate climate change. There was a perception amongst the students that their views and opinions were not being sought on energy issues and that meant they could not influence decisions.

It was clear from all of the debates that action was needed and the following specific issues for action were identified:

1. Higher priority and more funding to cleaner fossil fuel technologies and to alternative renewable technologies.
2. Decisions on new base load electricity supply, including decisions on fuel types and final decisions on whether nuclear or not.
3. More effective energy efficiency and energy savings measures and gadgets accessible to the public to stimulate higher levels of performance. Better designed and more affordable energy savings in 'white goods'. Break the circularity of save costs on energy/ buy more energy consuming devises through public education.
4. More financial support from government for bringing energy technologies from the laboratory to full-scale operation.

In order to test the local responses, we organised a conference to conclude our work and invited major figures in the international energy world to participate so that we could call for action with the support of public and industry opinion behind us. The consensus at the conference was that Scotland is no different from other countries and we needed to think in a global context as well as act locally. Claims that there were choices to be made between, for example, central and decentralised systems of electricity supply, between specific technologies or a mix, between supply led approaches or demand management, or concentration on Scotland as a net energy exporter or importer were not accepted. The general consensus emerging was that a mix of solutions, rather than selecting specific winners, was the most sensible course of action. The mix should comprise of old technologies with improved carbon sequestration, new technologies, energy efficiency and energy savings.

Debates could be never ending on polarised issues. To prepare the ground for timely and effective decisions, it was necessary for more objective information to be provided, and for consensus building. The overwhelming priorities for action identified were:

- improvement in the efficient use of energy, and
- reducing the use of fossil fuels in space and water heating and in transport.

There is a wide consensus on the need to constrain the rate of growth of consumption, and to reduce the use of fossil fuels and so reduce the emission of greenhouse gases.

We concluded that to improve the quality of debate and to ensure that the decision-making process is better informed:

- an objective methodology to assess the relative merits of energy technologies, including full lifetime costs was urgently required; and
- bodies independent of government and sectoral interests should be active in stimulating the debate and the identification of decisions needed and the urgency of the situation.

In the wider global and regional debates on energy, I consider that IUCN has a major role to play. It should use its convening power to bring together the various interests, just as it did with the mining industry. I recognise that there are those in IUCN who consider that these discussions and engagements are a step too far, but without them we will not achieve a greater understanding of the different perspectives. If we feel we can stand on the sidelines and shout our views and opinions and be heard then we loose our credibility and fail to use the convening power and knowledge base that exists within the Union.

Conclusion

Energy is a vital matter for societies throughout the world. It is also vital that environmental interests engage with civil society and with the energy industry to indentify the common ground, to determine the areas of divergence and the topics where agreement is unlikely and to consider what action should be taken.

'The Royal Society of Edinburgh is to be congratulated on bringing some sanity to the energy debate that is becoming unhinged from reality'. I hope that others, and especially IUCN, will take up the challenge.

I hope that the model we used in Scotland is of some interest and might be applied by independent bodies in other parts of the world. An editorial in the international scientific journal Nature[3] stated that 'The Royal Society of Edinburgh is to be congratulated on bringing some sanity to the energy debate that is becoming unhinged from reality'. I hope that others, and especially IUCN, will take up the challenge.

Roger Crofts (roger@dodin.idps.co.uk) is World Commission on Protected Areas Regional Vice-Chair for Europe and a member of the Commission on Ecosystem Management. He was Secretary of the Royal Society of Edinburgh Energy Inquiry 2006-2007.

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3 Anon 2006.

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Pollution from aircraft

Mark Barrett

Abstract. Aircraft presently release some 2 or 3 per cent of global emissions of carbon dioxide and, together with the effect of other pollutants, contribute a large fraction of global warming that will increase rapidly because of demand growth, unless policies are changed. Aircraft emit a mixture of other pollutants including nitrogen oxides, soot, carbon monoxide and hydrocarbons, and about half of these emissions is injected into the atmosphere at an altitude of 8 to 12 km where they generally have more serious and enduring effects than at ground level— even water has adverse impacts. Nitrogen oxides and water emission bring about global warming and can also cause ozone depletion. Scientific uncertainty about the impacts is great, and will persist. A number of control options are available but reducing aviation demand growth is the only way so far known of creating a marked and immediate reduction.

This article summarises a complex issue; more details may be found in reports such as those by Barrett[1] and the Intergovernmental Panel on Climate Change.[2]

Introduction

The demand for air transport is continuing to grow rapidly, despite rising fuel costs, and the long term growth potential is potentially vast because of the low current per capita demand in poor populous countries. Budget airlines have transformed the sector over the last decade. Pollution emission will grow less rapidly than demand because of technological improvements, but with unchanged policies pollution from aircraft will double in two decades or so. A series of new or augmented policy measures is needed to moderate this increase.

The environmental impact of aircraft

In terms of atmospheric and climatic impacts, air transport has five main effects:

- The emission of carbon dioxide (CO_2) constitutes a small but fast growing contribution to global warming;
- The emission of nitrogen oxides (NO_x) leads to ozone increase near the tropopause and this causes global warming;
- Water emission may lead to increases in high altitude clouds, and these may contribute to global warming;
- The emission of water and NO_x may exacerbate stratospheric ozone loss;
- Other pollutants such as soot and trace chemicals may also have effects either synergistically or separately.

The global fuel burn of aircraft is only approximately known. The coefficients of emission per fuel burn for some pollutants (*e.g.* carbon dioxide and water) are known with accuracy and do not vary significantly with engine type and aircraft operation. The coefficients for others are not precisely known, and do vary with type and operation; for example, the estimate of total NOx emitted by civil aircraft may not be accurate to better than 50 per cent. Accordingly there are uncertainties in total emissions. Furthermore, the effects of pollutants apart from carbon dioxide can vary according to when and where, in terms of altitude, longitude and latitude, they are released in the atmosphere.

Aircraft presently release in excess of 2.5 per cent of the total global emissions of **carbon dioxide** as a result of the burning of fossil fuels. This is equivalent to approximately 12 per cent of the total emissions released by the transport industry according to a report from the Intergovernmental Panel on Climate Change (IPPC);[3] the proportion will have increased since.

Aircraft presently release in excess of 2.5 per cent of the total global emissions of carbon dioxide as a result of the burning of fossil fuels.

Certain anthropogenic pollutants generate or destroy ozone in the atmosphere. Unfortunately the nitrogen oxide from aircraft probably generates ozone where it is not wanted, at low altitudes; and removes where it is wanted, at high altitudes. At low altitudes (less than 15 km or so), extra ozone increases global warming. Its warming impact is thought to be greatest at about 12 kilometres, the altitude at which large commercial jet aircraft typically cruise. Ozone at much greater altitudes decreases global warming.

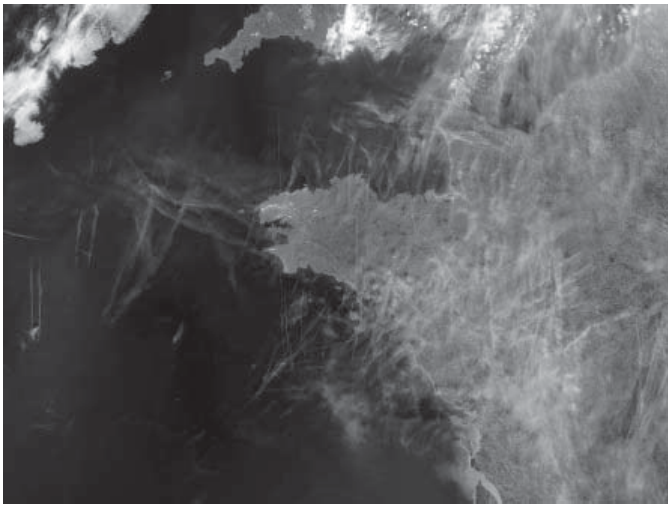
Water vapour has two potential effects. First, through augmenting the formation of high altitude clouds, it can act as a potent global warming agent. Second, extra water vapour at high latitudes may increase the formation of polar stratospheric clouds that are implicated in ozone loss and the formation of the ozone hole.

Aircraft emit a number of other pollutants. This includes carbon monoxide, sulphur dioxide, metals, soot and lubricating oils. Although many of these are emitted in minute quantities which makes insignificant changes to pollution concentrations near ground level, at a high altitude the additions may be significant.

There are considerable uncertainties for pollutants other than carbon dioxide: first, in the amounts and spatial distribution of pollutants from aircraft; and second, in the precise functioning of many atmospheric processes and the impact of pollutants. Many pollutants act synergistically. Their marginal impact depends on the concentrations of other pollutants, and indeed of the pre-existing level of the pollutant being considered. It is therefore not generally possible to assign a particular unique value for the impact of any pollutant. Such is the uncertainty in some of the processes that, for example, some pollutants at certain altitudes are now thought to decrease global warming, rather than increase it.

Nitrogen oxide from aircraft probably generates ozone where it is not wanted, at low altitudes; and removes where it is wanted, at high altitudes.

The UK Royal Commission on Environmental Pollution[4] highlighted the risks of high altitude release of pollutants: "*The impact of aircraft emissions can be very different depending whether they are in the upper troposphere or the lower stratosphere. Both the abundance of trace gases and the dominant chemical composition and associated chemical reaction are very different in the two regions. In particular water vapour content is relatively high in the troposphere and low in the stratosphere whereas ozone levels are much higher in the stratosphere. Stratospheric ozone absorbs radiation from the sun. This leads to a heating profile in the stratosphere that determines its character, and also protects life at the surface from the harmful effects of the UV radiation*."



Picture 1. Airplane condensation trails (contrails) over Brittany, France (© *Jacques Descloitres, MODIS Rapid Response Team, NASA/GSFC*)

The Commission noted the rapid increase in air travel and concluded that it had: "*particular concerns about the contribution that aircraft emissions will make to climate change if this growth goes unchecked. The total radiative forcing due to aviation is probably some three times that due to the carbon dioxide emissions alone*."

Controlling pollution from aircraft

Relating to the impact of air pollution from aircraft, there are two basic non exclusive control options:

- The total emissions of pollutants can be limited;
- Emission may be reduced in sensitive zones such that the impacts of pollutants are diminished.

To reduce the environmental impact of aircraft three categories of action are required:

1. Research and monitoring to establish the actual extent of emissions and their effects.
2. Policy options that mitigate environmental impacts need to be devised.
3. Mitigating policies have to be implemented through appropriate legislative and institutional frameworks.

Control options can be put into three categories: demand management; operational change; and technological change. Measures in each of these three categories can be implemented severally. Implementation methods can be divided into intelligence and information, incentive and disincentive, regulation and investment. Table 1 outlines a matrix of basic options and means of implementation with examples of particular measures.

The complex interactions that occur in the aviation industry make it generally difficult to discuss and assess particular control options in isolation from others. Some examples of these interactions and potential dilemmas include:

- Putting more taxes on fuel and aircraft movements makes air travel more expensive thereby suppressing demand. But such taxes may increase load factors which would decrease capital and fuel costs per passenger or tonne or freight, thereby lowering total flight costs and stimulating demand.
- Managing air freight demand can not be best accomplished without at the same time managing passenger demand. Presently two thirds of air freight is carried with passengers. This is at a relatively low marginal economic and environmental cost because of the design of aircraft for mixed passenger and freight transport.
- Provided the same fraction of seats is filled, large aircraft are more efficient and so produce less emission

per passenger kilometre than smaller aircraft ones and so. However it is difficult for large aircraft to meet noise limits, even though the larger the aircraft the fewer the aircraft movements.

Table 1. Some emission control options

Options	Intelligence	Incentive	Regulation	Investment
Operations	flight planning models	fuel and emission taxes	bubble emission limits	global booking system
higher load factor	advanced booking; integrated flight planning	aircraft movement tax	ticket transfer permit	less seat spacing
shorter route	ATC (air traffic control)			
lower altitude	optimum height		zone emission limits	
slower cruise		fuel and emission taxes		
less congestion	better ATC	aircraft movement tax		better ATC
Technology				
engine emission	information to operators and consumers	emission taxes	emission limits per unit thrust	more efficient, low emission engines
aircraft emission	information to operators and consumers	emission taxes	emission limits per seat.km	large aircraft optimised for passenger transport
Demand management	advertising and labelling			
passenger	advertising and labelling	passenger movement or distance tax		better local environment and holiday facilities telecommunications alternative modes
freight	economic information	freight tax		alternative modes
	advertising and labelling			localised production

There is scope for extending technological improvement to airframes and engines, and this might include the introduction of slower more fuel efficient aircraft optimised for passenger transport. Operational changes, especially increasing the load factor of aircraft, could reduce pollution substantially and rapidly by about 20 per cent. However, even if these two categories of measures are applied to a maximum, fuel use and pollution still double in three decades or so under current projections.

In consequence, if aviation is to stabilise or reduce its current emissions of

greenhouse gases and other pollutants, demand management will be required. Most air freight is not inherently urgent and much of it could be carried by less polluting surface modes. Business travel could be limited by the increased use of telecommunication. Leisure travellers could be encouraged to visit nearer locations and use less damaging modes where possible. Reducing the demand growth rate by over a half in these ways would, in conjunction with the technological and operational measures, stabilise emissions over the next four decades or so, after which emissions would once again increase.

Most air freight is not inherently urgent and much of it could be carried by less polluting surface modes. Business travel could be limited by the increased use of telecommunication.

All of these measures would be difficult to implement, especially a high degree of demand management. They will however all be required in order to stabilise emissions; to reduce emissions significantly and permanently, heavier constraints on demand or radical technological innovations will be necessary. In a situation of scientific uncertainty, deciding on appropriate policies and timing their implementation, is problematic.

Both the IPCC and the UK Royal Commission recognised the need for demand management, and a study for the UK government[5] noted that: '*even with deployment of the most promising future technologies, if demand is unconstrained by capacity then, in absolute terms, the net effect of the aviation industry on the environment is set to increase*.'

Conclusions

The current contribution of civil aviation to anthropogenic global warming is almost certainly at least 3 per cent, but may be much higher due to the emission of nitrogen oxides and water. There are serious concerns about the specific impacts of aircraft at high altitude especially with respect to their effect on ozone, but the scientific uncertainties remain very great. Global warming and the other environmental impacts of aircraft will increase because of the growth in aviation demand.

About half of air transport is for leisure causing some 50 per cent of total aviation emissions. The prospect is for large long term increases in emissions from aircraft if current policies and strategies are unchanged. With about 5 per cent of the world's people, the USA accounts for some 40 per cent of aircraft pollution and is therefore a key country when constructing control policies, and when considering the consequences if the rest of the world made as many flights. Barrett shows how global warming from aviation may constitute half of total UK global warming by 2050, even with some emission control measures.[6]

About half of air transport is for leisure causing some 50 per cent of total aviation emissions.

Emission limits should be applied to aircraft emissions of greenhouse gases generally. But there are problems suggesting limits for particular gases singly and in combination.

Currently, global anthropogenic CO_2 emission is about 8 billion tonnes of carbon and to avoid unsupportable impacts, reductions of 60 per cent or more over the coming decades are required.[7] With population growth, this would mean an equitable emission

allowance of about 0.3 tonnes of carbon per person per year, equivalent to a person making one flight of a few thousand kilometres and doing nothing else that emits carbon. Since most of aviation is for inessential leisure and freight with alternative modes, it should be expected that aviation will have to reduce its emissions substantially to leave scope for essential services such as food production or heating dwellings. In general, however, reducing carbon emissions from aircraft is problematic as the technical options for deep cuts are limited and costly.

The application of firm emission control policies would be effective in reducing emissions substantially below levels projected in business as usual conditions. If all the control measures suggested by Barrett were implemented then aviation emissions would not increase vastly over the current level in the medium term.[8] However, reducing demand growth is the single most important element in such a strategy.

The aviation industry will find it difficult to make global greenhouse emission reductions and will have to make a dramatic response to the challenge, or establish that emissions from aircraft do not have to be reduced pro rata as much as those from other sectors of the global economy.

Recommendations

- A method and convention for calculating and allocating all aircraft emissions to individual countries needs to be developed.
- The prejudice should be for limits to aircraft emissions to be allocated pro rata to other limits of a similar kind (*e.g.* carbon emission). It may be that special derogations might be allotted to aviation in particular regions.
- Aircraft emissions above critical altitudes should be subject to separate international negotiations for their control and limitation in light of their special effects at altitude.

The more important policy issues and measures include:

- It is most critical is that demand management measures are implemented. First, freight should be transferred to low impact surface transport modes having a lower impact. In the short term this should mean the virtual elimination of freight only air transport. Second, measures to reduce both business and leisure air travel such as telecommunication and modal change are required.
- The load factor of aircraft should be sharply increased.
- The possibility of reducing fuel use by lowering speeds should be investigated, as should the avoidance of cruising near the tropopause and in the lower stratosphere.
- The development of aircraft and engine designs aimed at reducing emission should be promoted.

As far as possible, policies to limit the environmental impact of aircraft should be implemented by the aviation industry, both manufacturers and operators. However, the national and international policy framework must be set by governments and international negotiation, and governments must take much responsibility for policy measures such as the management of demand and the development and coordination of transport modes. Governments will have to use a full range of regulatory, planning and taxation options to ensure reductions in fuel use and emissions.

All social and economic sectors of wealthy societies face huge challenges

to control greenhouse gas emissions. For aviation, it is particularly difficult given the growth and technical nature of aircraft and aviation fuels. However, governments and the aviation industry need to act urgently in order to develop low impact, sustainable, long distance communication and transport systems. If development is too slow, then the world will suffer worse global warming, and the industry itself will face a rapid and deep crisis because of pressure from emission targets and other, essential sectors.

The aviation industry needs to take a positive rather than a defensive posture. It can first push through technological and operational improvements as fast as possible. This will generally make the industry less vulnerable to fluctuations in fuel prices and environmental taxes or charges, thereby improving the stability of its cost base. As far as the aircraft and aeroengine manufacturing industries go, the recommendations for the rapid introduction of cleaner and more efficient aircraft should be good news because it means more sales. It will mean more costs for operators and consumers, but the impact would be quite gradual and not necessarily very large compared to the total cost of a holiday or business trip. Perhaps most important is for the aviation industry to seek a stable, long term future by diversifying into long distance transport and communication businesses. It can use its great expertise to help develop systems using multiple modes— air, sea and rail— that operate in an integrated fashion with low impact and at minimum cost. In the longer term, it could extend its expertise to address the management of demand; for example to integrate transport planning and systems into international manufacturing and services production systems.

Governments and the aviation industry need to act urgently in order to develop low impact, sustainable, long distance communication and transport systems.

Notes

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2 IPCC 1999.
3 IPCC 1999.
4 RCEP 2002.
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A proposed contribution to an oil and gas strategy

Sandra Kloff, Emmanuel Obot, Richard Steiner and Clive Wicks

Abstract. The oil and gas industry dominates global energy supply, but is working with finite resources and also often carries high environmental and social costs. Key issues include the move into critical marine areas and the question of oil and gas extraction inside or beside protected areas. Numerous attempts have been made to address these problems, but they continue to be hampered not least by a lack of regulations on critical aspects of exploration and extraction. The paper finishes with a call for a revolution in energy supply, with a major shift to renewable sources (including a shift of subsidies from fossil fuels to renewable energy), reduction in wasteful practices such as gas flaring and elimination of decisions being made about major projects in the absence of Strategic Environmental and Social Assessments.

Background

Currently oil and gas extraction create most of the energy and resources needed to run our society. Unfortunately, they also result in a range of present and future environmental and social costs, both direct and indirect, which need to be balanced against the benefits they bring.

The world is highly dependent on oil— it powers our transport, heats or cools our homes, creates industrial and domestic chemicals and provides the feedstock for many of the materials we use and wear. Transport uses 60 per cent of oil production, mostly to fuel cars and trucks. Oil is a non-renewable resource that we use at a rate of 70 million barrels a day, at present and some estimates are that this will double by 2025. Other estimates, by some of the Industry's own geologists are that by 2025 there will be severe shortages of oil and gas as reservoirs are depleted. Already oil wells in Texas and the North Sea are drying up.

The oil and gas industry impacts on people and the environment in three ways, through climate change, through their operations on land and at sea and finally through positive or negative impacts on the economy, which can have for example also result in adverse social impacts such as corruption, (rent seekers) and civil disturbance.

Unregulated and irresponsible actions by the oil industry destroy habitats and damage biodiversity. "Low-energy habitats" such as mangroves, salt marshes and polar coastal wetlands can be seriously damaged by quite small amounts of oil. Onshore, drilling can harm ecology and open up wilderness areas. Offshore, drilling can damage some of the world's most important marine ecosystems.

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Oil spills at sea have damaged mangrove forests, coral reefs and fisheries, both through major accidents and regular leakage from tankers, loading buoys, drilling rigs and production platforms. Transport of oil is also implicated in ecological damage; for example, there were an estimated 16,000 spills

during the construction of the Trans-Alaskan pipeline.[1] Oil tanker accidents such as Exxon Valdez, Erica or Prestige are other well-known examples of ecological disasters that can have long-term effects.

The extractive industries (oil, gas and mining) have often failed to make a contribution to sustainable development or adequately protect the environment**.** The industry is considered by many civil society organisations to have contributed to corruption, pollution, environmental and social problems. Civil disturbance— including wars— are occurring in resource-rich countries, notably in Africa including Nigeria, Angola, Sierra Leone and the Democratic Republic of Congo. Terms like the "curse of oil" and "the paradox of plenty" are in common use.

The top ten oil and gas and the top 25 mining companies together with the 20-30 main hydrocarbon producing nations reap huge financial rewards. However because of corruption and mismanagement a proportion of the resource-rich countries also bear many of the environmental and social costs and remain poor and under developed. Neighbouring nations without hydrocarbon resources also bear many of the costs and reap few of the rewards from the extractive industries.

Extractive Industries Review

In response to this, in 2000 the World Bank Group launched the Extractive Industries Review (EIR) to discuss its future role in these industries with concerned stakeholders. Dr Emil Salim, a distinguished scientist and former Environmental Minister in the Indonesian Government, was asked to chair the review and he presented his report in 2004.[2]

Dr. Salim summarised the EIR in an editorial "World Bank must reform on extractive industries" that appeared on 16 June 2004 in the UK *Financial Times*. He said: *Not only have the oil, gas and mining industries not helped the poorest people in developing countries, they have often made them worse off. Scores of recent academic studies and many of the bank's own studies confirmed our findings that countries which rely primarily on extractive industries tend to have higher levels of poverty, child morbidity and mortality, civil war, corruption and totalitarianism than those with more diversified economies. Does this mean extractive industries can never play a positive role in a nation's economy? No, it simply means that the only evidence of such a positive role we could find took place after a country's democratic governance had developed to such a degree that the poorest could see some of the benefits. Before the fundamental building blocks of good governance— a free press, a functioning judiciary, respect for human rights, free and fair elections and so on— are put in place, the development of these industries only aggravates the situation for the poorest*. (Extracts from editorial)

Climate Change

The Inter-Governmental Panel on Climate Change (IPCC) has highlighted, the escalating threats that climate change poses for the environment and human survival. Climate change must be kept below the critical 2 per cent increase on pre-industrial levels otherwise risk to people and ecosystems will be very serious.

▷ *Human Impacts*

At all levels of warming, a large group of poor, highly vulnerable developing countries are expected to suffer increasing additional food deficits, which

is expected to lead to higher levels of food insecurity and hunger in these countries. Some quotations from the UN Framework Convention on Climate Change (see box) illustrate the degree of concern recognised by the global community.

Box 1. Article 2: United Nations Framework Convention on Climate Change (UNFCCC)

Ultimate objective to prevent dangerous anthropogenic **interference with the climate system**... within a time frame sufficient to:

- ▷ allow ecosystems to adapt naturally to climate change
- ▷ ensure that food production is not threatened
- ▷ enable economic development to proceed in a sustainable manner

Food and Article 2

Impacts of a 1^{o}C rise in temperature:

- ▷ Around 10 million more people at risk over the century
- ▷ Nearly all developed countries benefit
- ▷ Many developing countries in the tropics are estimated to experience small but significant crop yield growth declines

1^{o}C to 2^{o}C rise:

- ▷ warming triples number of people at risk of hunger in 2080s

Water and Article 2

1.5^{o}C to 2-2.5^{o}C

- ▷ Non-linear risk threshold of water shortages or water problems such as flooding
- ▷ Numbers at risk rising from close to **600 million** to between **2.4-3.1 billion**
- ▷ Mega-cities in India and China will be badly affected

2^{o}C +

- ▷ Very high levels of additional risk at all time periods, in the range **662 million** to around **3 billion.**

▷ *Eco-Systems and Species Impacts*

The impact on ecosystems and species varies but many ecosystems, particularly coral reefs and coastal wetlands are already being affected and more ecosystems and species will be affected as the temperature exceeds 1 per cent above pre industrial levels

Industry Response to Climate Change

Overall the industries' energy scenarios for the 21st Century are not sustainable and will contribute to an environmental and social disaster, which will hit the poorest hardest and increase the gap between the rich and the poor.

BP and Shell took the lead by accepting that climate change is a problem and that biodiversity is fundamental to economic development and human welfare including spiritual, aesthetics, and cultural values. Shell sees "*biodiversity as a real business issue: if not addressed properly it increases our risks and potentially jeopardises our license to grow*". Shell has made a first commitment to stay out of "World Heritage Sites" but this is a long way from the IUCN "Amman declaration" of 2000, which recommended that governments

The industries' energy scenarios for the 21st Century are not sustainable and will contribute to an environmental and social disaster, which will hit the poorest hardest and increase the gap between the rich and the poor.

prevent mining and fossil fuel extraction in all IUCN Category I-IV protected areas.

Shell's energy scenario planning is based on UN population forecasts that the current 6 billion population will rise to between 8.5 and 10 billion by 2050, with 80 per cent of the population living in urban environments. Shell estimate that by 2050 the energy requirement will be 100-200 Giga Joules (GJ) per capita. 100 GJ per capita would be just over twice what it is now and at 200 GJ per capita three times as much. Shell predicts that by 2050 traditional forms of energy (oil, gas and coal) will provide 70 per cent of the requirement while renewables will provide only 30 per cent.

This bleak scenario for climate change is shared by Exxon Mobil the world's largest oil and gas Company. Exxon Mobil appears to go even further in not fully accepting either the principles of the Kyoto or the 2000 Amman Declaration. Exxon claims that oil producers' struggle to keep up with rampant global demand growth will only be won with access to oilfields now off-limits. Exxon Mobil's chief executive Lee Raymond said in a speech to the OPEC International Seminar in Vienna on the 16th Sept 2004 that:[3]

First, the outlook sets before us an enormous task of finding and producing the huge and increasing amounts of energy needed by the people of the world. Inevitably, most of the energy that will be used for many decades will continue to be from fossil fuels: coal, oil and natural gas. For a variety of reasons, we expect demand for fossil fuels to increase in absolute magnitude by about 65 to 85 million oil equivalent barrels per day by 2020.

Just how much is, 65 to 85 million barrels per day? Well, it is in the range of eight times Saudi Arabia's current oil production. Obviously, this is no small chore. Cooperation will be critical in several areas.

There will be a need to ensure that energy-producing companies have access to resources. Today we see a number of access restrictions around the world.

These restrictions exist in energy-importing countries such as the United States, where limitations have been placed on exploring areas where energy resources may be found. But they also exist elsewhere, in energy-exporting countries. The future need for petroleum energy will be such that restrictions— in whatever form and wherever imposed— will jeopardise the provision of adequate energy supplies to world consumers.

Shell predicts that by 2050 traditional forms of energy (oil, gas and coal) will provide 70 per cent of the requirement while renewables will provide only 30 per cent.

With significant heavy oil, tar sands, and other "unconventional" resources, new technology will be critical to making the "unconventional" energy resources of today the "conventional" resources of tomorrow. Making development of these unconventional resources economically attractive will ensure adequate supplies of fossil fuels are available at affordable prices for the next 100 years."

This kind of response is only delaying the end of the oil era not solving long-term energy needs.

It is believed that Raymond is referring particularly to the Arctic Refuge in Alaska. Research by WWF and others has shown that even if all the extractable oil was pumped from under the Arctic Refuge it would only supply about nine months of US demand. It would damage one of the most critical ecosystems on earth, on which the "Gwitchen" people depend for survival. This kind of response is only delaying the end of the oil era not solving long-term energy needs.

In spite of this the US Senate approved, by a two vote majority, the exploration of oil and gas in the Arctic Refuge. Exploitation of Canadian oil shales has recently been stepped up, despite widespread concern about the environmental consequences.

The struggle to keep up with energy demands, particularly from rapidly developing countries like India and China, is driving more and more companies into remote, fragile ecosystems and areas of unique biodiversity where governments often have limited capacity to protect the environment, other economic activities or the people who live there.

Picture 1. The prospect of drought and increasing food shortages are real threats in many developing countries (*Courtesy Sue Stolton, Equilibrium Research*)

Exploration in critical marine areas

Most of the increased oil and gas production in West Africa and other parts of the world will be from offshore wells in sensitive marine environments.

Most of the increased oil and gas production in West Africa and other parts of the world will be from offshore wells in sensitive marine environments, which are critical for human economic survival. There are several reasons for these developments:

- The social and environmental problems that have occurred on land, *e.g.* in Nigeria-the Niger Delta
- Oil reserves on land are starting to dry up, *e.g.* Texas and Gabon
- The technical problems of operating in deep water and rough seas have been largely solved through work in the North Sea, Gulf of Mexico etc
- The lack of laws controlling off shore operations in the marine environment and the ability to negotiate individual agreements with governments, even though the main impact of a spill will be on a neighbouring country not the country in which the spill occurs.
- The ability to convert 25-30 year old single hulled tankers which should have gone to the scrap yards into floating production platforms (so-called FPSOs) for use in countries that do not have strict laws. The USA will not permit them to be used and the maritime certification agency Bureau Veritas[4] has produced a

report advising against the conversion of old single hulled tankers.

- Some civil society organisations claim that there is even a lack of control over what is exported from offshore wells and therefore there is an opportunity for fraud/corruption.

Protected Areas and the oil industry: conflict and attempts at reconciliation

Claims by the industry that they can work in fragile vulnerable environments has not generally been born out in reality, as shown in the World Bank Extractive review and many other reports.

As with other extractive industries oil and gas companies pose many actual and potential threats to protected areas. The wide-ranging methods of extraction, on land and underwater, and the risks of pollution during transport, use and disposal of fossil fuels, mean that a wide range of impacts is possible. These impacts can range from air, land and water pollution to habitat loss and fragmentation, increased settlement and related impacts for instance as a result of roads, pipelines or seismic lines being cut through primary forest or disturbance from drilling camps.

Many governments clearly regard protected areas as suitable for oil and gas production, using arguments about the overall importance of energy supplies.

Many governments clearly regard protected areas as suitable for oil and gas production, using arguments about the overall importance of energy supplies and the possibility that oil and gas extraction can take place in a relatively benign way. On the other hand, others prohibit such activities in protected areas absolutely. Even more common is exploration and exploitation near to protected areas, including within buffer zones. Whether near to or within officially protected areas, there have been increasing pressures on the companies that conduct these extraction activities to operate in a responsible manner, including keeping negative impacts to an absolute minimum and avoid undertaking operations in some specific areas and encouraging positive benefit wherever possible.

Industry and conservation groups have responded through a number of joint ventures to address environmental issues. In 1993, IUCN and the Oil Industry International Exploration and Production Forum (E&P Forum—now the Association of Oil and Gas Producers) jointly published guidelines "*to establish internationally acceptable goals and guidance*" for environmental protection for *Oil and Gas Exploration and Production in Arctic and Sub arctic Onshore Regions.*[5] The guidelines specifically recommended that selection of the drill site should be guided by a number of pointers, including the "*avoidance of protected and conservation areas"* and listed the "*awareness and avoidance of protected areas"* first in a list of general environmental protection measures that should guide activities.

IUCN sought to tackle the issue of extractive industries impacts on protected areas more generally through a recommendation (2.82) at the World Conservation Congress in Amman, Jordan in October 2000. The recommendation calls "*on all IUCN's State members to prohibit by law, all exploration and extraction of mineral resources in protected areas corresponding to IUCN protected area management*

categories I-IV". And recommended that "*in categories V and VI, exploration and localised extraction would be accepted only where the nature and extent of the proposed activities of the mining project indicates the compatibility of the project with objectives of the protected areas".* Although this recommendation was aimed at Governments, it clearly has implications for many companies. For instance, BP has 49 units operating in or adjacent to national or international protected areas, with five of these units operating within protected areas categorised as IUCN I-IV.[6]

In order to further help countries work, effectively with the Extractive Industries a number of organisations have produced guidelines. WWF produced "*To Dig or Not to Dig*"[7] (see box) with criteria for determining the acceptability of mineral exploration, extraction and transport from ecological and social perspective.

Box 2. To Dig or Not To Dig

WWF suggests in "To Dig or Not To Dig" that mineral activity should not take place in the following places:

- **Highly protected areas** (IUCN categories I-IV, marine category I-V protected areas, UNESCO World Heritage sites, core areas of UNESCO biosphere reserves, Natura 2000 sites and in European Union countries);
- **Proposed protected areas within priority conservation areas** selected through Eco-regional planning exercises;
- **Areas containing the last remaining examples of particular ecosystems or species** even if these lie outside protected areas; and
- **Places where mineral activities threaten the wellbeing of communities**, particularly including local communities and indigenous people.

The term "mineral activity" is used to denote all levels of activity— prospecting, extraction, processing, transport and decommissioning— which are related to either fossil fuels or minerals, metals or building materials.

The Energy and Biodiversity Initiative aims to develop and promote best practices for integrating biodiversity conservation into oil and gas development and transmission. The first meeting of the Initiative was held in January 2001 and a publication has now been produced[8] under the auspices of nine organisations: BP plc, Conservation International, Chevron Texaco, Fauna & Flora International, Smithsonian Institution, Shell International, The Nature Conservancy (TNC), Statoil and IUCN. The Initiative is a collaborative process to produce outputs with broad dissemination, and important stakeholder groups have and will continue to be consulted throughout the development of these outputs. The principal issues addressed are:

- The rationale for integrating biodiversity conservation into oil and gas operations
- Identification and implementation of on-the-ground best technical and management practices
- Metrics and performance indicators for measuring the positive and negative impact of oil and gas development on biodiversity
- Criteria for deciding whether to undertake activities in sensitive environments

The International Petroleum Industry Environmental Conservation Association/ International Association of Oil and Gas Producers (IPIECA) was

founded in 1974 and provides the oil and gas industry's main channel of communication on environmental issues with the United Nations, particularly the United Nations Environment Programme. IPIECA's focus is on key environmental issues such as oil spill preparedness and response, global climate change and biodiversity; as well as health and social responsibility issues. There are currently over 35 members, drawn from private and state owned companies as well as national, regional and international associations— the membership covers Africa, Latin America, Asia, Europe, Middle East and North America.

In spite of all the efforts of these organisations the reality on the ground is that many areas of high biodiversity including protected areas have been badly affected by the oil and gas industries. The experience of CEESP members helping local NGOs working on oil and gas projects in many parts of the world including West Africa and the Former Soviet territories such as Azerbaijan and Georgia has highlight the problems. One of the fundamental issues is that oil and gas fields are being developed in isolation from or in the absence of National Energy Plans.

The reality on the ground is that many areas of high biodiversity including protected areas have been badly affected by the oil and gas industries.

Another problem is that contrary to OECD, UNEP, UNDP and World Bank Transparency Guidelines, extractive industries are still signing secretive agreements such as Inter Governmental Agreements (IGA's), Host Government Agreements (HGA's), Production Sharing Agreements (PSA's), Contracts of Work, etc, with Government. They have even ordered equipment and approved construction contracts before they have carried out a social study or environmental impact or had their Environmental and Social Impact Assessments (ESIA) approved.

Worse of all the industry are not following International Standards for developing projects, which require decisions to be made on the basis of prior and informed consent.

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A classical example of this is the Baku-Tiblisi-Cheyan pipeline. The decision on the route of the pipeline was made in 2000 before ESIA was even started. HGA and construction agreements were signed in October 2000, the final route was approved in January 2001 but work began on the ESIA only in June of that year. Some NGOs such as WWF Turkey were not even consulted until Dec 2001 after the first ESIA had been carried out.

Lessons learned

Lesson 1: Transparency

All oil and gas companies should respect the UN Convention on Corruption and the Extractive Industries Transparency Initiative and practise total transparency. Companies should inform governments of their standards prior to signing contracts and work with governments to meet the International standards on Transparency.

Lesson 2: National Sustainability

Both Rio and Johannesburg WCSD's proposed that National Sustainability plans should be developed. These should include National Environmental and Energy plans including renewable energy. All oil and gas projects should be developed within a Strategic Environmental Assessment as part of the framework of National Sustainability/Energy Plans. These plans should include the current and future energy needs for the country and the substitution of finite resources with renewables.

Lesson 3: Strategic Environmental Assessment (SEA)

A good model of an SEA has been prepared by the UK Department of Trade and Industry (DTI with support from staff from WWF and many other organisations). A key early step is an SEA scoping exercise to obtain external input to help define:

- ▷ The issues and concerns that the SEA should address
- ▷ Key information sources and perceived gaps in understanding of the natural environment
- ▷ Key information sources and perceived gaps in understanding of the effects of the activities that would result from oil and gas licensing

SEAs are vital for critical marine systems, on which millions of poor people depend for survival. These systems are going to be badly affected unless industry is forced to meet the highest international standards.

Lesson 4: Combined environmental and social studies

Oil and gas companies must complete all environmental and social studies including health impacts at the same time and have them checked by relevant government departments, civil society and an independent agency before giving them to the government for approval. This must be completed before investment decisions are made.

Lesson 5: International Standards

Oil and gas companies should follow the highest international standards both in construction methods and the equipment they use. The use of old (25 plus years) single hulled converted tankers as floating production platforms will cause concern particularly when they are stationed in areas of very high marine biodiversity.

Lesson 6: Treaties

International treaties are needed to control oil and gas operations when the impacts of their operations, including oil spills or discharged process water, may affect a number of countries.

Lack of international legislation for offshore oil and gas operations

Although some general principles exist in both Rio and United Nations Convention on the Law of the Sea (UNCLOS), as shown below, there is a serious lack of detailed international legislation for offshore oil and gas operations. The onus is primarily on states to develop legislation, even though the main impact of pollution may be on neighbouring countries.

There is a serious lack of detailed international legislation for offshore oil and gas operations.

This problem has been highlighted by the Canadian Maritime Environmental Law Association (CMLA): *The present plethora of national legal regimes and the individual contractual negotiations between the major oil companies*

and nation states, often with little or no bargaining power, has resulted in an assemblage of political and economic environments which resembles European medieval fiefdoms.[9]

Principle 2 of the Rio Declaration provides: *States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental and developmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.*

UNCLOS states in Article 208 that: *Coastal States shall adopt laws to control marine pollution from offshore units and seabed activities no less effective than in international rules and standards. States shall establish global and regional rules for this purpose*.

A strategy for energy

In recognition of the severe problems arising from the oil and gas industry, and the finite nature of these resources, calls for an Energy Revolution on the scale of the industrial revolution to solve the world's energy and climate change crisis. Key elements of such a "revolution" would be:

- By 2050 virtually all energy to come from environmentally-sound renewable, or decarbonised sources. This will also reduce the need for the oil and gas industry to move into areas of high biodiversity and low civil society and government capacity or areas, which are critical for human survival.
- Governments and other key constituencies need to overcome the current unsustainable fossil-based energy system and take clear and decisive steps towards renewable energies and energy efficiency.
- Industry should pay the real cost of their impacts on climate change and other environmental damage; this will also help to ensure that renewable energy sources are competitive and new technologies are developed.
- All direct and indirect subsidies need to be stopped, except those supporting fuel for the poorest people.
- The energy needs for future generations must not be wasted and gas flaring should be stopped; when it occurs it should be subject to financial penalties.
- Countries should be helped to develop National Sustainability Plans including energy plans, which include renewable energy strategies. They should avoid exporting all their fossil fuels before they have developed renewable replacements.
- All extractive industries and all governments should be encouraged to sign the Extractive Industries Transparency Initiative, (EITI) and respect the UN Convention on Corruption.

Picture 2. West African marine environments could be at risk from increased oil and gas production (*Courtesy Nigel Dudley, Equilibrium Research*)

- Industries should stop signing secretive Host Government Agreements, Production Agreements and Contracts of Work. No contracts should be signed before Strategic Environmental Assessments (SEAs) and Environmental and Social studies (ESIAs) have been carried out. Governments must give prior and informed consent in accordance with OECD Guidelines.
- All poor people should be supplied with renewable low cost energy efficient systems suited to their needs.
- Sums at least the equivalent of the current fossil fuel subsidies need to be invested in research and subsidising the development of renewables and the improvements in energy efficiency.
- The revenue from oil and gas should be used to help countries develop and implement sustainable development plans thereby protecting the environment and helping to eradicate poverty.

Engaging citizens in a legitimate, empowered manner is not just good for companies and concerned and affected stakeholders; it is the heart and soul of ethics and sustainability.

One of the main pillars of achieving environmental and social justice in large-scale projects is to have fully informed stakeholder participation and citizen oversight in projects that are implemented by large industries. Engaging citizens in a legitimate, empowered manner is not just good for companies and concerned and affected stakeholders; it is the heart and soul of ethics and sustainability.

Sandra Kloff, **Emmanuel Obot** and **Richard Steiner** are all members of CEESP's Working Group on Social and Environmental Accountability of the Private Sector (SEAPRISE). **Clive Wicks** (clivewicks@googlemail.com) is co-chair of SEAPRISE, with a particular interest in fossil fuels and mining in Africa. He worked for many years with WWF UK.

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Climate change and protected areas

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

Jacques Pollini

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.

A baseline scenario would be established for each concerned party by calculating current emissions and future trends in term of deforestation and forest degradation.

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.

Is there a paradox in attempting to slow deforestation by a further expansion of markets, i.e., by giving a monetary value to the carbon stored in forests?

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.

Direct transfer of payments to individual forest users could lead to "conflict and the marginalisation of less powerful claimants" in the absence of clear property rights and use rights.

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.

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.

But for addressing the issue of deforestation itself, which, beyond its impact on climate, also causes biodiversity losses,

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*)

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.

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.

A significant share of REDD funding should be channelled directly to stakeholders having historically constituted use rights over the concerned forest land and resources.

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.

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.

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

A sort of global guarantee fund for primary forests, reflecting the recognition of the intrinsic value of biodiversity by the international community...

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.

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

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.

The increasing market value of carbon creates an unprecedented opportunity to design new mechanisms for financing environmental conservation and development.

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.

Jacques Pollini, PhD (jp267@cornell.edu) is a Visiting Fellow at the Department of Natural Resources, Cornell University.

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

As our climate changes the hydrological cycle will intensify. In particular, rainy seasons will become shorter and more intense and droughts will grow longer.

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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Ecologists, engineers and disaster relief specialists are increasingly looking for the right balance between development, conservation and disaster preparedness, often drawing on traditional approaches used by indigenous peoples or local communities.

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

Ecologists, engineers and disaster relief specialists are increasingly looking for the right balance between development, conservation and disaster preparedness, often drawing on traditional approaches used by indigenous peoples or local communities.

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

Although, there has been considerable and welcome recognition of the role of ecosystem services in disaster mitigation by many governments and international organisations there is still little best practice guidance to help implement the various declarations and agreements that have resulted.

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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

Sue Stolton (equilibrium@compuserve.com) is a partner in Equilibrium Research. For the last six years Equilibrium have been working on a joint project with WWF and a number of expert partners to develop a series of reports which aim to identify and where possible quantify the wide range of the benefits derived from protected areas, to increase support for protection, identify innovative partnerships and financing mechanisms and broaden and strengthen protected area management strategies. This article is based on the latest report in this series, *Natural Security: Protected areas and hazard mitigation*. Jonathan Randall is Senior Program Officer for the WWF-US Humanitarian Partnerships Program. Over the last ten years, he has been working at the intersection of natural disasters and the environment with a focus on freshwater, land use planning, and hazard mitigation. He has served as an environmental consultant for several post-disaster reconstruction efforts including the 2004 Indian Ocean tsunami in SE Asia, Hurricane Katrina in the US Gulf Coast, and recent cyclones in Mozambique and Bangladesh.

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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.

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.

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.

Adrian Phillips (adrianp@wcpa.demon.co.uk) is the former Director General of the UK Countryside Commission (1981-1992), and Chair of WCPA (1994-2000). Author of the *Management Guidelines for Category V Protected Areas— Protected Landscapes and Seascapes*, (IUCN 2002).

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]

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*)

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.
- 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.
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24 Ruddell (forthcoming).
25 Swallow *et al.* 2007.
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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.

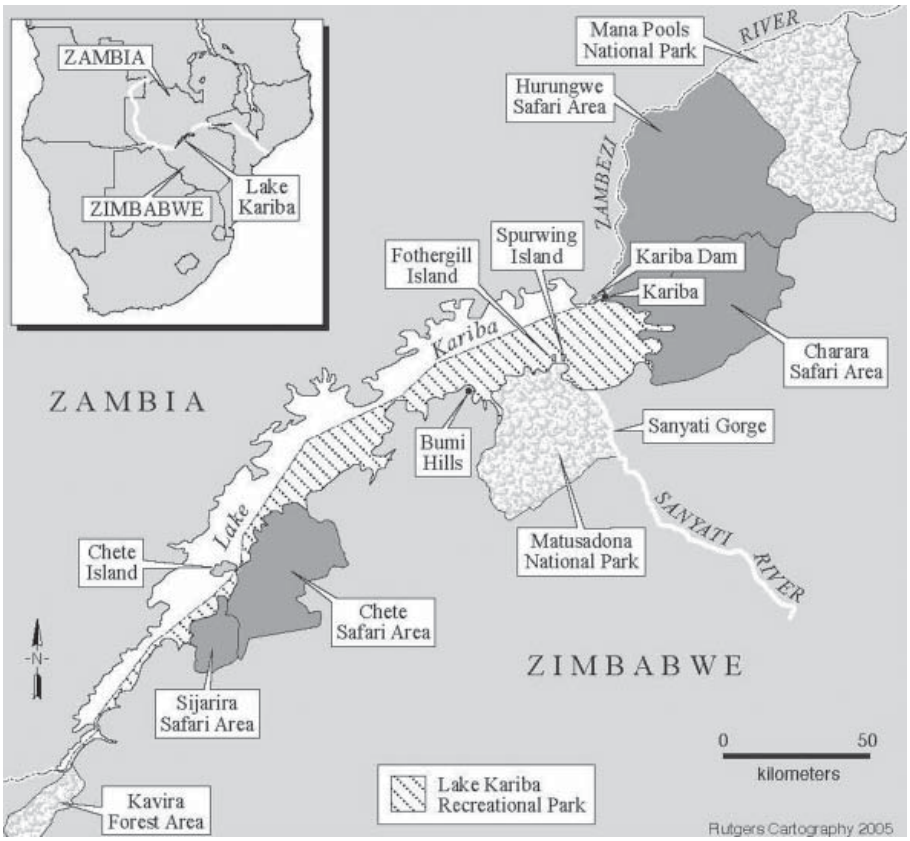

Figure 1. Map of the Zambezi Valley

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.

David McDermott Hughes (dhughes@aesop.rutgers.edu) is Associate Professor of Human Ecology and Anthropology at Rutgers, the State University of New Jersey, USA. Also at Rutgers, he directs the Center for African Studies. He frequently advises conservation agencies and is author of From Enslavement to Environmentalism: Politics on a Southern African Frontier (Seattle: University of Washington Press and Harare: Weaver, 2006). A version of this paper was presented at the "White Oak workshop: protected areas, governance, and ecological scale", World Conservation Society, 4-7 June 2008

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

Jamison Ervin (jamie_ervin@TNC.ORG) is senior protected area specialist with The Nature Conservancy. She previously developed a system-wide protected area management effectiveness system for WWF, worked with the Forest Stewardship Council and worked as an anthropologist in Nepal.

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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Trevor Sandwith (tsandwith@tnc.org) is Director of Global Protected Areas Policy for The Nature Conservancy. He was previously with the South African National Biodiversity Institute managing the Cape Action for People and the Environment Programme, and is the Deputy-Chair of the IUCN World Commission on Protected Areas.

Comments and advice on this concept have been generously provided by: Charles Besancon, Josh Bishop, Joanna Durbin, Frank Hawkins, Lex Hovani, Tony Knowles, Cyril Kormos, Nik Lopoukhine, Kathy Mackinnon, Duncan Marsh, Vance Martin, Sarene Marshall, Jeff Price, Nik Sekhran, David Sheppard and Chris Warner.

Climate change and livelihoods

Managing and mitigating climate change through pastoralism

Jonathan Davies and Michele Nori

Abstract. Mobile pastoralists are amongst those most at risk to climate change, yet they are amongst those with the greatest potential to adapt to climate change, and they may also offer one of the greatest hopes for mitigating climate change.

The vulnerability that is associated with climate change in some pastoral environments has its roots in the restriction of tried and tested pastoral coping strategies. Pastoral adaptation faces a myriad of challenges, of which climatic change is but one, and indeed, the challenge of climate change seems insignificant to many pastoralists who are faced with extreme political, social and economic marginalisation: relax these constraints and pastoral adaptive strategies might enable pastoralists to manage climate change better than many other rural inhabitants.

The capacity to adapt is something intrinsically pastoral, and sustainable pastoral development must be founded on the understanding that adaptive capacity is what makes pastoralism work: restoring and enhancing adaptive capacities must therefore be central to development plans. The flexibility, mobility and low-intensity use of natural resources afforded by pastoralism may increasingly provide livelihood security in environments where sedentary production fails.

Along with the moral imperative to enable pastoralists to take control over their own development comes a new imperative to recognise and promote the environmental services of mobile pastoralism. Soil organic carbon is one of the largest terrestrial carbon reservoirs, and much of this soil is in open grazing lands that cover over 45 per cent of the earth's surface—1.5 times more of the globe than forest. Whilst forests may add only about 10 per cent to their total weight each year, savannas can reproduce 150 per cent of their weight annually, and tropical savannas have a greater potential to store carbon below ground than any other ecosystem. Enabling sustainable rangelands management by pastoralists is therefore now of global significance as well as of local importance.

Where the wind blows

Take the world's most hostile and unpredictable terrains, and look at who you find there: the chances are they will be pastoralists. In cold arctic tundra and on the Asian steppe, in the hot drylands of Africa and West Asia, and in the high altitudes of the Himalayas, the Andes and the world's other mountain regions, pastoralism provides a means to manage climatic extremes and unpredictability. Pastoralism is practiced in some 25 percent of the global land area, predominantly in places where constraining soil, rainfall and temperature conditions render the land unsuitable for crop cultivation.

"There are strong commonalities in livelihood strategies of pastoral groups inhabiting and exploiting distant and diverse drylands or highlands of the world (from Sub-Saharan African dry lowlands to cold Asian plateaux, from the tropical savannah to the cold northern steppe)— a feature that is much less evident among other population groups across the globe"[1]

Pastoralism is the finely-honed symbiotic relationship between local ecology, domesticated livestock and people in resource-scarce, climatically marginal and often highly variable conditions. It represents a complex form of natural resource management, involving a continuous ecological balance between pastures, livestock and people. The livelihood patterns of pastoral communities hinge upon strategies that continuously adapt to a limited, highly variable and often unpredictable resource endowment. The range of strategies that pastoralists use results from and is affected by the larger geo-political system.[2]

The adaptive capacity of pastoralists is what has made them so resilient throughout history and has enabled them to sustainably exploit their natural environment. Their adaptive management skills have enabled pastoralists to create and maintain biodiversity in many environments of extraordinary natural beauty, which are enjoyed by consumers worldwide. Yet pastoral development over the past century has been characterised by the loss of this adaptive capacity, and the outcome has been a vicious cycle of impoverishment, resource depletion and environmental degradation, which further erodes adaptation.

Changing environments may provide suitable conditions for an expansion of pastoralism, as the flexibility and mobility afforded by pastoralism can increasingly provide security where other more sedentary models fail. More than once in our history, pastoralism provided a means through which sedentary populations could adapt to survive in the face of deteriorating climatic conditions. Archaeological evidence indicates that pastoralism in Africa developed about 6000 years ago in direct response to long-term climate change and variability, and spread throughout northern Africa as a means of coping with an increasingly unpredictable and arid climate.[3] Current climate changes are predicted to bring rising temperatures and erratic precipitation, which increase the likelihood of both drought and flood: changes to which pastoralism, more than any other rural land use system, has traditionally been well adapted.

Are pastoralists truly at risk from Climate Change?

Opinions over what the future holds in store for the world's pastoralists are polarised, with some experts considering pastoralists to be the "canaries

in the coal mine" of climate change, whilst others consider that, since pastoralism is an adaptation to climate change, pastoralists will be amongst the best equipped to deal with such a threat. Such diametrically opposed points of view characterise the broader discourse and they reflect a widespread lack of understanding of pastoralism, and a systematic failure to listen to the opinions of the pastoralists themselves. This divergence of opinions has created major challenges for policy makers and development planners and has contributed to development failures in pastoral regions.

During an e-conference, held in February 2007, many agencies that work closely with pastoralist groups around the world felt that the challenge of climate change seems insignificant to many pastoralists who are faced with extreme political, social and economic marginalisation. The general consensus was that, if this multitude of constraints to pastoralism were relaxed, their adaptive strategies might enable pastoralists to manage climate change better than many other rural inhabitants. The vulnerability that is associated with climate change in some pastoral environments has its roots in the restriction of tried and tested pastoral coping strategies, including the ability to move through different territories, to access critical livelihood resources, to trade across borders, to benefit from appropriate investments, and to participate in relevant policy decision-making. As is so often the case in developing regions, the main concern for pastoralists is the accessibility, rather than the availability or variability, of resources.

It would be wise not to overstate the importance of traditional coping strategies, since some of them may have become permanently out of reach for pastoralists. Growing population pressure, together with the shrinking of effective rangelands, poses an important challenge to the sustainability of pastoral livelihoods, and places constraints on one of the most familiar pastoral coping strategies: migration into new regions. The scale of movements that some pastoralists have made in the past, to cope with climate change, insecurity and other challenges, are no longer possible in many countries, and pastoralists must be enabled to identify new coping strategies that are appropriate to their current situation. However, the technical possibilities for raising productivity in the rangelands are limited and tend to be more resource-degrading than in higher rainfall areas, which compounds the challenge of population growth for pastoralists.

Picture 1. Masia in Kenya (*Courtesy Sue Stolton, Equilibrium Research*)

Pessimistic views of pastoralism in the face of climate change are particularly rife in Africa south of the Sahara, where food insecurity is widespread and where many pastoral communities are regularly confronted with drought, which is said to be increasing. Yet it is important to examine this 'drought' more closely before it is simplistically attributed to climate change. Scientific predictions and computer simulations suggest that in the short term the Sahel might actually benefit from climate change, through a greening of the Sahel and southern Sahara.[4] Pastoral areas of southern Kenya and northern Tanzania may also be getting wetter.[5] Yet food insecurity appears to have increased in the pastoral areas of both East and West Africa over the past 10 years. To simplistically put this down to increasing drought would be misleading.

The scale of movements that some pastoralists have made in the past, to cope with climate change, insecurity and other challenges, are no longer possible in many countries, and pastoralists must be enabled to identify new coping strategies that are appropriate to their current situation.

There are many factors that could be influencing food security besides climate change, including demographic growth, loss of land and sustained underinvestment and marginalisation. Additionally, rather than facing meteorological drought, many pastoralists may be faced with a form of agricultural drought: a phenomenon that is evidently man-made and is influenced by poor policy and mismanagement. As a result, even if there is a silver lining in the cloud of climate change and levels of precipitation rise in parts of Africa, pastoralists are not in a good position to take advantage.

In reality, climate change will not favour pastoralists if they do not recover the ability to adapt. Policies and investments frequently favour crop growers over livestock keepers, particularly in the drylands where crops are being made more and more resistant to drought. The land rights of crop growers are usually more secure than those of livestock keepers, and the tendency over the past 50 years has been incursion of cultivators into grazing lands. Even if the projected "greening of the Sahara" does take place, under the current conditions it is likely to be crop growers that benefit at the expense of pastoralists.

rather than facing meteorological drought, many pastoralists may be faced with a form of agricultural drought: a phenomenon that is evidently man-made and is influenced by poor policy and mismanagement.

Climate change will therefore affect pastoralists differently in different parts of the world, and according to the extent of their marginalisation and under-development. Although pastoralists may cite other threats to their livelihood as of greater importance, there is good reason to be concerned about the risks that climate change presents, and to assist pastoralists to be aware of those risks and to develop new adaptive strategies. Above all, pastoralists risk being caught out by the rate and the scale of climate change, and if their adaptive strategies are already failing to move with the times, then climate change is likely to increase that failure, with huge social and environmental consequences (Box 1).

Box 1. reasons to be fearful

Although the phenomenon of climate change is not a new one, three main factors justify the current growing concern over this critical challenge: the rate and the scale of its occurrence and the magnitude of its social impact.[6]

1. *The fast pace of the process compromises adaptation strategies*: When the pace of change is too fast, some organisms face extinction, as they will not have the necessary time to adapt, leading to important ecosystem changes and biodiversity loss. Recent estimations indicate a 20 to 30 per cent biodivesity loss in the coming years at this pace of change. The UN Framework Convention on Climate Change (article 2) explicitly recognises the critical link between climate change and the natural capacity of ecosystems to adapt.
2. *Major changes in resource availability at the global scale*: Critical resources are becoming scarcer for the mounting population of the world, with freshwater particularly at stake as the immediate effects of climate change have important consequences on its availability (less, and more variable precipitation in some areas; lower glacial reserves; higher sea levels). Important freshwater reserves that are diminishing include Lake Turkana in East Africa and the Chad Tog Lake in West Africa; as well as other West African lakes such as the Daouna, Faguibine, Tanda et Kabara.
3. *Poorer countries bear the biggest burden*: Climatic variability increases with the degree of aridity[7], and many of the world's poorer countries own a significant share of the drylands. In these countries livelihoods are more reliant on the natural resource base and on environmental goods and services, but their capacity to invest in adaptive technologies, such as improved varieties or water system, is lower.

Pastoralists already face an overwhelming challenge to adapt to an array of forces that threaten their livelihood, and their means of adaptation must change to keep up with the times. Whilst the dominant discourse remains on pastoralists' vulnerability, there is a slow but steady shift in emphasis towards their capabilities. This shift in emphasis is critical if the benefits of pastoralism with regard to climate change are to be realised. By focusing on building capacities and empowering people, pastoral development can ensure that poverty is reduced and capacities for sustainable natural resource management are strengthened within the rangelands.

Pastoral resilience

Pastoralist resilience depends heavily on indigenous knowledge: of the environment and of the production system, and the customary institutions that enable pastoralists to capitalise on this knowledge. Strong social organisation and customary institutions are common features of many successful pastoral societies and have been critical for the effective management of unpredictable environments. These institutions enable herd mobility, pooling of labour for production or security, and spreading of risk through systems of reciprocity and obligation (see Box 2).

In the drylands, low and unpredictable rainfall means that the only effective management system is an opportunistic one: to go where the resources are. This means spatial flexibility (being mobile) and temporal flexibility (having variable herd sizes and risk management strategies). This flexibility depends on the functioning of effective institutions to govern mobility, resource use and redistribution.

Customary institutions are also integral to the social safety nets and shared claims over productive assets that characterise pastoralist systems.

Rangeland policies of the past 50 years have been driven by an entirely inappropriate theory: the tragedy of the commons. This theory explains the impact that resource users have on their environment when unconstrained by any management control. Yet most rangelands are anything but unmanaged, and intricate management mechanisms and institutions found in communally managed rangelands enable pastoralists to manage them effectively whilst maintaining the economic efficiency of mobility and resource pooling. In terms of grazing management, informal rules ensure that herds avoid grazing areas that are already in use, maintain an appropriate distance from other herds, and avoid grazing areas recently vacated. Such practices are critical for the rest and recovery of pastures and for maintaining the long-term viability of pastoralism.

Box 2. Pastoralist risk management strategies at a glance[8]

1. **Livestock mobility** optimises the use of the range, enables pastoralists to access seasonally available resources and buffer zones, and enables herders to evade disease-prone areas;
2. **Livestock diversity** (grazers and browsers) reduces risk from disease, droughts and parasites;
3. **Maximizing stocking densities** helps to ensure long term survival after drought stock loss;
4. **Grazing reserves** (*e.g.* swamps, highlands and riverine areas) are of critical importance to pastoralist risk management strategies;
5. **Herd splitting** spreads risk and enables systems of strong social relations and security to be maintained;
6. **Redistributing assets** and mutually supportive relationships and support networks are critical for coping with crises;
7. **Livelihood diversification** allows pastoralists pursue a number of activities that can be seasonal or permanent, and may be complementary to pastoralism, or a temporary alternative to pastoralism;
8. **Labour migration** enables pastoralists to mitigate risk from drought by moving into distant labour or trading markets;
9. **Use of wild foods** allows households to supplement reduced productivity during droughts;
10. **Opportunistic cultivation** through rain-fed or flood recession agriculture spreads risk.

Constraints to pastoral adaptation

A combination of "*colonial governance, scientific homogenisation, and simplistic economic theories about the use of the commons*"[9] is largely responsible for the history of misguided and failed pastoral development interventions. The perception of pastoralism as intrinsically self-destructive[10] led to efforts to introduce 'modern' systems of governance and natural resource management, which have deliberately or inadvertently eroded traditional governance structures and have undermined the fabric of pastoral society and the foundations of the pastoralist economy. Faced with growing external interference and a rising

The perception of pastoralism as intrinsically self-destructive led to efforts to introduce 'modern' systems of governance and natural resource management, which have deliberately or inadvertently eroded traditional governance structures and have undermined the fabric of pastoral society and the foundations of the pastoralist economy.

pressure on rich-but-fragile environments, pastoral societies have become increasingly unable to retain control over resources.[11]

As nation states have developed, the lands inhabited by pastoralists have been widely viewed as great natural frontiers, and pastoral territories and peoples have been left at the geographic margins of countries, and often divided from their kin by international frontiers and their territories parted by internal administrative boundaries. Ethnic differences have led to further marginalisation of many pastoralists in their respective countries and have compounded the widespread misunderstanding, often bordering on contempt, towards their livelihood. Scientific misunderstandings, inappropriate policies, power plays and resource grabbing have further fuelled the conflict between centralised government structures and pastoral citizens.

Under current conditions pastoralists are more vulnerable to the political and economic environment than to climate change *per se* as it is pastoralists' political marginalisation that constrains them from employing their adaptive strategies and denies them adequate investments for their sustainable development. Under such conditions, even changes that could be nominally positive for pastoralists become a burden, as pastoralists are unable to capture the benefits on offer. Globalisation of trade, growing urban population, increased decentralisation and democratisation, and even climate change as discussed above, all offer benefits to pastoralists, but only if they have the capacity and the freedom to make pragmatic choices over how they develop their livelihoods (Box 3).

Box 3. Global trends that influence pastoralism

A number of major processes currently reshaping the global society present important consequences for pastoral livelihoods and for their overall adaptive capacities:

- ▷ Expansion of trade, integration of markets and increasing regional interconnectedness;
- ▷ High and increasing demand for animal proteins all over the world;
- ▷ A political setting comprising state retrenching and economic liberalisation and implying shifts towards decentralisation, devolution and local participation;
- ▷ Technological developments enhancing mobility and telecommunications, but also improvements in genetics, which enable 'new' animal and plant organisms, that challenge traditional pastoral systems;
- ▷ Growing investments in the extraction of valuable resources and related conflicts, such as oil and uranium in the Sahelian region;
- ▷ Regional stability, security and geopolitical interests, which are particularly critical in marginal regions.

The term *marginalisation* captures a wide range of social phenomena and outcomes that need to be unpacked. In many countries, marginalisation is reflected in the widespread lack of recognition for pastoralism, and a low level of social acceptance. One of the outcomes of this lack of recognition is that many pastoralists are routinely excluded from decision making, at both local and national (not to mention regional and global) levels. As a result of this exclusion they are not afforded an input to policy and planning, and they cannot influence public spending, which means that public investments either fail to serve the interests of pastoralists, or promote competing interests over pastoral resources. Low public spending means that many pastoralists have poor access to basic services (health and education), and poor access to financial institutions, which together create obstacles to diversification of their livelihoods. Many of these outcomes of marginalisation, such as illiteracy or failure to adopt complementary livelihoods, act to reinforce the negative perceptions of outsiders towards pastoralists, and serve to reinforce the marginalisation.

One of the outcomes of this lack of recognition is that many pastoralists are routinely excluded from decision making, at both local and national (not to mention regional and global) levels.

Pastoralism as a tool for mitigating climate change

▷ *Pastoralism and biodiversity*

None of the misunderstandings surrounding pastoralism seems as deeply entrenched as that regarding the impact of pastoralism on its environment, and any debate over the role of pastoralism in sequestering atmospheric carbon hinges on understanding the positive environmental externalities of extensive livestock production. Although many commentators still mention pastoralism and land degradation in the same breath, there has been a major change in understanding overgrazing in the rangelands, at least at an academic level, over the past 20 years.[12] Most informed commentators now acknowledge that overgrazing is found where livestock congregate in one place for too long, but in the wider rangelands, where mobility and customary institutions for resource allocation remain effective, overgrazing is less evident.[13] Overgrazing, therefore, is an outcome not of too many animals, but of restrictions to their effective management

The rich biodiversity that characterises many rangelands is often the result of pastoral management patterns, which is directly linked to the critical reliance of herding systems on the natural resource base and its sustainable regenerative capacities. This ecological wealth has often been created and maintained by pastoralists and these areas have been coveted by conservationists and the tourist industry, resulting in numerous protected areas and national parks located within pastoral areas, such as the Serengeti-Mara region of East Africa, the Three Riverheads area of China and the National Parks of Abruzzi and of the Picos de Europa in Europe.

Just as pastoralists have adapted to their environment, so rangeland environments have adapted to pastoralism, over thousands of years of management. The precise impact of livestock on their environment is complex and has defied scientific replication, which is why science-based solutions to rangelands management usually recommend low and steady stocking rates: a recommendation that is both economically

irrational and environmentally damaging. Positive impacts of livestock on range ecosystem health include: grazing and browsing, which removes ligneous pasture, diminishes fire risk and promotes tillering of many grasses; hoof action which breaks soil crusts and improves water infiltration, embeds seeds and mulches dead vegetation; gut-scarification and transportation of seed; manuring which fertilises the soil and distributes seeds.

Picture 2. Pastoralists in Tanzania (*Courtesy Sue Stolton, Equilibrium Research*)

Many rangelands are considered "grazing dependent", and research in the USA has shown that appropriate cattle grazing can improve the quality of seasonal rangeland forage available to elk during critical periods of nutritional stress.[14] Similar observations have been made for North American sagebrush grasslands and in Mongolia.[15] In recent centuries there may have been a shift from wild ungulates to domestic stock, with livestock replicating the animal impact of wild herds (grazing, manuring and trampling).[16] Evidently such impact relies on managed livestock mobility, which explains the extremely low performance of steady-state stocking systems that have been prescribed in the past by development practitioners.[17]

Just as pastoralists have adapted to their environment, so rangeland environments have adapted to pastoralism, over thousands of years of management.

▷ Pastoralism and soil carbon capture

"The broad figures are that we can store enough carbon in the living biosphere of our planet, to offset all of the carbon emissions since the beginning of the industrial revolution."[18]

Grasslands store approximately 34 per cent of the global terrestrial stock of CO^2 and cover 1.5 times more of the globe than forest. Although the standing carbon store of forests is much greater than that of grasslands, some forests add only about 10 per cent to their total weight each year, whilst savannas can reproduce 150 per cent of their weight annually,[19] and tropical savannas have a greater potential to store carbon below ground than any other ecosystem.[20] Since effective herd management has been shown to increase primary productivity of the rangelands,[21] and given the scale of pastoralism, and the obvious importance of the rangelands to global environmental health, it is vital that Carbon Financing mechanisms are developed to promote this significant environmental service of pastoralism.

Grasslands store approximately 34 per cent of the global terrestrial stock of CO^2 and cover 1.5 times more of the globe than forest.

However, it is also argued that pastoralism is part of the global livestock sector, which contributes more to global carbon emissions than almost any other industry (9 per cent of all CO^2 deriving from human-related activities, and an even greater share of even more harmful greenhouse gases such as nitrous oxide and methane). Furthermore livestock now uses 33 per cent of the global arable land to produce livestock feed, plus a large area of pasture land that has been created through the felling of forests, especially in Latin America where, for example, some 70 per cent of former forests in the Amazon have been turned over to grazing.[22]

Grasslands store approximately 34 per cent of the global terrestrial stock of CO^2 and cover 1.5 times more of the globe than forest.

The true extent of the contribution of pastoralism to climate change is therefore hard to assess, considering that these global figures are not disaggregated. Yet many of the main emissions of greenhouse gases come either from intensive production systems, or from commercial extensive systems that have been created through the clearance of extensive tracts of forest (*e.g.* in South America). Considering the steady growth in demand for livestock products around the world, there is an urgent need to disaggregate the environmental impacts of different livestock systems, to understand which systems are least costly to the environment, and to promote the most environmentally friendly practices.

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Policies in support of sustainable pastoralism

In marginal environments characterised by resource variability mobile pastoralism can be the best way to mitigate risk and it may be part of the solution to climate change, just as enhancing mobile pastoralism is part of the solution to overcoming poverty and reducing drylands degradation. Improving pastoralists' entitlement to a wider range of resources and enabling them to use such resources as needed, is vital to reduce their vulnerability and to support their capacity to tackle the sustainable development challenge in marginal areas. Sustainable pastoral development must be founded on the understanding that adaptive capacity is what makes pastoralism work, and the adaptive capacity of pastoralists needs to be seen not as something different to, but as a primary indicator of, pastoral development.

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The effect of climate variations in pastoral areas remains uncertain: huge new habitats may be created, whilst competing land uses may be compromised to a greater degree than pastoralism. Higher variations in temperature and humidity levels could affect the conditions of typical drylands animals and temperature increases may improve access to highland areas, changing seasonal access to grazing and water resources. Growing population, shrinking lands and shifting rain patterns may aggravate resource conflict, and availability of fresh water will be one of the main points of concern. The new balance between land, water and pasture that climate change will

reshape has implications for the adaptive capacities of pastoralists, vis-à-vis other groups. Clearly defined rules and increased negotiating power concerning the access, control and management of such resources is therefore critical to mitigate conflict as well as to enhance development and adaptation.
The effect of limited and sometimes contradictory scientific understanding over the diverse implications of climate change translates into a variety of recommendations, which give little indication about what to do. Climatic models, early warning mechanisms, scenario analysis and other tools are sometimes used to pay lip-service to the concerns about climate change, but are often unconvincing to local communities.
At the same time the UN Framework Convention on Climate Change warns explicitly that *'lack of full scientific certainty should not be used as a reason for postponing measures to mitigate impacts of climate change'*.

Reacting to climate change

So what is to be done, when we do not fully know what will happen? The answer is not so much a technical one as a political one. Pastoralists hold many of the skills and capacities needed to respond to changing climate patterns and related ecological consequences, and they need to be enabled to adapt accordingly. Pastoralist resource management could in this respect provide important lessons for society: as climate change involves higher degrees of uncertainty, rather than struggling to achieve certainty in an uncertain world, the best response may be to embrace the consequences of uncertainty and rethink responses accordingly.[23]

Not only do pastoralists need to innovate, but the overall society is in critical need of new resource management paradigms to tackle the challenge of climate change. Within this context, renegotiating knowledge and power represents a most critical factor. The political will to acknowledge the effectiveness of pastoral traditional practices, both at institutional and at scientific levels, represents the starting step of any process aimed at enhancing societal adaptation to increasing climatic variability. In this respect, it is worth fostering dialogue to enable development of innovative and complementary skills and forms of knowledge.

Pastoralism is changing and must innovate accordingly; policy, science and market contributions are all needed to make achieve this sustainably. The wider society is facing an unprecedented challenge, as shifts in climate patterns are likely to represent the main force driving social change in coming times. The skills and the capacities different human systems have developed show degrees of complementarity which are vital to synergise and exploit. The leap forward should enable overcoming the traditional-modern, sedentary-mobile, public-private, local-central dichotomies which have so far contributed to patterns of unsustainability.

Adaptive capacity is the potential of a social system to adapt to external stressors; it is the ability to cope with impacts of climate variability and change.[24] It would be meaningless to analyse the consequences of climate change without considering the range of adaptive responses a specific society is capable of putting into practice.[25] Three important areas need to be addressed in order to understand the capacity of pastoralists to change and adapt to climatic variations: institutions and power; science and technology and; economy and market.

▷ *Institutions and power*

Social institutions are crucial in shaping the way that environmental stress affects communities and individuals.[26] Formal statutory institutions have often contributed to undermining customary institutions and have fuelled conflict, while failing to deal with the complexity of range ecosystems and pastoral resource management. Nowadays the importance of pastoral institutions and their capacity to enhance proper management of a scarce and variable resource base is increasingly recognised, but at the same time it is acknowledged that traditional institutions may not be enough to enhance pastoralists' adaptive capacities in the future: alliances and synergies with more formal institutions must be developed, from community to national, regional and global levels. Clear evidence of the importance of governance systems has been documented in Central Asia, where satellite imagery of grasslands in China, Mongolia and southern Siberia reveal large differences in degradation processes under different resource access right patterns. In particular, grazing resources in Mongolia, where pastoralist institutions had been kept in place, are much less degraded than those administered through Russian and Chinese policies, where different degrees of government ownership and privatisation of lands had taken place.[27]

▷ *Science and knowledge*

Science has all too frequently been used to turn a political problem into a technical one, and technological solutions have been used as a cover for inaction by those who want to abdicate responsibility. However, this is not to denigrate the role of science and technology: action-oriented research approaches could yield a range of options for adaptation to climate changes in pastoral environment. Science must look beyond early warning systems, which are poorly trusted by rural inhabitants, and should learn from traditional capacities to understand and monitor climate changes. Scientists need to explore the synergy between indigenous knowledge and external response mechanisms, rather than imposing an externally driven, science-based culture of prediction and control.

The time is long overdue for scientists must adopt, enhance and disseminate new understanding in rangeland ecology and pastoral economics, and to recognise pastoralism's capacity to sustainably produce valuable goods in marginal lands. The challenge that was raised during the 1990's by the "New Rangeland Ecology"[28] has not permeated far enough to actively influence the way pastoralism research and development is carried out and more coordination is required between the natural and the social sciences.

Economy and market

Pastoralists everywhere are steadily integrating into market dynamics, with implications for their adaptive capacities as resource access and use inexorably shifts, whilst their livelihoods diversify accordingly. Economic integration and diversification bring positive benefits of spreading risk, but also introduce pastoralists to new areas of uncertainty, such as market forces, consumer demand, financial services and institutions, and rent-seeking behaviour of market agents. Discussions around adaptation to climate change cannot overlook the fact that some pastoralists are failing to adapt to more immediate changes related to their economy. To make this adaptation more effectively, pastoralists need recognition of the value of the diverse

goods and services that they provide, commensurate public investment in marketing infrastructure, better conditions for effective private investment, and legal protection to ensure equity in the marketplace.

Box 4. Policy recommendations

1. Climate change will be less damaging to pastoralists than to other rural societies, but only if development assistance addresses the political roots of pastoral marginalisation. Strengthening the capacity of pastoralists to claim their rights will be more effective than investing in costly technical solutions.
2. The complete re-think of rangeland ecology in recent years must urgently start to influence policy in developing countries so that the positive environmental externalities of pastoralism can be recognised and promoted. New markets and other payment mechanisms must be developed to promote the environmental services of pastoralism, particularly biodiversity conservation and soil-carbon capture.
3. The vital role of pastoral institutions, in both enabling pastoral adaptation and in sustainably managing rangeland resources, must be recognised and promoted by the State, and innovative ways are needed to enable State and customary institutions to operate complementarily. Policies that have proven particularly effective at enabling pastoralism are those which have promoted customary governance, and those which have afforded pastoralists a degree of security over their land.
4. Science and technology must accept the validity of mobile pastoralism and of pastoral knowledge, and must work with pastoralists to determine the best way that technology and science can serve them.
5. Markets, both domestic and international, must be made to work for pastoral development and pastoralists need assistance to adapt smoothly to the new opportunities that markets offer. This includes intervention by government to reduce marketing and transaction costs and rent seeking behaviour, and relaxation of punitive tariffs and laws at national, regional and global levels.
6. With increasing climate-related risk, particularly in the context of growing demographic pressure, customary systems of insurance are coming under strain and innovative systems of insurance need to be developed that complement, and perhaps build on, existing social insurance systems.

Conclusions

Climate change may be affecting many of the world's pastoralists, but the climate-related shocks that characterise some of the world's drylands regions must not be simplistically attributed to climate change. When those shocks lead to livelihood failure, it reflects the failure to understand and support pastoralism: attributing development failures to climate change will only serve to divert attention from the responsibility to address those failures.

In reality pastoralists are sophisticated managers of risk whose capacities are being eroded, but who, with appropriate support, can teach us a lot about how to manage uncertainty. Reducing pastoralists' vulnerability requires building strengthening of their capacity to innovate and to put into practice their livelihoods strategies. Enhancing pastoralists' entitlement to a wider range of resources, agro-ecological as well as socio-economic, and

enabling them to use such resources as needed, is vital to reducing their vulnerability and to supporting their capacity to tackle the sustainable development challenge in marginal areas.[29]

Current subsidy schemes and technological distortions encourage livestock production in ways that are contributing to climate change and greater recognition is needed of the advantage of pastoral livestock production from a sustainable development perspective. Incentives that value and remunerate the environmental services of pastoralism represent a way to strengthen pastoral resource management and the burgeoning market for carbon finance offers a great opportunity to simultaneously alleviate poverty, protect biodiversity, reverse desertification, and mitigate climate change.

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The challenge of climate change forces our society to rethink resource management, and pastoralists possess skills, knowledge and capacities to deal with scarce and variable resource endowment, from which lessons can be learnt. Pastoralism might indeed provide a perfect setting where participatory processes and indigenous, traditional knowledge could really be used to find appropriate solutions, leading us to learn from herders how to deal with a scarce and unpredictable resource endowment. While efforts must be made to integrate these skills into our development patterns, pastoralists must also be enabled to articulate themselves, and non-pastoralists must be enabled to listen, so as to enhance their capacity to adapt to changes over which they have no control.

This paper was written by **Jonathan Davies** (Jonathan.davies@iucn.org) and **Michele Nori** of the World Initiative for Sustainable Pastoralism (WISP) a global knowledge network that supports the empowerment of pastoralists to sustainably manage drylands resources. WISP is a programme of IUCN, the International Union for Conservation of Nature, currently funded by the GEF and IFAD. For more information go to: www.iucn.org/wisp

Notes

1 Nori, 2007.
2 Pratt *et al*., 1997.
3 Climate Change, Adaptation and Pastoralism, available on the WISP website: www.iucn.org/wisp/wisp-publications
4 Brooks 2007.
5 Thornton *et al*., 2002; quoted in Galvin *et al*., 2003.
6 Nori and Davies, 2007.
7 Niamir-Fuller, 1999.
8 Barrow, *et al.*, 2007.
9 Warren, 1995.
10 Anderson *et al.*, 1999.
11 Swift, 1994; Lane and Moorehead, 1994; Lane, 1998.
12 Ellis *et al.*, 1993, Behnke *et al.*, 1993, Scoones, 1995.
13 Niamir-Fuller, 1999.
14 Sheehy and Vavra, 1996.
15 Mearns, 1996.
16 Voisin, 1959.
17 Scoones, 1995.
18 Prof. Tim Flannery quoted by Tony Lovett, Presentation on Soil Carbon Capture (details)
19 Reid *et al.*, 2008.
20 IPCC, 2000.
21 Briske *et al.*, 2008.
22 FAO-LEAD, 2006.
23 Scoones, 2004.
24 Smit & Pilifosova, 2001.
25 Neil and Mick, 1999.
26 Pelling and High, 2003.
27 Sneath, 1998.
28 Behnke, 1994; Behnke and Scoones, 1992; Behnke *et al.*, 1993; Scoones,1995.
29 Neil and Mick, 1999.

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Climate, carbon, conservation and communities

Dilys Roe, Hannah Reid, Kit Vaughan,
Emily Brickell and Jo Elliott

Abstract. The growing market for carbon offers great opportunities for linking greenhouse gas mitigation with conservation of forests and biodiversity, and the generation of local livelihoods. For these combined objectives to be achieved, strong governance is needed along with institutions that ensure poor people win, rather than lose out, from the new challenges posed by climate change. This paper explores the opportunities from and limitations to carbon-based funds for conservation and development. It highlights mechanisms that may help secure benefits for climate, conservation *and* communities.

The new generation of carbon funds must address the need for a sustained reduction in carbon emissions, while also building good governance and strengthening the resilience and adaptive capacity of ecosystems and local communities in the face of increased vulnerability to climate change. To tackle climate change effectively, we need to "join the dots" between biodiversity loss, local livelihoods and land use changes such as deforestation. There is a strong need for credible standards that link curbing emissions with forest conservation to ensure they provide robust carbon benefits while incorporating biodiversity conservation and benefits to local communities. Conservation-based strategies that address carbon emissions, which include afforestation, reforestation and curbing deforestation, must be made robust. Forest carbon stores are vulnerable to disease or fire, and carbon emitting activities can displaced elsewhere.

With climate change riding high on the political and economic agenda, more and more attention is being paid to different mechanisms for offsetting, reducing and preventing carbon releases into the atmosphere. The UK's 2006 *Stern Review on the Economics of Climate Change*[1] estimated that land use change— and deforestation in particular— is responsible for 18 per cent of global emissions. Yet so-called "avoided deforestation" or "reduced emissions from deforestation and degradation" (REDD) projects were not recognised under the Clean Development Mechanism (CDM) of the United Nations Framework Convention on Climate Change (UNFCCC) during the first commitment period (2008-2012) of its Kyoto Protocol.

The exclusion of standing forests from the CDM stemmed from a number of concerns, including:

1. The risk of deflecting attention from the need to curb industrial emissions
2. Technical issues relating to whether forests can deliver robust carbon benefits. For example, forest carbon stores can succumb to disease, fire or logging, making them less than permanent, with a risk that emissions from forest conversion are often displaced to other locations.

Discussions on the development of a new post-2012 Kyoto framework reignited debate on whether to include REDD projects. This is in large part due to the increasing recognition of the significance of emissions from deforestation and also to the technical improvements in monitoring carbon stocks— for example

Picture 1. Mount Elgon, Uganda (*Courtesy Intu Boedhihartono, IUCN*)

through better satellite imagery. As a result the 2007 Conference of Parties to the UNFCCC held in Bali concluded that any future agreement under the UNFCCC to combat climate change must include measures seeking to reduce deforestation in tropical countries.

Along with climate change, biodiversity loss is another environmental issue of international concern. The Millennium Ecosystem Assessment (MA) highlights how biodiversity underpins the delivery of a range of "ecosystem services" on which human well-being depends but is being degraded at an unprecedented rate. Although the complex links between biodiversity loss and climate change are not yet well understood, there are some clear overlaps:

1. Land conversion contributes to greenhouse gas emissions and has been identified by the MA as a major driver of biodiversity loss.
2. The MA estimates that by the end of the century, climate change will be the main driver of biodiversity loss.

So efforts to tackle climate change are becoming increasingly entwined with efforts to address biodiversity loss. As a result, carbon emissions are a concern within both issues.

This should be good news for biodiversity. For a number of years, conservation organisations have been lamenting the decline in available funding. Carbon funds, however, are growing at a phenomenal rate, and offer the potential to make up some of the shortfall. Forest carbon provides a tool for mitigating climate change and financing forest conservation. Because conservation, development and climate change goals are inevitably closely linked, it is vital that any mechanism provides a robust carbon benefit, while ensuring protection of biodiversity and attending to socio-economic goals.

Different mechanisms for linking carbon emissions and biodiversity conservation

Carbon trading

Under the Kyoto Protocol, industrialised countries in Annex B to the Protocol are able to address emission reduction obligations through three mechanisms:

1. Trading carbon credits with other Annex B countries (emissions trading)
2. Offsetting emissions through investment in emission-reduction projects in other Annex B countries (Joint Implementation)
3. Offsetting emissions through investment in emission-reduction projects in developing countries (CDM).

Picture 2. Timber from a community forest near Hue, Vietnam (*Courtesy Nigel Dudley, Equilibrium Research*)

In addition to these so-called "compliance" mechanisms, a "voluntary" carbon market has emerged through which individuals and organisations can choose to offset their carbon emissions for various purposes, often linked to individual or corporate responsibility. These include:

1. Government-led mechanisms such as the New South Wales GHG Abatement Scheme
2. Schemes run by specialist carbon brokers and/or retailers. Carbon funds operate like any project-based investment fund: a set of partners invests in the fund, the fund invests in a portfolio of emissions-reducing projects (for example, renewable energy and energy efficiency projects) and the fund manager or broker sells the carbon credits generated, with profits going to investors.
3. Individual carbon-offset projects run by NGOs.

Although many schemes purport to offer sustainable development benefits in addition to carbon offsetting, some have been criticised for lack of transparency, accountability and rigorous carbon measurement systems. There is a strong need for voluntary emission reductions to be verified against clear standards to ensure that they provide a robust carbon benefit, alongside any additional co-benefits they promote.

A number of means exist through which investments in either compliance or voluntary mechanisms can link payments for carbon emissions with biodiversity conservation:

1. Individual projects can be designed to meet CDM criteria, registered with the CDM and sold on the international market. Sellers include government agencies, conservation organisations and community groups. CDM projects are intended to secure firm carbon reductions and also contribute to sustainable development, and have to meet certain standards to be eligible.
2. Outside the CDM, retailers may invest in a portfolio of biodiversity-based projects for sale to individuals or organisations on a "pay as you go" basis— for example, planting trees to offset emissions from air travel.
3. The development of standards can help ensure optimal benefits: The Climate, Community and Biodiversity Alliance— a partnership convened under the Center for Environmental Leadership in Business— has developed a set of standards for land-based carbon projects that simultaneously address climate change, support local communities and conserve biodiversity. WWF helped develop the Gold Standard to measure sustainable development benefits (including biodiversity) of offset projects, but this does not currently include forestry projects. Both are applicable to the compliance and the voluntary markets.

4. The World Bank BioCarbon Fund is an example of a carbon fund specifically aimed at projects in forests and agro-ecosystems, with a view to securing climate and biodiversity co-benefits.

Conservation funds

Because of concerns over biodiversity loss, conservation organisations have long invested in projects that tackle tropical deforestation through the various sources of funding available to them. These include official development assistance, corporate donations, contributions from philanthropic foundations and member donations. With REDD included under the second commitment period of the Kyoto Protocol, funding for conservation could increase significantly. Estimates of likely revenue streams vary widely, depending on which costs and benefits are included and which carbon pools and mitigation options are assessed. One review noted that as much as US$43 billion could flow into developing countries for conservation if REDD projects are approved. A recent World Bank report[2] estimated that forested land could be worth between US$1,500 and US$10,000 per hectare if returns to forest land were funded through the carbon market.

Meanwhile, substantial conservation funds are already beginning to emerge alongside the carbon market. For example, as part of its £800 million Environmental Transformation Fund, the UK Department for International Development has established a £50 million UK contribution to a new fund to help conserve the Congo Basin rainforest. The World Bank is developing a Global Forest Alliance to address key international forestry challenges, including climate change mitigation. Linked to this, a new funding mechanism— the Forest Carbon Partnership Facility— is proposed to generate payments for efforts to reduce emissions from deforestation and to build national capacity to establish baselines, analyse drivers and monitor impacts of measures to reduce emissions from deforestation and degradation.

Other proposals also exist for various forms of conservation trust funds. The Brazilian government, for example, has called for the establishment of an international trust fund to which industrialised countries make voluntary contributions and which can be used to provide compensation for slowing or preventing deforestation.[3]

Conservation-based strategies to address carbon emissions

A wide range of forest-based projects can help reduce, prevent or offset carbon emissions. These include:

Afforestation

- ▷ Large scale commercial plantations
- ▷ Smaller scale tree planting schemes
- ▷ Agroforestry
- ▷ Community woodlots

Reforestation

- ▷ Large scale plantations on deforested land
- ▷ Tree planting on degraded land
- ▷ Forest restoration

Slowing or preventing deforestation

- ▷ Establishment, expansion or enforcement of
- ▷ Protected areas
- ▷ Sustainable forest management.

To date, afforestation and reforestation projects have attracted relatively little investment, with the bulk of carbon

funding going towards industrial and energy projects. Under the CDM, for example, only one such project has been registered. This is largely to do with problems of guaranteeing the "permanence" of forest stock and of "leakage" or "displacement"— that is, displacing the carbon-emitting activity elsewhere.

Dialogue within the UNFCCC is beginning to move away from the term "permanence" towards "time bound sequestration agreements", whereby a resource owner commits to maintaining carbon stocks for an agreed period. Issues around displacement can be reduced through setting national and, where appropriate, regional targets (rather than a project-based approach) and gaining broad participation of countries with significant forest areas to avoid the potential risk of displacement between neighbouring countries. "Additionality" refers to the requirement that activities under the CDM project should be additional to those which would have happened without the carbon finance. This is a problematic concept with all CDM projects and is not specific to forests.

One criticism of many forestry projects is that the biodiversity value is the primary reason for the project and that, therefore, the activity would have taken place even without carbon finance. Projects can demonstrate "additionality" if they face barriers that cannot be overcome without carbon finance or when the activity without carbon finance is not financially the most attractive and, therefore, will not happen on its own.

Under the current CDM, assessment of "additionality" generally focuses on establishing whether a reforestation activity is economically viable without the CDM. The issue of economic viability is relevant to REDD projects, as the economic incentives to convert forests are often greater than the incentives to conserve or manage them responsibly. However, this is a complicated area. Overcoming concerns relating to "additionality" requires careful control to ensure that only projects proven to meet these requirements receive finance.

Who benefits from conservation-carbon projects?

Conservation-carbon projects have different implications for different stakeholders— national governments, conservation NGOs, private companies and local communities. Overall, the carbon trading market is dominated by large-scale projects with little community ownership and benefit. Large-scale monoculture plantations are an efficient way of sequestering carbon, due to their rapid growth rates and minimal management regimes, but they have negative impacts on biodiversity and ecosystem functioning. They present high barriers to entry for poor producers because they are capital intensive and scale dependent. These producers may also lose access to land that is designated for a plantation or other carbon-related activity. As noted by the Center for International Forestry Research (CIFOR), "A number of countries have targeted 'degraded areas' for CDM plantations. In many cases, however, these may be lands held under traditional common property systems that are used by local people for a variety of purposes."[4] With potentially high rates of return from carbon offset projects, opportunities are being seized by powerful elites, while local communities often lack the secure tenure and

The carbon trading market is dominated by large-scale projects with little community ownership and benefit.

resource rights to stake their claim. In Uganda, for example, a project entailing the planting of trees for carbon offsets in Mount Elgon National Park has been criticised for ignoring local people's land rights and exacerbating the conflict between the park authorities "guarding" the trees and adjacent communities claiming rights over the land.[5]

Projects aimed at reducing deforestation appear to have greater long-term potential for attracting investment, but again the likely distribution of costs and benefits raises concerns. It is estimated the largest income flows would accrue to only a few countries.

The *Stern Review* reports that eight countries are responsible for 70 per cent of emissions from land use change (Bolivia, Brazil, Cameroon, Democratic Republic of Congo, Ghana, Indonesia, Malaysia and Papua New Guinea), with Brazil and Indonesia accounting for 20 and 30 per cent respectively. A framework which also includes incentives for maintaining low levels of deforestation would expand the number of countries that could benefit from a forest carbon market, such as India, and also reduce the risk of transnational displacement.

Concerns have also been raised that benefits are likely to be captured by government ministries, private companies and conservation NGOs. Local communities will likely bear a disproportionate share of the cost in terms of restrictions on resource use while reaping little of the benefit. Simply increasing investment in forestry through funding for carbon storage and sequestration is unlikely to generate more sustainable forest management or greater benefits to biodiversity and poverty elimination, without first addressing critical governance issues.[6] A few of the common pitfalls are outlined below. Reducing emissions from deforestation, by reinforcing protected areas without the full participation of local communities, could be a form of "protectionism by the back door" and reopen decades of discussion on the livelihood and poverty impacts of protected areas. For these schemes, the Overseas Development Institute highlights two key concerns for local, forest-dependent people:[7]

Reducing emissions from deforestation, by reinforcing protected areas without the full participation of local communities, could be a form of "protectionism by the back door" and reopen decades of discussion on the livelihood and poverty impacts of protected areas.

1. How will incentive or payment schemes be targeted to ensure that the benefits reach those whose livelihoods are affected by changes in land use practice?
2. How will displacement be addressed and what are the implications for local resource rights and livelihood needs?

These concerns are echoed by the Forest Peoples Programme (FPP), which fears states may use REDD funds to reinforce state and private sector control over forests and revert to a "guns and guards" approach to forest protection. FPP also highlights the risk of REDD funds fuelling land speculation and the appropriation of community land— either by external actors or by more powerful individuals within a community.[8]

Picture 3. A community forest near Hue, Vietnam (*Courtesy Nigel Dudley, Equilibrium Research*)

Connecting carbon, conservation and community benefits

While there are certainly risks to local communities from the rapidly growing interest in carbon conservation, there are an increasing number of fledgling schemes that could benefit local communities and generate income streams in areas with very little alternative economic potential, particularly where explicitly designed to do this.

Little attention has been paid to such "bottom-up" approaches to date, but some good examples exist of projects which provide both carbon and biodiversity benefits.[9] The BioCarbon Fund portfolio includes a number of community-based projects. In Niger, for example, local communities enter into a partnership agreement with a private company to grow *Acacia senegalensis* for the production of gum arabic.

Plan Vivo is a good example of a scheme specifically designed with community benefits in mind, and supports small-scale initiatives with local communities that can be used to generate tradable carbon credits. One is a Community Carbon Project in the N'hambita community in the buffer zone of the Gorongosa National Park, Mozambique. The project improves the livelihoods of this very poor community by introducing agroforestry systems that provide income from carbon finance and a range of other benefits such as fruit, timber, fodder, fuelwood and improved soil structure. The community also benefits from improved organisational capacity, education and awareness about forest stewardship and conservation, and the introduction of novel income through beekeeping, cane rat production and craft making. The Forest Stewardship Council (FSC) provides accreditation for sustainably managed forest products, which takes into account the rights of indigenous people, local communities and workers. FSC requires that:

1. The legal and customary rights of indigenous peoples to own, use and manage their lands, territories and resources are recognised.
2. Forest management operations enhance the long-term social and economic well-being of forest workers and local communities.

FSC's principles and criteria provide an example of how local community benefits can be linked to forest conservation.

Next steps: Beyond carbon conservation?

The urgent need to reduce carbon emissions is generating exciting new initiatives. While these offer a big increase in investment flows for conservation, there are a number of critical concerns. Our preliminary review suggests the need to understand the role of biodiversity and impacts on local communities of carbon management within these initiatives: in their prioritisation of projects, and in the process of agreeing to include "avoided deforestation" as a legitimate carbon reduction approach. These new mechanisms have yet to include the lessons from the past few decades of biodiversity conservation and sustainable forest management. As yet, they pay scant attention to governance issues, and the rights of poor local people, particularly those with limited livelihood diversification options and those critically dependent on forest resources.

It is vital that biodiversity, social and cultural values are taken into account in the design and implementation of afforestation/reforestation (A/R) and REDD projects. The concept of High Conservation Value Forests (HCVFs) aims to ensure that forests of outstanding and critical importance are maintained, given their high environmental, socio-economic, biodiversity or landscape values. The aim is to identify HCVFs and ensure that management decisions are consistent with maintaining those attributes of high conservation value. The concept was originally developed within the Forest Stewardship Council certification process, but is increasingly being used by timber purchasers, land-use planners, conservation advocates and within policy debates. It would provide useful elements to incorporate in standards for A/R and REDD projects to ensure that these values were respected and maintained. Encouraging innovation through a "seed-bed" approach by supporting small-scale projects is part of the answer, as is greater attention to rights, equity and livelihoods within all initiatives.

Equally important is to recognise that sustainable resource management mitigates climate change through reducing carbon emissions, and also helps local communities adapt to the effects of climate change. In Vietnam, for example, tropical cyclones have damaged the livelihoods of those living near the coast, and climate change is likely to increase the frequency and severity of such tropical storms. Since 1994, the Vietnam National Chapter of the Red Cross has worked with local communities to plant and protect mangrove forests in northern Vietnam.[10] Nearly 12,000 hectares of mangroves have been planted, and the benefits have been remarkable. Although planting and protecting the mangroves cost US$1.1 million, it has saved US$7.3 million per year in dyke maintenance. During the devastating Typhoon Wukong in 2000, project areas remained unharmed while neighbouring provinces suffered huge loss of life, property and livelihoods. The Vietnam Red Cross estimates that 7,750 families have benefited from mangrove rehabilitation. The mangroves are also a reservoir for carbon sequestration and family members can now earn additional income from selling crabs,

Sustainable resource management mitigates climate change through reducing carbon emissions, and also helps local communities adapt to the effects of climate change.

shrimp and molluscs while increasing In Sudan, local farmers harvest gum from gum arabic trees. The trees seed themselves naturally on farmland, and the farmers leave the seedlings to grow for five years until they can be tapped for gum. Local people are also selecting varieties with greater resistance to drought and hotter temperatures, both associated with climate change. These activities enhance livelihoods, help local people adapt to a changing climate, sequester carbon in tree growth and support good land management and biodiversity conservation.[11] The UNFCCC Adaptation Fund will expand the number of such projects.

For new carbon funds to succeed, they must bridge local and international interests, and engage with local people to ensure these partnerships for sustainable forest management are transparent and accountable.

The wise development of carbon funds offers a major opportunity to respond to climate change in ways that blend mitigation and adaptation. However, for these new carbon funds to succeed, they must bridge local and international interests, and engage with local people to ensure these partnerships for sustainable forest management are transparent and accountable. They need to deliver tangible livelihood benefits, maintain biodiversity and ensure long-term gains from forests, rather than rapid disbursement of funds.

Dilys Roe is the Senior Researcher in the Natural Resources Group of the International Institute for Environment and Development (IIED), her work concentrates on the linkages between biodiversity conservation and poverty reduction (dilys.roe@iied.org). Hannah Reid also works for IIED primarily on the links between climate change and sustainable development, especially from the perspective of developing countries. Kit Vaughan and Emily Brickell both work for WWF-UK. Jo Elliott is a Visiting Fellow at IIED.

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The climate, community and biodiversity standards—a mechanism to screen for and support projects that simultaneously deliver significant benefits to the global climate, local communities and biodiversity

Joanna Durbin

Abstract. One response to debates about carbon offsetting is to promote best practice. The Climate, Community & Biodiversity (CCB) Standards were created to foster the development and marketing of projects that deliver credible and significant climate, community and biodiversity benefits in an integrated, sustainable manner. They enable identification of land-based carbon projects that are designed using best practices to deliver robust and credible greenhouse gas reductions while also delivering net positive benefits to local communities and biodiversity. The CCB Standards were agreed by a coalition of industry groups working with environmental and social NGOs. The standards were agreed in 2005 and as of June 2008 five projects had completed the validation process and four projects are in the public comment phase, mainly from the tropics. The current First Edition of the standards includes 23 criteria and has three levels: approved and silver and gold depending on how many of the criteria are met.

The Intergovernmental Panel on Climate Change's fourth assessment report[1] documents the impacts of human-induced climate change that are already occurring and which will worsen in coming decades, causing dramatic changes to ecosystems, to productivity and to the global economy. The effects will be particularly devastating for poor people who rely on natural resources and have minimal reserves and capacity to cope with the expected changes. To add to the problems, climate change will accelerate the ongoing loss of biological diversity that is the basis of healthy ecosystems on which all life depends.

Emissions from land-based activities like agriculture and deforestation are responsible for 30 per cent of total human greenhouse gas production. Well designed land-based activities are therefore an essential component of climate change mitigation. Reducing deforestation and forest degradation can help to reduce greenhouse gas emissions, while reforestation and agroforestry activities can remove carbon dioxide from the atmosphere. Land-based climate change mitigation activities also have exceptional potential to deliver additional benefits. When sensitively designed, they can help local people by generating sustainable livelihoods through the diversification of agriculture, soil and water protection, direct employment, use and sale of forest products and ecotourism, all of which can also help to build capacity to adapt to the effects of climate change. They can also make a substantial contribution to conserving biodiversity by restoring and protecting natural ecosystems throughout the world, saving threatened animal

Picture 1. The CCB Standards were tested in several countries including Costa Rica (*Courtesy Sue Stolton, Equilibrium Research*)

and plant species from extinction and maintaining resilient and productive natural life-support for humankind.

Exemplary land management projects can address the global problems of climate change, biodiversity loss and poverty simultaneously and in a cost-effective way. Multiple-benefit projects are also more likely to attract a diverse portfolio of investors. For example, a reforestation project with obvious environmental and social co-benefits may attract private investors for the carbon credits, government money for sustainable development and philanthropic grants for biodiversity conservation.

Exemplary land management projects can address the global problems of climate change, biodiversity loss and poverty simultaneously and in a cost-effective way.

Conversely, poor quality land management can result in negative tradeoffs between various outcomes. For example, a non-native plantation may sequester carbon, but bring negative impacts in other spheres if it blocks migratory routes of key species or excludes traditional use of ecosystems by communities. Although major international agreements call for integrated approaches to global problems, there is little concrete guidance on how to develop such holistic projects.

The Climate, Community & Biodiversity (CCB) Standards[3] were created to foster the development and marketing of projects that deliver credible and significant climate, community and biodiversity benefits in an integrated, sustainable manner. They enable identification of land-based carbon projects that are designed using best practices to deliver robust and credible greenhouse gas reductions while also delivering net positive benefits to local communities and biodiversity. The CCB Standards were created by the Climate, Community & Biodiversity Alliance (CCBA), a partnership between some of the world's leading companies and NGOs: BP, Intel, SC Johnson, Sustainable Forestry Management, Weyerhaeuser and GFA

The CCB Standards identify land-based projects that are designed using best practices to deliver robust and credible greenhouse gas reductions while also delivering net positive benefits to local communities and biodiversity.

Envest, Conservation International, CARE, Rainforest Alliance, The Nature Conservancy and the Wildlife Conservation Society. The CCBA aims to foster the creation of a robust, global market for land-based activities that simultaneously benefit the global climate, local communities and biodiversity.

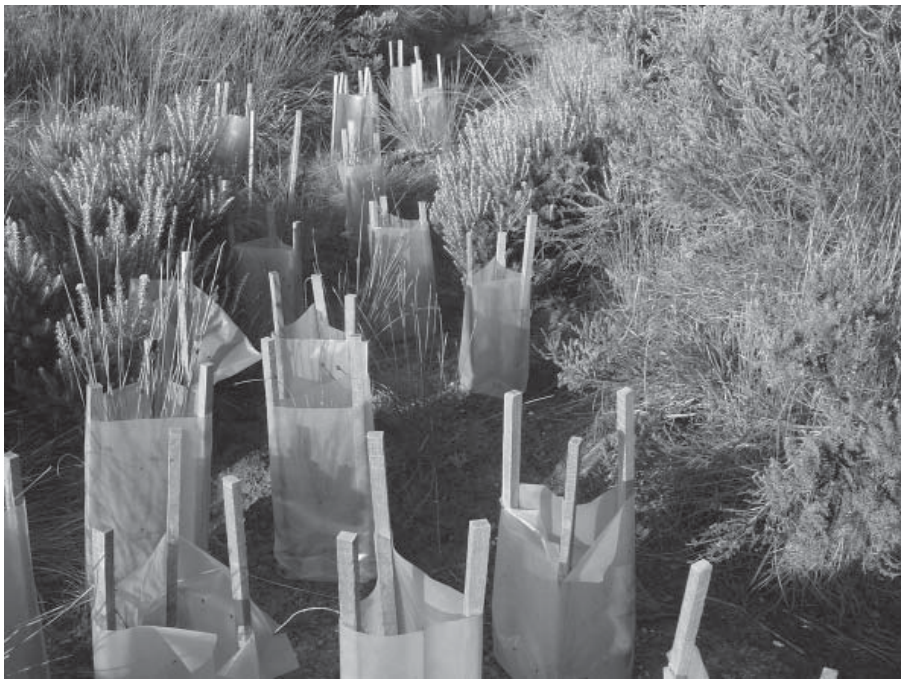
The CCB Standards identify land-based projects that are designed using best practices to deliver robust and credible greenhouse gas reductions while also delivering net positive benefits to local communities and biodiversity. They can be applied to any land-based carbon projects including those that reduce greenhouse gas emissions, for example from deforestation or forest degradation (REDD), and those that remove carbon dioxide by sequestering carbon, for example from reforestation, afforestation, forest restoration, agroforestry and sustainable agriculture.

The CCB Standards are beneficial to a variety of users, including:

1. *Project Developers and Other Stakeholders*— Communities, NGOs, agencies and others use the CCB Standards for guidance in developing projects that deliver a suite of environmental and community benefits and demonstrate the high quality and multiple benefits of their project to potential investors and other stakeholders from an early stage. Projects that meet the CCB Standards are likely to garner preferential investment and even a price premium from funders that support multiple-value projects and best-practices projects.
2. *Project Investors*— Private companies, multilateral agencies and other funders investing in carbon credits can use the CCB Standards as a project screen. The Standards help investors to minimise portfolio risks by identifying high-quality projects that are unlikely to become implicated in controversy. Multiple-benefit projects create valuable goodwill and other ancillary returns for investors. Social and environmental benefits and sustainability are also an important means to reduce risks to the permanence of the climate benefits.
3. *Governments*— Governments of countries hosting projects can use the CCB Standards to ensure that projects will contribute to national sustainable development goals. Also, donor governments can use the Standards to identify Official Development Assistance (ODA) projects that efficiently satisfy multiple international obligations, such as the Millennium Development Goals and the UN conventions on Climate Change and Biological Diversity.

The CCB Standards perform two important roles, as a:

- **Project design standard**: The CCB Standards can be applied early on during a project's design phase to validate projects that have been well designed, are suitable to local conditions and are likely to achieve significant climate, community and biodiversity benefits. This validation helps to build support for the project at a crucial stage and attract funding or other assistance from key stakeholders such as investors, governments or other important local, national or international partners. The CCB Standards are also useful as a design tool, offering rules and guidance to encourage effective and integrated



Picture 2. Well designed reforestation and agroforestry activities can remove carbon dioxide from the atmosphere and provide multiple local benefits
(*Courtesy Nigel Dudley, Equilibrium Research*)

project design to achieve robust multiple-benefits. This early project support and funding can be of particular importance for multiple-benefit land-based carbon projects which often require considerable investment and effort for project development before greenhouse gas emissions reductions can be generated.

- **Multiple-benefit verification standard**: The CCB Standards can be applied throughout the project's life to evaluate the social and environmental impacts of a land-based carbon project. The CCB Standards can be combined very effectively with a carbon accounting standard as provided, for example, by the Clean Development Mechanism (CDM) or the Voluntary Carbon Standard (VCS). In this case, the CCB Standards evaluate the social and environmental impacts while the carbon accounting standard enables verification and registration of quantified greenhouse gas emissions reductions or removals. The CCB Standards verify the social and environmental benefits generated by a project, enabling investors to select carbon credits with additional multiple benefits and to screen out projects with unacceptable social and environmental impacts.

There is no geographical restriction or limit on project start date or limit on project size for use of the CCB Standards. The Standards can be used for projects funded with private and/or public investment and designed for regulatory or voluntary carbon markets. It is important to note that the CCBA does not issue quantified emissions reductions certificates and therefore encourages the use of a carbon accounting standard (such as CDM or VCS) in combination with CCB Standards.

The First Edition of the CCB Standards was released in May 2005 after a rigorous two year development process based on input from community and environmental groups, companies, academics, project developers and others with expert knowledge or affected by the standards. The Standards were then tested on projects in Asia, Africa, Europe and the Americas and peer reviewed by the world's leading tropical forestry institutes: the Center for International Forestry Research (CIFOR) in Indonesia, the Tropical Agricultural Research and Higher Education Center (CATIE) in

Costa Rica and the World Agroforestry Centre (ICRAF) in Kenya. The CCBA initiated a participatory review process in 2008 to develop a Second Edition of the standards that will integrate lessons learned from their use and ensure their continued effectiveness in the light of evolving policies and markets for forest carbon.

As of June 2008 five projects had completed the validation process and four projects are in the public comment phase. These nine CCB projects aim to reduce greenhouse gas emissions by a nearly 4 million tons of CO2e per year and cover 786,552 ha. Around 100 additional projects have indicated to the CCBA their intent to use the CCB Standards. Of these, approximately 40 per cent are in Latin America, 35 per cent in Africa, 20 per cent in Asia and a few projects each in Europe, Australasia and North America. Around 43 per cent of these projects will involve reduced emissions from deforestation or forest degradation (REDD), 30 per cent will include reforestation, 30 per cent will include native forest restoration, 16 per cent will include agroforestry, 14 per cent will include sustainable forest management and 3 per cent afforestation. Many projects are combining several of these project activities to help optimise their multiple benefits.

The relatively large number of REDD projects reflects the high potential multiple benefits associated with REDD and the growing interest in this project type in response to the increasingly favourable international policy environment.

The preponderance of projects in tropical developing country regions, and particularly in Africa, where there have been relatively few projects registered under the Clean Development Mechanism, suggests that the CCB Standards are playing a role to stimulate project and market development to channel carbon market investments to areas where funding is most greatly needed for sustainable development, improved livelihoods and biodiversity conservation. The relatively large number of REDD projects reflects the high potential multiple benefits associated with REDD and the growing interest in this project type in response to the increasingly favourable international policy environment. A number of investors have declared their intention to give a preference to, give a premium to, or exclusively purchase land-based carbon offsets derived from CCB projects. From the other side, some project developers are charging and receiving substantial price premiums for the carbon coming from their CCB projects compared to their non-CCB projects. Much remains to be done to further stimulate the multiple-benefit forest carbon market and bring these multiple-benefit projects to scale, but the rapid developments to date indicate that the CCB Standards are making important contributions towards their goal of catalyzing a robust carbon market for multiple-benefit forest carbon projects.

Joanna Durbin (j.durbin@conservation.org) is the Director of the Climate, Community and Biodiversity Alliance based in Washington DC. Previously she lived and worked for many years in Madagascar.

Box 1. CCB Standards scorecard

The following scorecard shows all twenty-three Standards criteria for the First Edition of the CCB Standards, consisting of fifteen required criteria and eight optional "point scoring" criteria. To earn CCBA approval, projects must satisfy all fifteen required criteria. Exceptional projects that go beyond basic approval may earn a Silver or Gold rating, depending on the number of points scored.

General section		
G 1	Original conditions at project site	Required
G 2	Baseline project	Required
G 3	Project description and goals	Required
G 4	Management capacity	Required
G 5	Land tenure	Required
G 6	Legal status	Required
G 7	Adaptive management for sustainability	1 point
G 8	Knowledge dissemination	1 point
Climate section		
CL 1	Net positive climate impact	Required
CL 2	Offsite climate impact ("leakage")	Required
CL 3	Climate impact monitoring	Required
CL 4	Adapting to climate change and climate variability	1 point
CL 5	Climate benefits withheld from regulatory markets	1 point
Community section		
CM 1	Net positive community impact	Required
CM 2	Offsite community impact	Required
CM 3	Community impact monitoring	Required
CM 4	Capacity building	1 point
CM 5	Best practice in community involvement	1 point
Biodiversity		
B 1	Net positive biodiversity impact	Required
B 2	Offsite biodiversity impact	Required
B 3	Biodiversity impact monitoring	Required
B 4	Native species used	1 point
B 5	Water and soil resource enhancement	1 point

Scoring:

Approved = all requirements met

Gold standard = all requirements met plus one point from at least 3 sections

Silver standard = all requirements met plus 6 points, at least one point from each of three sections

Notes

1 IPCC 2007

2 WRI, undated

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Adapting to climate change and why it matters for local communities and biodiversity— the case of Lake Bogoria catchment in Kenya

Musonda Mumba

Abstract. Climate change is already threatening ecosystems with severe consequences in Africa. Poor people that are dependent on these ecosystems need help to strengthen their capability to adapt to this change. Thus adaptation to climate change is essential and especially for the vulnerable millions. This paper reviews a case study in the Lake Bogoria catchment where WWF has been actively engaged on a project on integrated water resources management. It discusses how the local communities are adapting to climatic variability within the area, indicating the interventions undertaken and providing recommendations and the way forward.

Introduction and background

Science has provided clear evidence that climate change is real and is happening. Within Africa there is growing acknowledgement that climate change impacts are inevitable. Poor people's livelihoods are more threatened than ever by this change and thus their ability to adapt to these changes is necessary. In Eastern Africa reliance of communities on land for agriculture, rivers and other natural resources is very high. However, these resources are climate-sensitive and are likely to be affected. Most parts of the region are already water scarce and hence even more vulnerable. Therefore adaptive capacity of the local communities dependent on these resources is very critical.[1]

Its note worthy that non-climate changes may have greater impact on water resources than climate change. Thus climate change presents an additional challenge to water resources management. The impact of climate on water resources not only depends on climate itself but also the characteristics of the system, how the management of that system evolves over time and eventually how it adapts to the change.[2]

The Lake Bogoria case study aims to show how local farming communities in the upper catchment are adapting to climate change following highly variable rainfall patterns and reduced flows in the Waseges River. WWF has recognised the importance of adaptive strategies by local communities and why partnering with various stakeholders is environmentally sustainable especially for water resources which are climate sensitive.

Working within the Lake Bogoria catchment— history and objectives

Lake Bogoria is one of several rift valley lakes located within the East African Rift Valley (Figure 1). The lake and its wider catchment are rich in natural resources that include the lake itself, forests, wildlife and pastures. The upper catchment comprises forests where the source of the Waseges River (Figure 2)— the main freshwater inflow into the lake— starts. This part of the catchment has multiple land-use practices but mostly small-

Picture 1. Discussions held with Water Resources User Association (WRUA) (*Courtesy WWF-EARPO/Musonda Mumba*)

scale farm holdings where irrigation agriculture is the main practice. The middle and lower catchments on the other hand lie within a semi-arid to arid region where the main land-use practices are livestock production and irrigated agriculture. Originally dominated by nomadic groups, most of the livestock keepers are now sedentary. Both the upper and middle catchments have experienced an increase in population and changes in land-use over the years. Rainfall variability over the years has compounded the problem even further. However, like many agricultural zones of Kenya, the problems are further exacerbated by uncontrolled, illegal over-abstraction from the Waseges River.[3] These factors clearly have had enormous pressure and effects on the environment and particularly water resources.

Approach and intervention—community adaptation strategies to climate change

The Waseges River flows down to the middle catchment in Subukia, a semi-arid area with no more than 700 mm per annum. Communities here rely predominantly on irrigated agriculture for food and cash crops for subsistence. The Lari Wendani Irrigation Scheme was initiated by the irrigation department in 1984 as a way of enhancing food security and production. Currently it supports 94 families covering 25 ha. Over the years deforestation and over-abstraction within and upstream of the scheme resulted in less water available for the scheme, and downstream there was sometimes no flow for over 5 months.

Working with various partners and stakeholders such as the Department of Irrigation, the Water Resources Management Authority (WRMA), local community based organisations (CBOs), the Water Resources Users Associations (WRUA), WWF engaged with the local communities within the middle catchment to find a solution for better water resources management. The WRUA (Picture 1) was particularly a good entry point as this included different user within the community. The WRUA is a representative group consisting of members of various common interest groups and the community at large whose main interest is to discuss issues related to water. This forum presents itself as an effective medium for participatory management of conflicts that arise from water resource use.

In effect the process described above required the use of a nested approach (Figure 4) were participation was from a micro scale (farm level) to the macro scale (basin level). For the purpose of this case study,

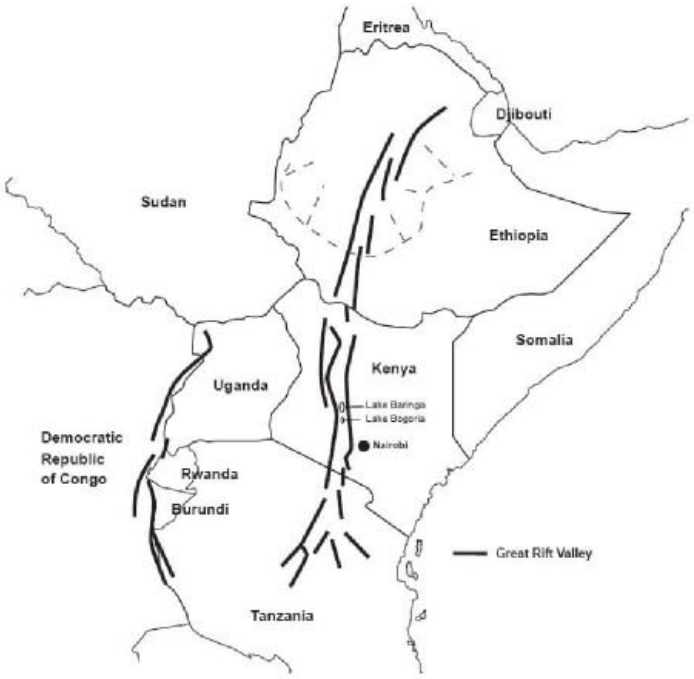


Figure 1. Location of the Lake Bogoria within the East African Rift Valley.

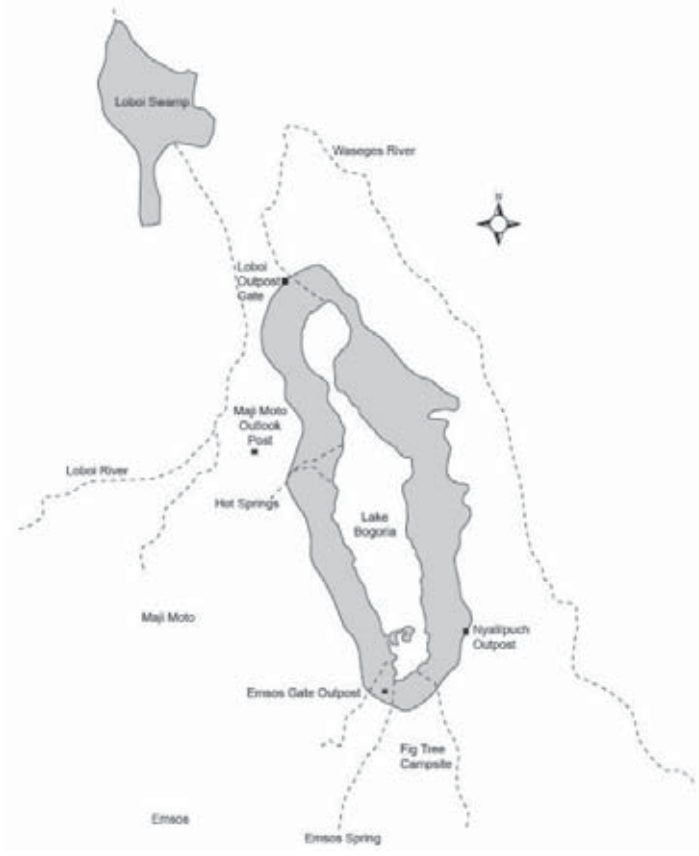


Figure 2. Lake Bogoria National Reserve and its drainage system.

focus was more at the catchment level were several farmers were engaged. There was general recognition that climate change also had a role to play in the reduced availability of water resources, Integrated Water Resources Management (IWRM) was deemed as an environmentally sustainable approach with the different stakeholders.

Over-abstraction of water from the Waseges River, mostly illegal, inefficient water use, combined with variable rainfall, resulted in reduced to no flows within the river for downstream communities. Due to this, conflicts between the downstream and upstream communities ensued.

Over-abstraction of water from the Waseges River, mostly illegal, inefficient water use, combined with variable rainfall, resulted in reduced to no flows within the river for downstream communities. Based mostly on qualitative and anecdotal evidence, the no flow spell lasted for well over eight years. Due to this, conflicts between the downstream and upstream communities ensued. WWF working with other stakeholders in the area organised some members of the WRUA downstream to meet with members of the WRUA upstream so dialogue could be initiated so as to resolve conflict. Though mandated through the Water Act (2002) to have dialogue, WRUAs were not in a position to initiate this. There was also recognition that climate change had altered water resources availability within the area and some coping strategies were needed at farm and community level.

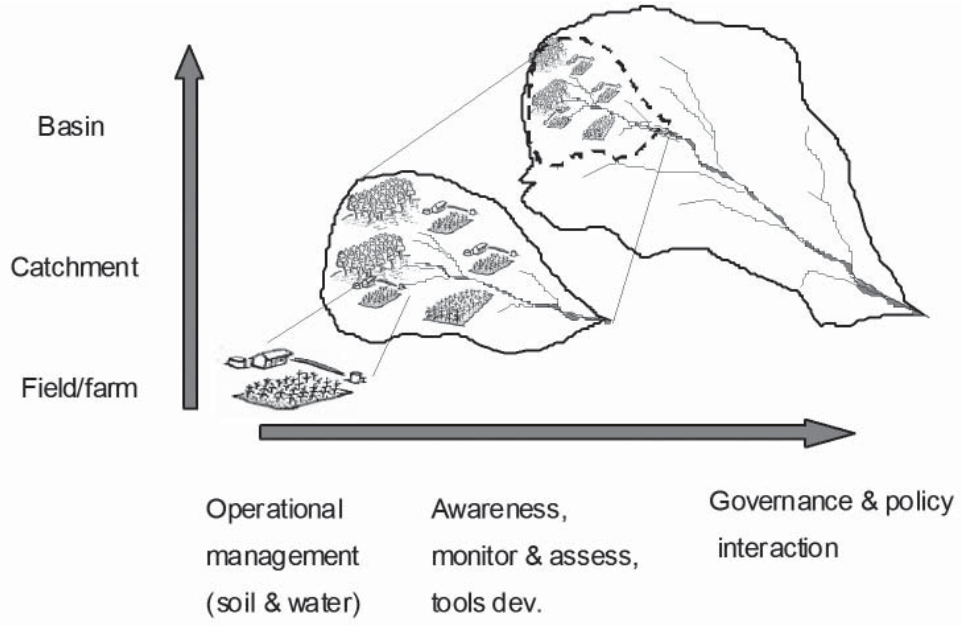


Figure 3. Nested approach for water governance at river basin scale

Communities in and around the scheme area through their engagement with WWF and Department of Irrigation were influenced to dig pan dams for water storage and use during the dry period so as to let the river flow. One requirement for getting a water permit is to have 90 day water storage on the farm. The irrigation department in partnership with WWF and the fisheries department provided training and sensitisation for the communities within the Lari-Wendani to develop water pan dams on their individual farms then stocking them with Tilapia and cat fish (Picture 2). As an incentive to the farmers the fisheries department integrated fish farming into the activity providing additional income to the farmers. During the rainy season between April and September the farmers can harvest storm flow and stock fish. At the end of the period farmers harvest can fish and use the stored nutrient rich water for irrigation during the dry season (October to March) without interfering with the river.

One key lesson that has been learnt is that a community-based approach is effective in developing appropriate adaptive strategies especially for vulnerable communities.

This adaptive strategy by the local communities has had positive consequences for the community and the environment. As a result of this intervention, the Waseges River flowed continuously in August 2007 reaching the Lake Bogoria (Picture 3). One key lesson that has been learnt is that a community-based approach is effective in developing appropriate adaptive strategies especially for vulnerable communities. WWF is therefore working very closely with the local communities within the Lake Bogoria Catchment on issues related to irrigated agriculture and the new National Water Resources

Picture 2. Releasing fish into a pan dam (*Courtesy WWF-EARPO/Musonda Mumba*)

Picture 3. Waseges River flowing continuously after 10 years during the dry season— August 2007 (*Courtesy WWF-EARPO/Musonda Mumba*)

Management Strategy (2007-2009) which clearly indicates the need for reserve water within river courses. This refers to the quantity and quality of water needed to meet both basic human and ecosystem needs. The strategy also emphasises that the reserve needs to be met before water is allocated for other uses.

Why adaptation is important: recommendations and way forward

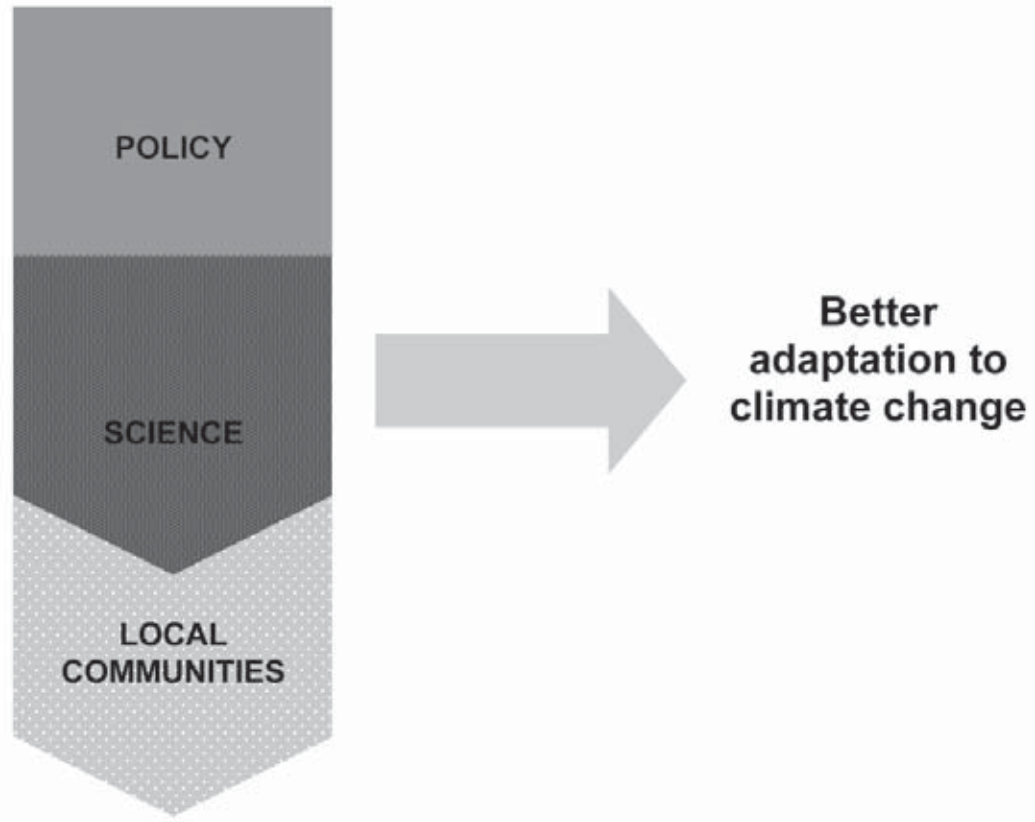
This case study takes cognizance of the fact that adaptation is necessary particular within water scarce areas where communities are likely to be most vulnerable. Furthermore it is clear that the local communities need the right and appropriate information about how they should adapt. WWF and the different stakeholders have served as change agents within this catchment, which is an essential element to adaptation. WWF's approach to environmental sustainability has been to advocate Integrated Water Resources Management (IWRM) mechanism within this catchment. Both the water and agricultural sectors are climate sensitive and this case study illustrates the need to mainstream climate change adaptation policies into these sectors, something that is still lacking.

Information about similar case studies within Kenya has not been forthcoming or known. It is particularly important for both environmental and developmental NGOs and civil society groups to share lessons about community based adaptation. Once such lessons are shared and known, it would be easier to influence governments about the necessary policy changes as regards climate change adaptation.

It is particularly important for both environmental and developmental NGOs and civil society groups to share lessons about community based adaptation. Once such lessons are shared and known, it would be easier to influence governments about the necessary policy changes as regards climate change adaptation.

Finally figure 4 below illustrates the importance of linkages between policy, science and local communities. National and international policy structures are important in supporting community adaptation to climate. These can be supported by the best available science and knowledge structures however local communities also need to be linked to such structures.[4]

Figure 4. Making linkages between Policy, Science and Local community engagement in climate change adaptation.



Musonda Mumba (mmumba@wwfearpo.org) is currently the Regional Freshwater Programme Coordinator for WWF—Eastern Africa Regional Programme Office (WWF-EARPO), based in Nairobi, Kenya. She has been involved in wetland conservation, water resources management and ecological research for over 10 years and is also working on climate change adaptation in the region. In February 2008 she was part of an expedition that climbed Rwenzori Mountain to see the impacts of climate change on the glaciers and consequently water resources in the region.

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Climate change and forests

Climate change, energy and biodiversity conservation in Bolivia— roles, dynamics and policy responses

Bernardo Peredo-Videa

Abstract. Biodiversity conservation is an economic, environmental and social process. It is also a political and cultural process in developing nations, characterised by being the richest regions in biodiversity but also the poorest economically. Paradoxically, whilst biodiversity provide socio-economic and environmental benefits, ecosystem degradation has increased. Discussions on the responsibilities of developing countries in climate change and the emerging roles in carbon offsetting and energy change for tropical developing nations are becoming part of policy responses in this regard. Furthermore, conceptions of energy development as part of existing economic policies and the potential opportunities arising from climate change have been considered as trade-offs to obtain economic and environmental benefits. The paper examines the role and dynamics of energy and deforestation and its relationship with climate change and conservation in Bolivia. It also identifies the policy implications and challenges in the existing climate change processes by providing up-to-date empirical evidence and analysis of the responses of the Bolivian government to climate change, energy policies and biodiversity conservation.

Resumen. La conservación de la biodiversidad es un proceso económico, social y ambiental. Es asimismo, un proceso político y cultural en países en desarrollo particularmente, caracterizados por ser regiones ricas en biodiversidad con importantes índices de pobreza. Paradójicamente, a pesar que la biodiversidad provee beneficios socioeconómicos y ambientales, la degradación de ecosistemas continúa inalterable. Discusiones sobre las responsabilidades de países desarrollo en cambio climático y los roles emergentes de sumideros de carbono y cambios energéticos en países tropicales, comienzan a formar parte de análisis en esta temática. De la misma manera, se consideran concepciones sobre desarrollo energético y oportunidades potenciales en el marco de cambio climático que puedan obtener beneficios económicos y ambientales. El presente artículo examina el rol y dinámicas existentes sobre deforestación, energía y su relación con cambio climático y conservación en Bolivia. Asimismo, identifica las implicaciones y desafíos de políticas en el escenario actual de cambio climático mediante análisis empírico de las respuestas del gobierno boliviano en políticas energéticas, cambio climático y conservación.

Introduction

Evidence produced in several studies since the early 1990s suggests that large-scale conversion of tropical forests into pastures or annual crops could lead to changes in the climate. Thus, it has been documented that land-use change impacts regional and global climate through the surface-energy budget as well as through the carbon cycle.[1] As well as influencing local long-term weather conditions, regional-scale land-cover change can impact on the global climate system besides energy emissions of greenhouse gases (GHGs). These aspects of human influence on climate were not accounted for under the Kyoto Protocol. The neglect of land-use effects lead to inaccurate quantification of contributions to climate change.[2]

The role of tropical forests may be significant in this process. Apart from their role as reservoirs, sinks and sources of carbon, tropical forests provide numerous additional ecosystem services. Many of the ecosystem services directly or indirectly influence climate, including the maintenance of elevated soil moisture and surface air humidity, reduced sunlight penetration, weaker near-surface winds and the inhibition of anaerobic soil conditions. Such an environment maintains the productivity of tropical ecosystems.[3]

Deforestation in Amazonia is progressing rapidly, with estimations by several authors suggesting that if deforestation were to continue at the present rate, a significant reduction of Amazonian tropical forests would occur in less than 100 years. Such rapid deforestation is clearly contributing to regional CO_2 emissions. Although, it is considered that deforestation and tropical forests fires contribute globally to about 20 per cent of total CO_2 emissions, the major impact is related to the rapid loss of forest ecosystems and biodiversity.

Academic and policy literature has directly linked deforestation rates with structural adjustment programmes (SAP) implemented in many South American countries, which promoted the expansion of timber and soy exports. In the case of Bolivia, deforestation has increased dramatically since the mid 1990s, particularly because Bolivia was amongst the first Latin American countries to initiate a far-reaching and relatively orthodox SAP, which greatly contributes to forest clearing for soybean exports and to higher timber exports.[4]

Bolivia: biodiversity conservation and deforestation

Bolivia is a landlocked country comprising an area of 1,098,581 km^2, which encompasses a range of different eco-regions. In contrast to what is common assumption, a large portion of the country is covered by forest vegetation. The country's total forest area is 534,000 km^2 which represents 48.60 per cent of the total surface. More than 80 per cent of the forest occurs in the Bolivian lowlands, the remaining 20 per cent is spread out in the highlands and the inter-Andean valleys.

In the lowland forests, four major zones have been identified: i) the humid and evergreen forest of the Amazonian located in northern Bolivia; ii) the Beni plains, characterised by natural savannas and small patches of gallery forests, much of which are seasonally flooded; iii) the Chiquitania region, whose semi-deciduous forests are typical of slightly drier areas; and iv) the semi-arid Chaco region, with lower and less productive forests adapted to dry climates.[5]

In terms of conservation efforts, protected areas in Bolivia play a role not only in conservation but in the support of local livelihoods and social participation as well. The Bolivian government estimates that around 60,000 people live inside protected areas and some 200,000 people live in surrounding areas. Consequently, involving local communities in national park affairs and the promises of development benefits has helped increase interest in conservation.

The National Service of Protected Areas developed the framework of "Parks with People" in 2005, considering the importance and role of protected areas for sustainable livelihoods, poverty alleviation and sustainable development in rural areas, including a significant role on ecosystem services provision.[6] As part of this process, which is currently evolving into a national policy of shared management under the new government administration, not only national areas were represented in the national system of protected areas, but municipal protected areas and neighbouring declared indigenous territories are also seen as areas for biodiversity conservation. The percentage of national territory covered by protected areas in Bolivia has thus increased in the last decade, to approximately 19 per cent of the total surface with representation of all the country's ecosystems (see figure 1).[7]

Nevertheless, several national parks are still constrained in enforcing conservation measures and there remain conflicts regarding access to natural resources, including minerals, hydrocarbons, timber, wildlife and land resources. Therefore, the institution in charge of safeguarding biological diversity in Bolivia is in permanent conflict.

Up until the late 1980s, deforestation rates in Bolivia were among the lowest in Latin America, based on key determinants which included a weak domestic demand for agricultural products and lack of infrastructure.[8] However, two national inventories of forest resources concluded that deforestation increased dramatically during the 1990s especially after the implementation of the structural reforms during the same decade.[9]

In this context, Camacho estimated that more than three million hectares of lowland forests in Bolivia have been cleared, with 1.4 million hectares (46.7 per cent) deforested in the department of Santa Cruz between 1993 and 2000. Consequently, deforestation rates have quadrupled during this time following the structural reforms and policies introduced in 1993. These estimates led to several proposals and studies suggesting that structural adjustment has contributed to increase

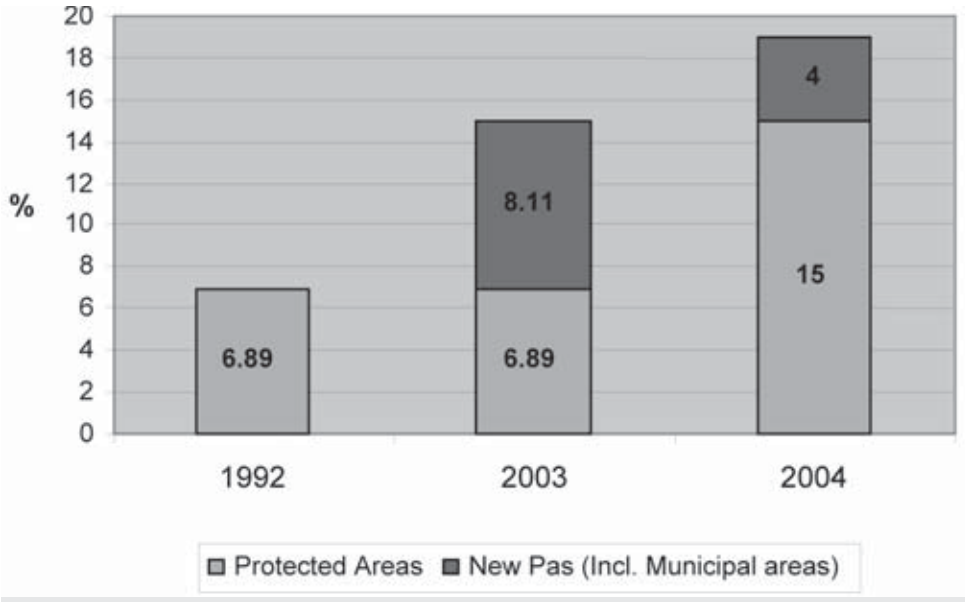

Figure 1. Percentage of territory covered by protected areas in Bolivia

More than three million hectares of lowland forests in Bolivia have been cleared.

deforestation rates for soy and timber exports, by applying economic instruments and policies that removed price controls on soybeans, devalued the Bolivian currency, promoted investments in physical infrastructure such as roads and telecommunications, and introduced tax breaks and fiscal incentives for exporters.[10] Studies argue that the increasing deforestation rates in Bolivia as a whole are indicative of the general weakness of the government in the forestry and environmental sectors. Moreover, municipal governments have been largely ineffective in preventing deforestation.[11] These reasons are also encapsulated in the notion that structural adjustment reduced the role and capacities of the government.

In national terms, deforestation increased from an average of 152,000 hectares per year in the period 1985-1993 to approximately 300,000 hectares per year in 2006 (see figure 2).[12]

CO_2 emissions in Bolivia: the role of deforestation and energy

The second national report on the accomplishment of the Millennium Development Goals in Bolivia estimated that national emissions of CO_2 were 62.614 Gg. for 2002. The official inventories on the emissions source of GHGs indicate that the dominant sector in the emission of CO_2 is land-use change.[13] In this sense, the widespread practice of slash-and-burn and the conversion of land for agro-industry and cattle-stock eliminate vegetation and burn of biomass, which represent the major cause for deforestation, biodiversity loss and CO_2 emissions.

Accordingly, these emissions are distributed in three main sectors. Around 89 per cent of CO_2 emissions are based on land-use change, followed by 10.5 per cent of emissions related to the energy sector and only 0.46 per cent to the industrial process produced by cement factories.[14] It is clear the differences between the first and second sources of emissions in the country.

Around 89 per cent of CO_2 emissions are based on land-use change

Available data on CO_2 emissions as a result of slash-and-burn practices shows a discrepancy between the official data provided by the National Programme of Climate change and those provided by San Andres University (UMSA). The official estimations by the NPCC were 0.044 GT of CO_2 for 1998,[15] while the emissions estimated by the university shows 0.36 GT of CO_2.[16] These scenarios were based in the vulnerability assessment of ecosystems undertaken by the National Programme of Climate Change and supported by different models accepted internationally, such as UKHI, HADCM2, GISSEQ, MAGICC, and the meteorological data available for the country.[17]

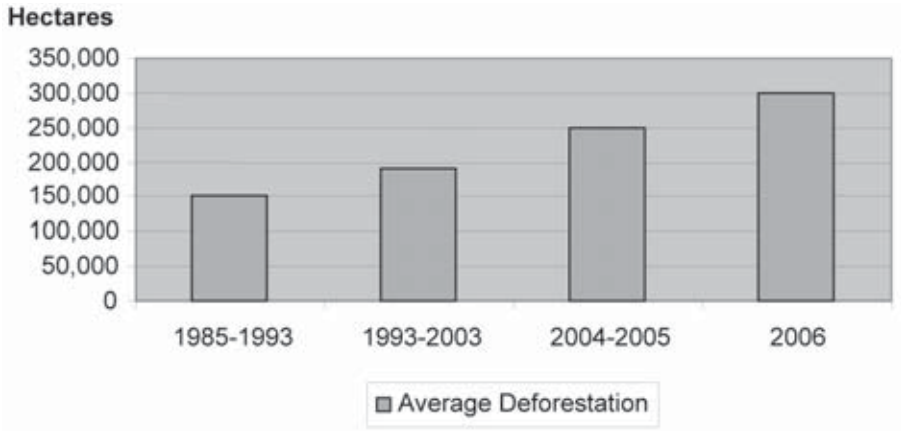

Figure 2. Evolution of Deforestation Rates in Bolivia 1985 - 2006

Such a high share of emissions from land use changes and deforestation are second only to Indonesia and are of a similar value to Malaysia (see table 1).[18] Bolivia and many other Latin American countries are currently undergoing an economic and development transformation, including a steep upward trend of GHG emissions, primarily as a result of deforestation and in lesser degree energy.[19]

Table 1. LULUCF Emissions as share of total GHG emission

Argentina	19%
Bolivia	82%
Brazil	69%
Indonesia	86%
Malaysia	82%
Mexico	16%

In terms of the energy sector, which represents the second source of emission although is of little comparison to deforestation, the Clean Development Office has been developing a project portfolio, which aims to achieve emission reductions of 5,811,046 tons of CO_2, in seven years under a CDM framework.[20]

It is clear that the highest CO_2 emissions in Bolivia are directly related to deforestation and slash-and-burn practices both in forests and savannas in the lowlands region, which are annually undertaken in order to expand the agricultural frontier for cultivation and cattle ranching. Nevertheless, these CO_2 emissions in the country are relatively low compared to other regions on a per capita basis. In Bolivia, they reach only 1.4 TM per capita, while in Latin-American and the Caribbean as a whole these carbon emissions reached 2.5 MT. In contrast, emissions in the United States are about 19.7 TM per capita.[21] Overall in Bolivia, GHGs emissions in terms of CO_2 are only 0.097 per cent of total global emissions.[22] These differences are considered as a major source of inequality (as illustrated in figure 3) and according to several interviews with former and current policy-makers, there is the perception that climate change has been produced by developed economies, and that these countries should be responsible for adopting mitigation, adaptation and compensation measures.

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These perceptions were enhanced after the unfortunate flooding of January and February 2008, in which more than 47 municipalities were affected, particularly in the Amazonian department of Beni. The floods caused left more than 50 people dead and affected over 45,000 people. Although this event is not directly linked to climate change, there is the perception that there is an increasing role which provokes traditional events to have more severe impacts

Bolivia is a country with high vulnerability to climate change for several reasons: the population density in fragile mountain ecosystems, the expansion of arid zones, the existence of several regions exposed to periodical flooding, particularly in lowlands and the valleys, and the increasing deforestation rate and high poverty levels.[23] Thus in terms

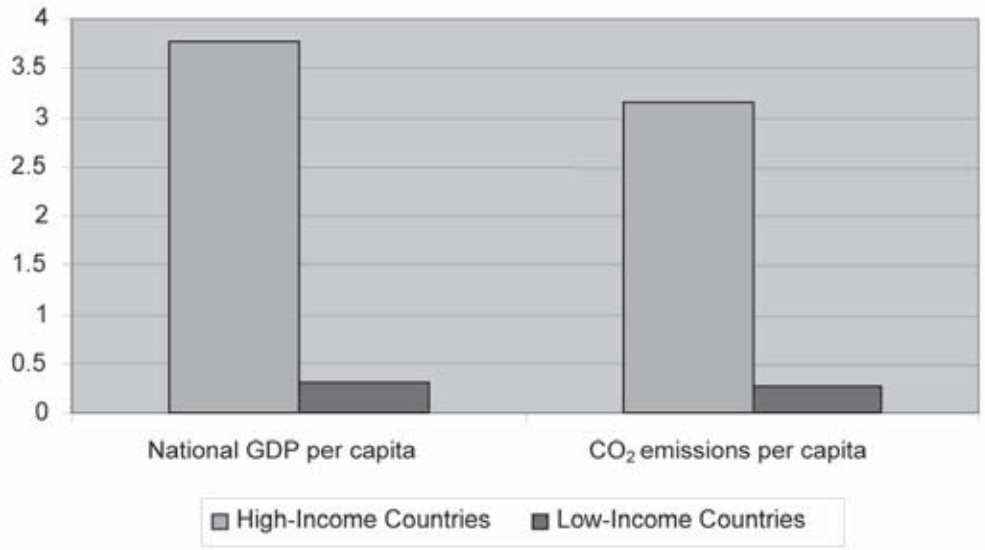

Figure 3. Links between per capita GDP and CO_2 in high and low income countries

of climate change, there is the wide perception that although Bolivia is not a country producing carbon emissions, the impacts of climate change will be severely suffered throughout the country. Climate alterations have already brought droughts in the Andean region, glaciers retraction in the Bolivian highlands and flooding in lowlands and the Amazon. For example, maximum temperature increases are predicted to occur in the high mountains of all Andean countries. If the models are correct, the changes will have important consequences for mountain glaciers and for communities that rely on glacier-fed water supplies.[24] Furthermore, the minimal infrastructure for natural disasters poses additional challenges.

Studies along the Tropical Andes indicate a temperature increase of 0.11°C/decade, compared with the global average of 0.06°C/decade between 1939 and 1998. Eight of the twelve warmest years were recorded in the last 16 years of this period. High-altitude mountain regions are then strongly affected by rising temperatures, as ice masses are declining rapidly.[25]

If water-resource buffers shrink further and some watersheds disappear completely, alternative water supplies may become very expensive or impractical in the face of increased demand as population and per-capita consumption rise. Furthermore, as water resources are affected by reductions in seasonal runoff in Andean countries, where hydropower is the major source of energy for electricity generation, there would be the need to shift to other energy sources, resulting in higher costs and most probably, an increased reliance on fossil fuels.[26]

Policy responses and perspectives

Bolivia has ratified the Kyoto Protocol through the enactment of Law 1988 of July 22, 1999. This ratification was conditioned according to the principles of sustainable development, as the country had a specific policy and mandate to achieve sustainable development. One of the reasons for this ratification, behind the broad ratification made by most countries, was the interest in accessing incentives and economic benefits around clean development mechanisms (CDM).

Initially a proposal for a Carbon Law was presented by the National Programme of Climate Change, which promoted the creation and development of a series of mechanisms for the certification of initiatives in terms of carbon sequestration and emissions avoidance. After several consultation

workshops, it was considered that there was only a very remote possibility to establish a carbon market, given the lack of suitable role models. However, in June 2005, Supreme Decree 28218 was enacted, declaring the implementation of projects and activities for climate change mitigation in forestry and energy sector as a national priority, in order to apply to CDM and other trade emissions schemes.[27] This Decree shows the importance of projects and activities and the interest of policy-makers in these schemes as a way of generating short and long-term income.

Climate change mitigation in both sectors in this legal framework included the following areas: forestation and afforestation, fossil fuels substitution using natural gas, natural gas supply for residential, commercial and industrial consumption, renewable energies, energy efficiency, biogas, the efficient use of biomass and other project that reduce, capture, store and avoid greenhouse gases emissions.

In December 2005, the historic election of Evo Morales and his Movement towards Socialism party (*Movimiento Al Socialismo* in Spanish) with more than 54 per cent of the votes, initiated a series of reforms and different visions on natural resources particularly, under the so-called process of change. These reforms involve a series of structural changes based on the elimination of the neoliberal era, both politically and economically, and the dismissal of sustainable development as a national policy.

These reforms include the active participation by the State both for primary production and for industrialisation in order to improve life conditions of the Bolivia population, particularly indigenous communities. The principles aim to re-establish the balance between nature conservation and economic needs for national development, under the concept of "Living Well". Under this framework, the current administration aims to strengthen the regulatory participation and promotion of the State for the exploitation of natural resources towards guaranteeing sustainable management of natural resources and a fair distribution of benefits resulting in that use, as well as changing the energy matrix. The government thus considers it necessary to consolidate the ownership by the State over natural resources and genetic variability. Through this vision, natural resources will not be able to become subjects of commercial exploitation. Hence, national policies are focused under the implementation of a holistic vision that takes from nature what is needed for the development of the country, but, at the same time, protecting it.[28]

Bolivia's forests and their resources, therefore, are considered as a property of the State, where the State commands and controls forestry resources, even in these forests are located in private lands or are part of concessions to private actors, designated for management, use and exploitation. The National Development Plan presented by the government in 2006 is the major instrument of public policy that would lead the way to this process of change.

In terms of climate change, interest in carbon sequestration has increased based on the results of the Climate Action Project conducted over the last ten years in the Noel Kempff Mercado National Park, which is located in the department of Santa Cruz. The project has generated more than one million tons of CO_2 in certified carbon credits. The possible development of markets and market-based mechanisms for

Picture 1. Land conversion in August 2007 in Santa Cruz.
(*Courtesy Bernardo and Ariadne Peredo*)

ecosystem services sold as commodities, has however been opposed as due to its clearly neoliberal approach. Nonetheless, according to the National Development Plan (NDP), carbon sequestration and certified emissions reduction (CERs) of GHGs represent an important opportunity for income generation at a national level. The policy sees the State participating as the owner of natural resources in the generation of economic surplus through certification, international negotiation, sale and fair distribution of benefits produced by the commercialisation of carbon bonds in international markets. Three programmes have been proposed to implement this strategy:

a. CERs, carbon sequestration and conservation towards the promotion of clean development strategies and mechanisms for international markets: aiming at generating higher income for the country and local communities based on a fair distribution of benefits. This programme promotes investments of CDMs and other relevant schemes.

The main implementation project is related to forestation and reforestation of 10,000 ha in tropical valleys in the department of Cochabamba aiming at sequestering CO_2 through production of vegetal biomass in forestry plantations and community agro-forestry systems in a 30-year period. The government aims to commercialise CERs from this project, as well as achieving the rehabilitation of degraded lands in this region through the integration of native ecosystems with appropriate forestry and agro-forestry systems, which are incorporated to local traditions and uses. Carbon sequestration and potential income generated by the commercialisation of environmental services represent an important incentive for local communities. Accordingly, effective and permanent participation of local communities, municipalities, national authorities and the private sector has been considered as a key factor in this process.

The participation of the private sector has been restricted because of changes introduced by the government and an unfavourable investment climate, which has resulted in the lowest private and foreign direct investment rates in the country for 20 years.

b. National Programme of Carbon Sequestration: according to the NDP, this programme aims to reduce deforestation rates in protected areas and its buffer zones, which are threatened by human intervention by avoiding illegal logging in protected areas and surrounding buffer zones. It aims to promote the certification, negotiation and commercialisation of carbon credits based on the experience of the Climate Action Project in the Noel Kempff Mercado National

Park. This project has duration from 1997 to 2025 and it is estimated that it will produce CERs for more than 990 t CO_2 during the project cycle life.[29]

The project includes the participation of local communities and has two key components: i) To stop industrial timber harvesting, avoiding further timber extraction and damage to vegetation, and ii) Stop slash-and-burn agriculture through community development programmes. It is expected that similar schemes will be created and replicated in other protected areas based on regional and local projects.

c. Transformation and Change of the Energetic Matrix for CERs: this programme is based on the proposal to change the energy matrix and energy efficiency to obtain CERs through the implementation of related projects. This is in-line with government proposals to strengthening the domestic demand of energy for social benefit.

This policy framework was supported and strengthened by the participatory development of an official proposal on climate change presented in September 2006 by the National Programme on Climate Change. This proposal was prepared and discussed with the participation of more than twenty institutions, including the academia, national agencies and municipal governments, as well as NGOs and local organisations from the forestry, environmental and climate change sectors. The proposal, which was coordinated with other developing countries, was presented in Rome in September 2006 and acknowledges and promotes the clear need to include avoided deforestation as a recognised mechanism for emissions reduction. The policy was developed because of the lack of an international agreement taking place under the Kyoto Protocol to address this important source of carbon emissions and any valid alternatives to tackle these causes that will provide social and economic benefits for tropical countries in particular. A key factor in terms of policy responses is that there are few specific policies (outside of protected areas) and measures in the NDP and other sector-related policies in order to reduce deforestation, particularly in the Bolivian lowlands and the Amazon.

Despite the significant potential in the forestry sectors, Bolivia could also offer a variety of mitigation options in the energy sector (for residential, commercial, industrial and transportation sectors). Even considering that gas fired plants and hydroelectricity produce a major part of electricity in Bolivia, a potential for GHG emissions reduction also exists in power generation sector. Switching from diesel and gasoline to compressed natural gas, especially as part of the official policy of the current administration to prioritise domestic use and demand of natural gas, also presents an interesting mitigation option in the Bolivian transport sector, which has great potential of GHG emissions reduction.

There also exists an interesting hydroelectric potential not yet developed in the country, as well as wind and solar energy. Mitigation options exist particularly in rural areas where dispersed populations are not connected to the grid and electricity is usually and commonly produced by diesel power generators, particularly in the Bolivian Amazon, which could be replaced by small hydroelectric plants. However, current policies in terms of hydroelectricity still focus on old-fashioned megaprojects, instead of providing the appropriate support and investment for small and mini plants that would cause less environmental impacts, while

producing social benefits and opportunities for CDM projects. This is the case of the San Miguel del Bala hydroelectric dam, located in the northern part of La Paz, in the Madidi National Park buffer zone. This project was initially conceived in the late 1950s, reconsidered and rejected in the decade of 1990s, and officially supported again by the current administration through the enactment of the Supreme Decree No. 29191 of July 2007.

Recent responses which may prove helpful in the short term to mitigate the impacts if climate change include the National Programme on Climate Change of the Bolivian Government project initiated in April 2008. This agreed the construction of 40 water reservoirs in rural areas of the Bolivian highlands, located in the departments of La Paz, Cochabamba, Tarija and Oruro. These measures are a clear response to water shortages for rural communities and are the first initiatives based on the approval of a National Adaptation Mechanism, representing important step forward in terms of climate change actions.

Future action

Around 97.7 per cent of Bolivia CO_2 abatement potential, which is equivalent to 903 million tons of CO_2, according to the national strategy study prepared in 2001 for the participation of Bolivia in the CDM, is related to changes of policy in relation to deforestation and slash-and-burn practices. This study identifies a mitigation potential for land use, land-use change and in forestry projects of 73.5 million tons of CO_2 per year in average, whilst the average potential in the energy sector is 1.8 million tons of CO_2 per year, even taking into CO_2 conservative assumptions for both of these estimations.

Avoided deforestation is of critical significance particularly following the recent outcomes of the United Nations Climate Change Conference in Bali, given the decision to encourage governments to take actions to reduce emissions from deforestation, and the agreement to consider how to reward those countries who take immediate action. With this encouragement, tropical-forest governments could feel confident that efforts undertaken now could build the institutional and technical capacity needed. In addition, it was also considered to efforts which not only reduce emissions from deforestation and degradation, but options to encourage the maintenance of carbon stocks found in countries with large intact tropical forests, such in the case of Bolivia, in order to prevent future emissions. It is further expected that under these recent outcomes, the consideration of the role of indigenous and local communities will be moved forward to ensure that forest-dependant communities and those most directly connected to forests are not negatively impacted or undermined.

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Three key areas would push the climate change agenda forward locally: economics, the media and political issues. In terms of economics, there is interest not only in the costs and impact of climate change but the opportunities for income generation through CDM schemes, and more significantly,

by implementing avoiding deforestation and similar proposals. The media has given major coverage nationally and internationally since the release of *An Inconvenient Truth* and, currently, climate change is an unavoidable subject on the news. Therefore, there is ground for political support based on this increasing interest in both areas. In Bolivia, political interest is framed under the policy framework which recognises the importance of climate change for future negative impacts and also, for the potential opportunities for income generation. Put together these three areas can help develop the policies and practices outlined here to avoid increased deforestation and thus reduce CO_2 emissions and the continued loss of habitat and biodiversity. Otherwise, deforestation rates may increase and will undoubtedly continue to represent the major source of CO_2 emissions with significant values at the national level unless avoided deforestation or other similar schemes are put practically and realistically in place.

Three key areas would push the climate change agenda forward locally: economics, the media and political issues.

Bernardo Peredo-Videa (bernardo.peredov@green.ox.ac.uk) is a Doctoral Candidate at the Oxford University Centre for the Environment (OUCE) and Consultant to CIFOR. He has been a consultant for the United Nations Development Program, the Canadian International Development Agency, Conservation International, the IFAD's Regional Programme in Support of Indigenous Peoples of the Amazon Basin, the Swiss Intercooperation, Fauna Australis at the Catholic University of Chile, and various national Bolivian organisations and government agencies. He is currently working in environmental governance and political ecology in Bolivia and South America.

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A Mediterranean response to climate change

Nora Berrahmouni

Abstract. In April 2008, professionals and practitioners met to discuss the impacts of climate change on Mediterranean forests— a global centre of biological diversity. The workshop entitled 'Adaptation to Climate Change in Mediterranean Forest Conservation and Management', was held by IUCN and WWF and organised by Nora Berrahmouni of WWF. The meeting focussed on the need for adaptation opportunities and options to enhance their social and environmental resilience. The resulting statement, reproduced here, is a concise summary of some key elements needed in addressing climate change in the Mediterranean.

Introduction

From 14 to 16 April 2008, Mediterranean experts, scientists, NGOs, conservationists, governmental officials and international organisations met in Athens, Greece to discuss issues related to the impacts of climate change on Mediterranean forests adding to the already ongoing threats and challenges impacting these ecosystems and the people depending on them, and to search for adaptation opportunities and options to enhance their social and environmental resilience

Statement

Mediterranean forests, woodlands and scrub, situated in a transitional zone between the European, African and Asian continents, are one of the planet's centres of biological diversity and are linked to outstanding cultural features. The Mediterranean vegetation includes 25,000 floral species, representing 10 per cent of the world's flowering plants on just over 1.6 per cent of the Earth's surface. It is also the second world leader in plant endemism, with an estimated 50 per cent (13,000) of these species found nowhere else on Earth. Species' groups with a Pan-European distribution, such as fir, beech, pine and oak have the highest species diversity in the Mediterranean region, and the Mediterranean populations are often the most variable ones in terms of genetic diversity. Furthermore, Mediterranean forests also host an amazing faunal diversity, especially when is expressed by the ratio between species richness and area.

Picture 1. Loss of tree cover in Mediterranean regions has contriubuted to soil erosion and flash flooding; studies have shown the economic benefits of restoration (*Courtesy Mark Aldrich, WWF*)

Forests provide vital environmental services— soil, water catchment, timber, food and medicine, stabilisation of urban microclimates, recreation, etc.— on which society depends. This is extremely significant in extreme environments like the Mediterranean climate, where water

Climate change could eventually overstretch the resilience and adaptive capacity of the Mediterranean forest ecosystems.

shortage constitute the main limiting factor and its irregular distribution can easily activate soil erosion and water run-off if forest cover is loss.

Rapid and abrupt land-use changes, mainly due to development pressures and urban sprawl, habitat fragmentation, resource overexploitation and poor management, are the main drivers of Mediterranean forests degradation. Climate change adds to these pressures, mainly through an increased incidence of heat waves, droughts and overall temperature rise, and could eventually overstretch the resilience and adaptive capacity of the Mediterranean forest ecosystems.

Recognising that:

- climate change is occurring and that it is exacerbating the already existing pressures and drivers for forest loss and degradation;
- forest wildfires are among the most direct and immediate consequences of climate change upon Mediterranean forests, and that climate change impacts, such as extended periods of drought, and extreme meteorological phenomena (heat waves and strong winds), combined with unsustainable land uses changes, bad management practices, lack of awareness and lack of adequate fire management strategies encourage the alarming trend of increasing the frequency, intensity and extent of fires;

Forest wildfires are among the most direct and immediate consequences of climate change upon Mediterranean forests.

- Mediterranean countries share common conservation and socio-economic development themes despite the significant disparities that are still present between the shores of the Mediterranean sea in terms of per capita gross domestic product, forest area coverage and landownership structure;

Picture 2. Discussion restoration issues on a WWF forest landscape restoration study tour in Spain and Portugal (*Courtesy Mark Aldrich, WWF*)

- despite the efforts deployed, Mediterranean forest ecosystems present a level of degradation that is still alarming, threatening the natural resources and cultural heritage therein;
- climate change compounded with "mal-adaptive" processes and inadequate land uses (*i.e.* unsustainable rapid land-use changes, rural abandonment and overexploitation of land resources) are likely to reduce the adaptability of Mediterranean forest to autonomously accommodate to climate change, and to increase the frequency and intensity of pathogens' outbreaks, dieback events, uncontrolled fires and other large-scale disturbances;
- the Mediterranean people and economies will be chiefly affected by the diminishing of forested areas, usually replaced by fire prone shrub communities, increased landscape fragmentation, which may consequently

impede migration/dispersal opportunities for a number of species at risk of extinction, and decrease of annual increments and the subsequent income from forests;

The participants:

- Urge all Mediterranean countries to mainstream fire risk reduction and climate change adaptation needs into all sectoral policies, regulations and rural/urban development plans linked with forest ecosystems, at national, regional, and EU levels
  - continue to improve the cooperation among the government, scientific community, NGOs, civil society groups and International organisations for the participatory planning and designing of *fire-smart* landscapes;
  - strengthen relations between managers of forests and rural areas and local communities, to ensure that forests are perceived as opportunities for increased livelihood and for the promotion of mechanisms for sustainable rural development, through information dissemination and public awareness;
  - support the development of participatory rural planning processes that empower land users and rural populations and provide them with resilient land uses and good practices relevant to adaptive farming habits and fuel reduction in forest landscapes;
  - raise awareness for the urgent need to adopt a new approach of "Learning to live with fire" with the aim of changing fire regimen to acceptable levels from a social, economic and environmental perspective, instead of a strict forest fire suppression strategy.
- Urge all Mediterranean countries to shift from predominantly natural catastrophes response strategies, like fire fighting, to integrated fire (or any other major disturbance) management strategies and policies, which
  - incorporate five key components: (1) research on forest fire dynamics and root causes of fires; (2) risk reduction and prevention; (3) readiness; (4) response; and (5) recovery;
  - stress the essential need to accentuate measures for the implementation of innovative fire management actions, assess the effectiveness of tools and policies relevant to fire risk reduction, prevent and control, and integrate vulnerability reduction and fire prevention as part also of wider landscapes planning tools and management practices;
  - recognise the essential role that rural people can play in fire vulnerability reduction, and the need for participatory planning processes supporting the identification and adoption of resilient land uses and landscape patterns;

Urge all Mediterranean countries to shift from predominantly natural catastrophes response strategies, like fire fighting, to integrated fire (or any other major disturbance) management strategies and policies.

- Urge all Mediterranean countries to jointly develop, assess the effectiveness, and fine-tune climate change adaptation strategies and tools through case studies
  - rethinking individual protected areas and regional and national protected areas networks, based

Picture 3. Forest fire sign in the reserve Dadia-Lefkimi and Soufli Forest Game Reserve Greece Project
(© *Michel Gunther/WWF-Canon*)

on the wider landscape scale "ecosystem approach", and securing provisions for both *in situ* persistence of unique Mediterranean reservoirs of forest diversity (genotypes, species and communities), and for the facilitation of species migration needs;

- ▷ *providing recommendations* to forest and land managers to increase forest resilience to climate change, such as the increase of diversity at all levels (genotypes and species composition in forest stands; habitat types and mosaic character of forest landscapes), changes in silvicultural practices (*i.e.* thinning for a wider spacing to improve resistance to drought conditions water shortages; longer rotation periods to increase carbon sequestration), and changes in soil management practices (*i.e.* low tillage and maintenance of permanent soil to reduce erosion rates and downstream flooding and increase water absorption and retention);
- ▷ encouraging forest managers, scientists and practitioners to actively assess and promote the economic valuation and sustainable use of forest products and services, a key step to reduce existing pressures on natural ecosystems and to increase the capacity of ecological and social systems to accommodate to climate change;
- ▷ encouraging forest landscape restoration initiatives that contribute to maintain the basic ecological processes and biodiversity values, to build landscape patterns, habitats and species compositions more resilient to large scale disturbances like fire, and to provide a wide range of benefits for the society;
- ▷ promoting successful results from existing projects and initiatives aimed at increasing the resilience of Mediterranean forests and people to global change impacts and fostering their replicability and adaptation through the development of further relevant initiatives addressing the different Mediterranean ecological and socio-economic contexts.

- ▷ Express the urgent need for Mediterranean North-South cooperation at all levels to face threats, and specifically in terms of improving knowledge sharing, scientific research, developing capacities, and developing partnerships for the implementation of adequate climate change adaptation processes in terms of conservation of biodiversity and cultural values, and nature resource management
  - ▷ The establishment of a body of experts of Mediterranean countries is suggested for regularly meeting to study and evaluate the changes and their expected impacts which may affect Mediterranean ecosystems and rural societies at large and

develop and propose measures and policies;

- The scientific community should commit to make the knowledge and science easily accessible to people and decision makers, and work together with communicators and other relevant actors to facilitate the use of a common language, economic valuations, case studies and visual tools;
- All practitioners should commit themselves to exchange information, experiences and expertise, and work together through regional networks with a balanced "north-south" approach, to promote concrete initiatives on research and monitoring as well as activities aimed at building capacity at all levels;
- A culture of continuous training, development of know-how and exchange of experiences is essential to have skilled land users participating in vulnerability reduction and fire prevention actions and integrating them in their management practices, to create modern, equipped and specialised forest fire-fighting units fully operational, and to secure effective co-ordination systems involving public authorities, land managers, scientific institutions and fire-fighting units;
- Engaging the private sector as partners in conservation, management and restoration work is essential;
- The international organisations of the Mediterranean region such as IUCN, WWF, FAO, UNDP, including the various national and international networks, should commit themselves to increase collaboration on Mediterranean forests and climate change adaptation, in order to ensure an important representation of Mediterranean forests in international environmental policy and fora;
- Regional countries should urgently position forest conservation and sustainable management to become a priority at national, regional and EU level, and develop powerful tools to raise awareness and educate societies on the services that Mediterranean forest ecosystems provide.

Increase collaboration on Mediterranean forests and climate change adaptation, in order to ensure an important representation of Mediterranean forests in international environmental policy and fora.

The participants, furthermore:

- Recognise the important role that Mediterranean countries play in ensuring the presence of highly trained technical and political representation to the international negotiations and fora that deal with forest policy issues;
- Request that governments and all relevant regional partners work together to ensure a wide distribution of the conclusions and outcomes of the meeting.

The participants recognise that this statement can only be implemented in the context of cooperation and solidarity in our region.

This statement can only be implemented in the context of cooperation and solidarity in our region.

Reduction of carbon emissions Brazil— the role of ARPA

Britaldo Silveira Soares Filho, Laura Dietzsch, Paulo Moutinho, Alerson Falieri, Hermann Rodrigues, Erika Pinto, Cláudio C. Maretti, Karen Suassuna, Carlos Alberto de Mattos Scaramuzza and Fernando Vasconcelos de Araújo

Abstarct. The Amazon Region Protected Areas programme (ARPA) is making a substantial contribution to protecting what remains of the great forests of the Brazilian Amazon. One of the many benefits of this conservation achievement is the protection of carbon stocks. This article reports research findings which indicate that the 61 protected areas supported by ARPA are preserving a forest carbon stock of about 4.6 billion tons of carbon (18 per cent of the total stock protected in the Amazon), which is almost twice the level of emissions reduction called for in the first commitment period of the Kyoto Protocol's if fully implemented.

The current and future contribution of protected areas in the Amazon and of the ARPA Programme is therefore crucial for the reduction of deforestation patterns in the Amazon and of its associated carbon emissions and for the planet's biodiversity conservation. Such efforts shall be internationally acknowledged and valued, especially within the context of international negotiations in the scope of the Convention on Biological Diversity and the United Nations Framework Convention on Climate Change.

The Brazilian Amazon forests stretches over 3.3 million km² and holds a large carbon stock of approximately 47±9 billion tons.

Introduction

What is left of the Brazilian Amazon forests stretches over 3.3 million km² and holds a large carbon stock of approximately 47±9 billion tons.[1] Nonetheless, continued deforestation is resulting in substantial emissions of carbon dioxide— in addition to loss of biological diversity and reduced ecosystem services.[2]

The total deforested area in the Amazon already amounts to 616,000 km² (15 per cent of the area)— an area twice the size of Germany. The concentration of deforestation is along a "deforestation arc", extending from northeastern Pará to the eastern region of Acre, encompassing the world's largest expanding agricultural frontier.[3] In the 1990's, annual deforestation rates were of around 17,000 km², and corresponded to average annual emissions of 200 million tons of carbon (considering that one hectare holds an average of 120 tons of carbon).[4] Over the past two years, and after a period of intense deforestation rates in the early 2000, the rates declined to approximately 13,000 km² in 2007.[5]

One of the main causes of deforestation in the Brazilian Amazon is the conversion of forests into extensive

Picture 1. Rio Negro Forest Reserve, Brazil (© *Michel Roggo/WWF-Canon*)

grazing land for cattle ranching.[6] Over 70 per cent of the deforested area of the Amazon is converted to cattle pasture, mainly with low productivity. More recently, the expansion of agribusiness and both the expectation of and the actual paving of regional of roads has been contributing to the maintenance of high deforestation rates, because infrastructure investments induce land speculation. The illegal market for land and timber, due to the government's difficulty in controlling criminal activity, further stimulates deforestation.

On the other hand, the decline of the Brazilian Amazon deforestation rates over the past three years, demonstrates that governance in the Amazon frontier has been increasing. Despite the positive influence of external factors in the reduction of deforestation, *e.g.* the decrease of international prices for soy and beef and the depreciation of the US dollar against the Brazilian Real, which makes exporting more difficult, Brazil has demonstrated greater capacity to enforce and implement conservation policies in the Amazon forest. The 148 new protected areas, equalling a total of 622,000 km², created between 2003 and 2008 is proof of government commitment to conservation.

This conservation effort could be threatened however by the growing demands for agricultural products from national and international markets. If past trends of agricultural expansion and road development persist, 40 per cent of the remaining Amazon forests may be eliminated by 2050.[7] The quantity of carbon to be released into the atmosphere during this period could reach 32±8 billion tons; which is almost equivalent to three years of global carbon dioxide (CO_2) emissions, at 2000 levels. In addition to biodiversity losses, deforestation in the Amazon may lead to major changes in the regional climate regime, such as substantial decrease in rainfall[8] and the consequent increase in forest fire frequency, which in turn contributes to larger emissions of greenhouse gas.[9] In 1998, for example, Amazon carbon emissions to the atmosphere doubled due to the widespread fires resulting from a severe drought that affected the region, caused by the El Niño phenomenon. The simultaneous advance of deforestation and global warming are likely to alter the Amazon climate significantly. Estimates point to a 20-30 per cent reduction of regional rainfall[10] and a 1.8 to 7.5°C increase of average temperatures during the dry season and of 1.6 to 6.0°C during the rainy season by 2080.[11] If the increased frequency and intensity of El Niño due to global warming is added to this scenario,[12] it is possible that the Amazon forest will enter an irreversible cycle of self-destruction.[13]

Picture 2. Cattle grazing near burnt forest in Roraima, Brazil
(© *Nigel Dickinson/WWF-Canon*)

Protected areas

One of the most promising mechanisms with which to stop massive destruction of the Amazon forest has been the creation of large blocks of protected areas. These areas have a role not only in protecting biological or forest diversity, but also in fostering social and cultural well-being by providing economic alternatives to local populations, *e.g.* through extractive reserves, sustainable development reserves and indigenous people's lands etc.[14]

The role protected areas play in halting deforestation has been assessed in several regions of the world. Generally speaking, deforestation rates within protected areas are significantly lower when compared to areas that are not protected.[15] This difference between deforestation rates within and outside protected areas is seen by some as a demonstration of their efficacy as a mechanism for the reduction of forest destruction, especially when these protected areas are properly implemented and, if possible, integrated with local social groups. Conversely, this interior versus exterior comparison has also been seen as a demonstration that the protected areas strategy can foster deforestation in other regions and induce negligence in the conservation of areas which are not protected.[16] Such statements are based on the argument that the establishment of a protected area can, at most, redistribute deforestation throughout a landscape and not decrease it in absolute values. Nonetheless, studies that quantify this effect on the redistribution of deforestation or its decrease are lacking.

The creation of protected areas in the Brazilian Amazon has played an important role in biological diversity conservation in the region and in the protection of extensive tropical forest areas. Approximately 50 per cent of the remaining Amazon forests are protected areas. The most ambitious biodiversity conservation programme related to this expansion of protected areas in the region is the Amazon Region Protected Areas Programme (ARPA), which was created by the Brazilian Government in 2003. Over a 10-year period (2003–2013), the ARPA intends to protect 500,000 km^2 of natural ecosystems, mainly forests.

Protected areas and carbon stocks

There is evidence therefore that protected areas have clear benefits for the conservation of biological diversity, but what about protected areas role in the reduction of greenhouse gas— especially carbon dioxide (CO_2) resulting from Amazon deforestation? To answer this question the partners WWF-Brazil, IPAM (Instituto de Pesquisa Ambiental da Amazônia), The Woods Hole Research Centre and UFMG (Universidade Federal de Minas Gerais) undertook an assessment of ARPA's contribution to the reduction of emissions through analyses of historical deforestation rates between 1997 and 2007 and of estimated future rates obtained from modelling deforestation scenarios for 2050.

Until 1997, most protected areas were strictly protected for nature conservation. However, since 1998 the government has recognised many indigenous people's lands and created over 300,000 km² of sustainable use areas. The carbon study thus addressed protected areas in their widest sense, looking at all protected areas (for nature conservation), indigenous people's lands and military areas. According to figures published in 2004, 43 per cent of the Brazilian Amazon is currently protected, of this, 54 per cent are indigenous people's lands and 44 per cent are strict nature protected areas.

An assessment of ARPA's contribution to the reduction of emissions through analyses of historical deforestation rates between 1997 and 2007 and of estimated future rates obtained from modelling deforestation scenarios for 2050.

The carbon study was undertaken by overlaying a map of these protected areas with historical deforestation maps from 1997 and 2007,[17] making it possible to assess deforestation both within and around protected areas. For the analysis of the region surrounding the protected areas, buffer zones of 10, 20 and 20+ km were defined so as to establish the proximal effects of the protected area. Furthermore, annual deforestation data were used to develop a Bayesian weights of evidence analysis, which calculates the *a posteriori* probabilities and the likelihood of events (deforestation), given a spatial pattern, which in this case is the presence or absence of a protected area.[18]

Results

The results show that protected areas inhibit deforestation. Accumulated deforestation within the areas analyzed was relatively low (1.53 per cent of the total protected area of the Brazilian Amazon), and totalled 28,000 km² from 2002 to 2007. Accumulated deforestation throughout different protected area categories were:

Protected areas inhibit deforestation.

- 2,800 km² (1 per cent of the total protected area) in strict conservation areas
- 13,100 km² (3 per cent) in sustainable use reserves
- 10,700 km² (1.1 per cent) in indigenous people's lands

This result is also confirmed by the findings that the probability of deforestation increases in areas more distant from the protected areas.

This same analysis was employed for each protected area individually, through a sampling of 255 protected areas with records of historical deforestation. In this case, the analysis focused on the contribution of each area to the relative reduction of deforestation, regardless of the increasing or decreasing deforestation trajectories for the Amazon region as a whole. For the purpose of comparison, protected areas were grouped according to four types: indigenous people's lands, strict preservation areas, sustainable use reserves and military areas. The sustainable use and strict preservation areas were separated into areas with and without ARPA support. The assessment compared deforestation rates between 2005 and 2007 with the rates between 1997 and 2004. Overall the effectiveness in reducing deforestation is similar in sustainable use areas, strict conservation areas and indigenous people's lands, whilst military areas have much lower values of relative effectiveness.

The data on the relative effectiveness of deforestation reduction in protected areas supported by the ARPA programme showed a considerable and statistically significant increase (test-t, n=105; $p<0.05$) in effectiveness of deforestation reduction in sustainable use areas supported by the programme. For the strict preservation areas, however, the difference observed was not statistically significant. The relative effectiveness of deforestation reduction in protected areas depends on their proximity to the deforestation arc.

Overall the effectiveness in reducing deforestation is similar in sustainable use areas, strict conservation areas and indigenous people's lands, whilst military areas have much lower values of relative effectiveness.

Future impacts

What role will the current expansion of the protected areas network play in curtailing further deforestation in the Amazon? As this role is still virtually unknown, the study employed a deforestation simulation model developed under the auspices of the "Amazon Scenarios Program" led by the Amazon Institute for Environmental Research (IPAM in Portuguese), The Woods Hole Research Center and the Federal University of Minas Gerais.

"Amazon Scenarios" allows the assessment of various policies, the regional economy, population mobility and infrastructure development scenarios on future Amazon deforestation.[19] The current version of this model "SimAmazonia-2" analyses how the expansion of soy,[20] cattle ranching[21] and logging[22] interact to cause deforestation. In addition, SimAmazonia-2 takes into account public policies, such as the creation and consolidation of protected areas and the implementation of the Forestry Code (Código Florestal) (Law No. 4,771, of 1965, with later amendments), for modelling future deforestation trajectories.[23]

SimAmazonia 2 models the future trajectory of deforestation in the Amazon region by considering a series of conservation measures versus the deforestation drivers. As both show growing trajectories, this conflict becomes increasingly vigorous and sensitive to the speed and timing at which public policies are implemented. In this case, deforestation is a result of the expanding agricultural market and of regional infrastructure investments.

SimAmazonia-2 was used to assess the future role of protected areas recently created (between 2002 and 2008) and areas that are expected to be created under the ARPA Programme. The impact of protected area on the future trajectory of deforestation was analyzed under two extreme scenarios:

- business as usual, *i.e.* the continued expansion of the agricultural frontier and the associated population mobility and extensive paving of roads and highways, and
- governance, *i.e.* moderate agricultural expansion and low population mobility and restricted paving of roads and highways.

In each of these scenarios all other variables were kept fixed to assess the effect of different protected area networks on the trajectory of deforestation until 2050. That is: only the extent and degree of protected areas were changed. The effect of protected areas on the trajectory of future deforestation was thus calculated by the mean value obtained from the two extreme

scenarios, and its uncertainty will be the difference between the extreme values and the mean value. An index of the level of threat by potential deforestation (level of threat corresponds to the year on which a parcel of the protected area will be deforested if it were not created and implemented: Threat = 100*(2050-year+1)/43)) was calculated. This index accounted not only for the chances of future deforestation, but also when it may occur, *i.e*. its suddenness.

The model then calculated the carbon stocks within each protected area supported by the ARPA programme and their respective emission potential if these protected areas did not exist. The figures were calculated by superposing the map of level of threat by 2050 on a map of forest's biomass[24] and assumed that 85 per cent of forest carbon is released into the atmosphere during and after deforestation.[25]

The calculations showed that the 61 protected areas that are currently supported by the ARPA Programme hold 4.6 billion tons of forest carbon; 18 per cent of forest carbon in protected areas of the Brazilian Amazon. With respect to potential emission from deforestation, the analysis on the level of threat shows that these areas have a direct potential in reducing emissions of 1.1 billion tons of carbon; *i.e.* the total released from deforestation by 2050 if they did not exist. The next step of the analysis consisted in modelling the direct and indirect impacts of the existence of protected areas in different scenarios. In other words, this analysis assessed the influence of protected areas on inhibiting deforestation both within as well as around them. By keeping unaltered the set parameters of the extreme-case scenarios and by altering the configuration of protected areas, six additional scenarios were modelled:

- areas created only until the end of 2002— this scenario works as a baseline and allows for comparisons to be made on the reduction of emissions as the protected areas network is expanded;
- by 2008 without the ARPA Programme, *i.e.* areas created until April 2008, except those areas that counted on ARPA support for their creation between 2003 and 2008 (13 protected areas);
- all protected areas created until April of 2008;
- all current protected areas plus the expansion planned for the future years according to the ARPA Programme;

The analysis on the level of threat shows that these areas have a direct potential in reducing emissions of 1.1 billion tons of carbon.

Picture 3. Aerial photograph showing burning tropical rainforest
(© *Nigel Dickinson/WWF-Canon*)

- ▷ all current protected areas, but with the complete impediment of deforestation within them, *i.e.* the maximum effectiveness in reducing deforestation;
- ▷ all current protected areas plus the expansion foreseen for the following years and with complete impediment for deforestation within them.

Therefore, the latter two scenarios represent variants of the third and fourth in which the probability of deforestation within the protected areas are adjusted to zero, thus making them 100 per cent impervious to deforestation.

Summary of results

Only the expansion of protected areas between 2002 and 2008 will allow for a 272±180,000 km^2 reduction of deforestation that could expected for 2050, which is, in other words, equivalent to a reduction of 3.3±1.1 billion tons of carbon emissions. Twelve percent of this global reduction can be attributed to the ARPA Programme, which supported the creation of 13 protected areas during this time period. Moreover, the expansion of 210,000 km^2 planned by the ARPA Programme for 2008 and 2009 could increase this reduction to 350±170,000 km^2, equivalent to 4,3±1.2 billion tons of carbon. Should all the protected areas be 100 per cent impervious to future deforestation, these reductions would reach 324±152,000 km^2 and 409±137,000 km^2 respectively, number that is equivalent to a reduction in carbon emissions of 3.9±1.3 to 4.9±1.5 billion tons of carbon.

Final assessment and recommendations

Nearly 50 per cent of remaining Amazon forests is under some type of protected area designation. Of this total, 16.8 per cent are supported by the ARPA Programme. Historically, protected areas have played a fundamental role in deforestation reduction and are, consequently, a barrier to the advancing agricultural frontier that, when uncontrolled, illegally and predatorily destroys the Amazon forest.

Protected areas not only inhibit deforestation within their lands, but also show an inhibitory effect on reducing deforestation in their surroundings.

Our empirical analysis has shown that protected areas not only inhibit deforestation within their lands, but also show an inhibitory effect on reducing deforestation in their surroundings. Notably, this inhibitory effect has been augmenting over time, as shown by the analysis of the effectiveness of protected areas in impeding deforestation, especially is the case of sustainable use areas supported by the ARPA Programme.

Mosaics, corridors or networks of protected areas play a fundamental role in conserving biological diversity, protecting habitats, maintaining hydrological regimes, as well as in the stability of regional climate. Today, the protected areas of the Brazilian Amazon hold nearly 50 per cent of the remaining

The areas supported by the ARPA Programme alone can reduce potential emissions from deforestation by 2050 of nearly 1.1 billion tons of carbon.

forest carbon stocks. The areas supported by the ARPA Programme alone can reduce potential emissions from deforestation by 2050 of nearly 1.1 billion tons of carbon. Nevertheless, the consolidation of this extensive protected area network represents a great challenge to the Brazilian nation, especially in areas located along the active deforestation front, where numerous land conflicts and other illegal activities threatens the social and natural environment. This challenge is likely to grow in the near future due to increasing demands for agricultural commodities. Thus, those areas located along the deforestation front face greater threats and present the greatest potential for carbon emissions. On the other hands, if efficiently implemented, these same areas also represent the greatest potential for the reduction of carbon emissions. For these reasons they deserve special attention from conservation investments, even though they do not fit the traditional conservation approaches that prioritise protection according to their high biological diversity and low levels of threat.

Picture 4. Aerial view of forest clearing to create grazing pasture for cattle, Juruena National Park, Brazil. (© *Zig Koch/WWF*)

In our view, the best way forward consists in encompassing both strategies. In other words, it is necessary to give priority in protecting key areas against the advance of the deforestation frontier, as well as targeting the highly representative biodiversity samples of the Amazon as a whole. In addition to continuing to expand the Amazon protected network, a substantial allocation of resources is vital to the success of this innovative conservation strategy that aims for the creation and consolidation of protected areas along regions of extreme land use dynamics.

It is necessary to give priority in protecting key areas against the advance of the deforestation frontier, as well as targeting the highly representative biodiversity samples of the Amazon as a whole.

Quantifying reductions of deforestation and associated carbon emissions through the implementation and consolidation of protected areas is an important contribution to the international debate. In the scope of the United Nations Framework Convention on Climate Change, this work brings major contribution to the decisions made by the Conference of the Parties, held in December of 2007 in Bali. The Bali Action Plan (Decision UNFCCC 1/ COP13), which addresses measures and proposals with the objective of increasing the implementation of national and international mitigation, specifically refers to the development of policy approaches and positive incentives on issues relating to reducing emissions from deforestation in developing countries. In a specific decision concerning deforestation (Decision UNFCCC 2/CP 13),

it is noted that sustainable reductions of emissions resulting from deforestation in developing countries require stable and predictable resources. It is also acknowledged that reducing emissions from deforestation in developing countries can foster multiple benefits and complement the objectives of other relevant conventions.

This huge effort towards conservation and reduction of deforestation emissions requires stable and predictable availability of resources.

The estimate of the reduction of emissions resulting from deforestation under various scenarios allow us to conclude that the strategy for the implementation and consolidation of protected areas, especially the ARPA Programme, can be classified as a demonstration activity for reducing emissions from deforestation in Brazil. As highlighted by the COP, this huge effort towards conservation and reduction of deforestation emissions requires stable and predictable availability of resources. It is imperative that the efforts made until the present moment be ensured and continued. The ARPA Programme is ready to become integrated with future formal and/or volunteer mechanism of positive incentives towards reducing emissions from deforestation.

Britaldo Silveira Soares Filho, **Alerson Falieri** and **Hermann Rodrigues** are from Universidade Federal de Minas Gerais (UFMG). **Laura Dietzsch**, **Paulo Moutinho** and **Erika Pinto** are from Instituto de Pesquisa Ambiental da Amazônia (IPAM), and **Cláudio C. Maretti**, **Karen Suassuna**, **Carlos Alberto de Mattos Scaramuzza** and **Fernando Vasconcelos de Araújo** are from WWF Brazil.

Notes

1 Saatchi *et al.*, 2007, Nepstad *et al.*, 2007.
2 Malhi *et al.*, 2008.
3 Morton *et al.*, 2006.
4 Nepstad *et al.*, 2007.
5 INPE, 2008.
6 Margulis, 2003, Alencar *et al.*, 2004.
7 Soares Filho *et al.*, 2006.
8 Sampaio *et al.*, 2007.
9 Nepstad *et al.*, 1999, Nepstad *et al.*, 2008.
10 Nobre *et al.*, 1991.
11 IPCC, 2007.
12 Nepstad *et al.*, 1999.
13 Nobre *et al.*, 1996; Nepstad *et al.* 2007, Nepstad *et al.*, 2008.
14 Naughton-Treves *et al.*, 2005; Maretti *et al.*, 2003; Maretti *et al.*, 2005; Peres, 2005; Schwartzman e Zimmerman, 2005.
15 Bruner *et al.*, 2001; Naughton-Treves *et al.*, 2005; Ferreira *et al.*, 2005; Soares-Filho *et al.*, 2006, Nepstad *et al.*, 2006.
16 Vandermeer, 1995; Cronon, 1995.
17 INPE, 2008.
18 Bonham-Carter, 1994.
19 Soares-Filho *et al.*, 2006.
20 Vera-Diaz *et al.*, 2008.
21 Merry *et al.*, in press.
22 Merry *et al.*, in press.
23 Soares *et al.*, in press.
24 Saatchi *et al.*, 2007.
25 Hougthon *et al.*, 2005.

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Climate change and policy

Emerging trends and threats of climate change—implications and amelioration strategies for sustainable protected areas management in Western Africa?

Edem A. Eniang

Abstract.Writing policy is relatively easy; implementing it can be much harder for many, especially developing, countries. This article highlights the efforts, achievements and impediments in trying to cope with the impacts of climate change in West Africa.

Using Nigeria, which shares the general socio-ecological trends of most West African nations, as an example the article attempts to draw viable conclusions and recommendations for the region as a whole. The article attempts to examine the likely effects of the climate change paradigm on human populations, socio-economics and in particular on protected areas. It concludes with a series of recommendations directed towards IUCN.

Introduction

There is currently an overwhelming literature and awareness on the global climate change paradigm and the effects of the biofuel phenomenon which portends a bleak future for developing nations' protected areas. A communiqué of the World Parks Congress (WPC) to the Convention on Biological Diversity (CBD) justifies this article, which aims to highlight efforts, achievements, impediments and paradoxes of the climate change paradigm in West Africa using Nigeria as a focal nation. The communiqué states in part:

- Biodiversity and ecosystems are essential to sustainable development.
- The CBD is an indispensable element to ensure sustainable provision of ecosystem services.
- A representative and effectively managed protected area system is crucial to achieve objectives of CBD and its 2012 targets with salient actions needed to fulfil its obligations and key elements of Millennium Development Goals (MDGs).

Environmental and socio-economic context of Africa

United Nations Environment Programme (UNEP) at its 21st session in Kenya[1] declared in its Global Environment Outlook (GEO), that Africa's ecological base was fragile and under various threats, *e.g.*, unsustainable exploitation and degradation of forests, soils, wildlife, fresh-water and other natural resources, which threaten to undermine the region's economic development prospects. It went on to show that most African economies were critically dependent on maintaining ecological integrity and many sectors of these economies were directly dependent on environmental goods and services. It maintained that the causes of Africa's environmental problems are many, complex, interrelated (*e.g.*, Africa lost 39 million hectares of tropical forest during the 1980s and another 10 million hectares by 1995), including drought, pollution, debts-burden and dwindling economies (economic growth in at least half of the region remained below 2 per cent per year, measured in GDP, while human population has grown at an average of 4 per cent per year in the last two decades).

Environmental and socio-economic context of West Africa

West African environment, socio-economics and biodiversity in the last century have been dynamic, with rapidly increasing degradation, conversion of protected areas to agricultural, and rapid urban development being just some of the threats.[2] These trends of environmental perturbations and survivalists' activities are the result of uncontrolled and rapid population growth, increasing poverty and desperation, as well as ambitious but often illegitimate economic policies and priorities of various regimes. Pursuance of livelihoods activities in parts of West Africa have led to rates of deforestation in excess of 3 per cent per year.[3]

Table 1 shows the land area and basic growth statistics for West African states as of 2004 while Table 2 shows the current forest estimates for each country. What is left of the West African natural forests and habitats are mostly within the territories of many somewhat nominal, plus a few well managed, protected areas. Most of the remaining forests estate is highly fragmented and scattered across national borders without foreseeable possibilities for natural or facilitated amalgamation.

In addition, desertification posses daunting challenge to the northern portion of West Africa. As an example, Nigeria has experienced enormous rates of desert encroachment in the last quarter of the 20th century. The semi-arid zone, which comprises the Sudano-sahelian region, is by its nature and characteristics the most susceptible sector to desertification— a phenomenon which is bound to accelerate with global warming and climate change impacts. The entire zone is particularly vulnerable to climatic and human pressures arising from rapidly increasing pursuits of biofuel, and requires urgent attention so as to ensure the semi-arid zones continue to support the socio-economic aspirations of the region where climate change phenomena are currently largely regarded as 'fairy tale'. Unfortunately, the extent and severity of desertification in West Africa has not been fully established nor the rate of its progression properly documented. Nevertheless, it is estimated that the region is currently losing more than 1.5 million hectares of its landmass to desert conditions annually.

Table 1. West Africa Basic statistics

Country	Land Area (1000 ha)	Total population (1000)	Population Density (Population/Km²)	Annual Growth Rate (%)	Per capita Income (US$)	Annual Growth Rate (%)
Benin	11,062	6,890	62.3	2.5	389	2.7
Burkina Fasso	27,360	12,387	45.3	2.3	257	3.9
Cape Verde	403	481	119,4	2.5	1328	5.5
Cote d' Ivoire	31,800	17,142	53.9	1.8	583	-2.3
Gambia	1000	1449	144.9	1.9	344	8.3
Ghana	22,754	21,053	92.5	1.8	285	5.2
Guinea	24,572	8073	32.9	2.1	433	2.6
Guinea Bissau	2812	1533	54.5	2.9	137	4.3
Liberia	9632	3449	35.8	2.2	120	2.0
Mali	122,079	11,937	9.8	2.4	260	2.2
Niger	126,670	12,095	9.6	2.8	174	0.9
Nigeria	91,077	139,824	153.5	2.4	361	3.6
Senegal	19,253	10,455	54.3	2.1	504	6.0
Sierra Leone	7162	5436	75.9	1.9	206	7.4
Togo	5439	4966	91.3	2.1	294	3.0

Table 2. Total forest area and area change of West Africa

Country	Forest Area -1000 ha	% of land area	Area per capita (ha)	Forest plantations (1000 ha)	1990-2000 (1000 ha)	2000-05 (1000 ha)
Benin	2351	21.3	0.3	-	-65	-65
Burkina Fasso	6794	29	0.5	76	-24	-24
Cape Verde	84	20.7	0.2	84	2	N.S
Cote d' Ivoire	10405	32.7	0.6	337	11	15
Gambia	471	41.7	0.3	-	2	2
Ghana	5517	24.2	0.3	-	-135	-115
Guinea	6724	27.4	0.8	33	-50	-36
Guinea Bissau	2072	73.7	1.4	-	-10	-10
Liberia	3154	32.7	0.9	-	-60	-60
Mali	12,572	10.3	1.1	-	-100	-100
Niger	1266	1	0.1	-	-62	-12
Nigeria	11,089	12.2	0.1	349	-410	-410
Senegal	8673	45	0.8	365	-45	-45
Sierra Leone	2754	38.5	0.5	-	-19	-19
Togo	386	7.1	0.1	38	-20	-20
Total W.A.	**74,312**	**14.9**	**0.3**		**-985**	**-899**
Total Africa	**635,412**	**21.4**	**0.7**		**-4375**	**-4040**

West Africa has witnessed political instability and anarchy in recent years, *e.g.*, in Cote d'Ivoire, Gambia, Liberia, Niger and Sierra Leone where millions of people have become displaced as refugees which further exacerbate pressures to threatened natural ecosystems. Ongoing conversion of wetlands by draining or in-filling negatively affects environmental values, *e.g.*, altering hydrological regimes such that they no longer provide desirable ecosystem services. Untreated effluents from domestic and industrial sources have polluted coastal wetlands for example in Lagos, Nigeria.

Furthermore, rapid population growth and urbanisation has created a number of very large cities with over-stretched infrastructures with attendant social problems. A number of West African cities straddle coastal wetlands which have been degraded by unplanned conversion and are thus currently incapable of providing the environmental services suitable for ameliorating or mitigating climate change impacts, *e.g.*, sudden increases in sea levels. West African coasts have witnessed a phenomenal invasion by alien invasive species of plants and wildlife including rodents, insects, birds and fishes. Among the notable invasive plants are Nypa palm (*Nypa fruticans*) and Water Hyacinth (*Eichornia gracipes*) which are threatening the coastal stabilisation functions of mangrove forests in Western Africa.

Location, size and biodiversity of Nigeria

Nigeria is located in West Africa, between latitudes 4°N and 14°N and longitudes 2° 2' and 14° 30' East with a total land area of 923,773 km^2 and a population of over 150 million. Nigeria is bordered by the Republics of Niger and Chad to the north and to the south by the Atlantic Ocean, whilst the east and west are bordered by the Republics of Cameroon and Benin. By virtue of its spatial extent, Nigeria has various climatic regimes and physiographical units giving rise to a variety of ecological zones. Vegetation ranges from lush forests in the south to Guinea savannahs in the middle-belt; Sudan savannah in the north and Sahelian savannah in the extreme north. Nigeria has a network of protected areas which includes a Biosphere Reserve, eight National Parks, 445 Forest Reserves, 12 Strict Nature Reserves, 28 Game Reserves and a number of yet to be gazetted Wildlife Sanctuaries. Nigerian National Parks cover approximately 2.4 million hectares with rich biodiversity. About 7,895 plant species have been identified in 338 families and 2,215 genera; 22,000 vertebrates and invertebrates species (including about 20,000 insects) have also been described. There are 1,000 birds species, 1,000 fish, 247 mammals and 123 reptiles of which 0.14 per cent are threatened and 0.22 per cent endangered.[4]

In efforts to fulfil several international conventions which she is signatory, Nigeria has established eight national parks which are managed by the Nigerian National Parks Service (NNPS). These have been strategically selected and located to represent the different ecological strata of the country, with the exception of mangrove forests. All are vulnerable to global warming, climatic change, human pressures and their associated impacts, including large-scale coastal erosion, deforestation,

Nigerian protected areas are unlikely to deliver or fulfil adequately, their ecosystem services in the light of the emerging global warming and climate change paradigm.

industrial pollution, political instability and failing infrastructures. Under such pressures and threats, Nigerian protected areas are unlikely to deliver or fulfil adequately, their ecosystem services in the light of the emerging global warming and climate change paradigm.

Since Nigeria exhibits the general socio-ecological trends of most West African nations, it can be used to draw conclusions and recommendations for West Africa as a whole. It is obvious that problems of sustainable protected area management need to be addressed in a holistic manner in order to ensure that different ecological zones continue to support human aspirations and natural resources sustainability. The following sections highlight the extent and severity of the problems and national efforts to address them; existing policies as well as proposed strategies for effective delivery of the various international environmental policy mandates arrived at separately in Rio, Kyoto, Durban and Bali with observable high points and associated paradoxes are also discussed.

Nigerian national policy on the environment

In 1989, Nigeria launched a national policy on environment which elaborates sectoral and cross-sectorial policies on control and sustainability and clearly stipulates synergies with other sectors and sub-sectors relating to population, culture, human health, settlements, biodiversity, conservation of natural resources, agriculture, water resources, forestry, wildlife and protected areas, minerals, energy, education, science and technology, and the cross-sectoral issues of public participation and synergy. Since the Earth Submit (WSSD) in Rio de Janeiro, Nigeria has made significant efforts in policy reviews to address environmental and sustainable development issues, which were identified and agreed upon at the United Nations Conference on Environment and Development (UNCED). Table 3 shows international conventions which Nigeria and other West African nations have ratified in favour of environment, biodiversity and development.

Institutional Framework

To fulfil these conventions a legal framework is needed which will ensure an enabling environment for success. In Nigeria attempts to establish this have been made and relevant legislations and laws enacted. However, the most significant of these laws in relation to environmental protection and control are the Forestry and Protected Areas Laws most of which are ineffective, outdated, ambiguous and require urgent review. Several institutional arrangements have been put in place for the management of matters relating to population, health and environment and many environmental, biodiversity conservation and intergovernmental organisations work in the country. The government has also interacted with civil society organisations such as the Biodiversity Preservation Center (BPC) and the Nigerian Conservation Foundation (NCF), among others.

However, despite the overwhelming endorsement and ratification of the majority of global environmental mandates by Nigeria and other West African governments, these endorsements have not necessarily been translated into actual implementation of key obligations. As an example, most West African governments having ratified the CBD are yet to implement several obligations contained in it including a clear understanding of objectives 2 (the sustainable use of biodiversity) and 3 (fair and equitable sharing of the benefits). This lack of implementation

Table 3. Ratification of international conventions and agreements by West African countries as at 1st January 2007

Country	CBD	UNFCC	KYOTO	CCD	CITES	Ramsar	World Heritage
Benin	Y	Y	Y	Y	Y	Y	Y
Burkina Fasso	Y	Y	Y	Y	Y	Y	Y
Cape Verde	Y	Y	Y	Y	Y	Y	Y
Cote d' Ivoire	Y	Y	N	Y	Y	Y	Y
Gambia	Y	Y	Y	Y	Y	Y	Y
Ghana	Y	Y	Y	Y	Y	Y	Y
Guinea	Y	Y	Y	Y	Y	Y	Y
Guinea Bissau	Y	Y	Y	Y	Y	Y	Y
Liberia	Y	Y	Y	Y	Y	Y	Y
Mali	Y	Y	Y	Y	Y	Y	Y
Niger	Y	Y	Y	Y	Y	Y	Y
Nigeria	Y	Y	Y	Y	Y	Y	Y
Senegal	Y	Y	Y	Y	Y	Y	Y
Sierra Leone	Y	Y	Y	Y	Y	Y	Y
Togo	Y	Y	Y	Y	Y	Y	Y

of international agreements was made clear in the case of Nigeria when, at the 55th meeting of the standing committee of CITES held at The Hague,[5] Nigeria was identified as one of the nations yet to make significant progress in developing legislative processes towards establishing national laws for implementation of CITES convention—despite ratifying the convention more than two decades ago.

This situation is largely due to a number of underlying impediments such as lack of funding, capacity for effective implementation, appropriate technology, an enabling political climate and will— *i.e.* bureaucratic "bottle necks" as well as endemic corruption. This renders the ratification of global environmental policy mandates mere ceremonial obligations that leave much to be desired, with most countries still on the "drawing board" in pursuance of crucial policy directions.

This renders the ratification of global environmental policy mandates mere ceremonial obligations that leave much to be desired.

Assessing Nigeria's drive towards mitigation and adaptation to climate change

Although implementation of international agreements has been slow, many countries have tried to realign policy directions. In responding to the challenge of global climate change shortly after UNCED, Nigerian government policy focused on protecting the atmosphere included conscious efforts aimed at: phasing out the consumption of ozone depleting substances (ODS); monitoring background atmospheric pollution and total column ozone; data bank automation; a greenhouse gas inventory;

Picture 1. Community consultation in the buffer zones of a national park (*Courtesy Nigel Dudley, Equilibrium Research*)

climate change research and training; promotion of environmentally friendly energy practices; and participation in Global and regional Earth-system (Atmosphere) Monitoring using Satellite and in-situ data project. The strategy developed aims to single out sources of gaseous emissions and maintain them at levels of full compliance by 2010. These strategies include:

- ▷ Review of existing national guidelines and standards to include vehicles, generators, aircrafts etc.
- ▷ Intensify public enlightenment campaigns at all levels on benefits of adequate maintenance, retrofitting, adopting effective technology, ensuring efficient energy use, and increased cost benefit.
- ▷ Maintain effective databases on industries and their compliance status.
- ▷ Maintain a register of technologies, vehicles, generators, and aircrafts for approval, manufacturing and importation.
- ▷ Introduce and enforce emission control certificates for vehicles, generators, and aircrafts by 1999.
- ▷ Eliminate ozone-depleting substance (ODS) consuming processes.
- ▷ Enforce laws relating to localisation of new industries.
- ▷ Install a minimum of primary treatment for all new industries.
- ▷ Build secondary central treatment facilities in all major industrial estates across Nigeria by 2005.
- ▷ Invoke the polluter pays principles.
- ▷ Ensure 100 per cent waste segregation, recycling and re-use by 1999.
- ▷ Promote research in Best Available Technology Effective for Local Adoption (BATELA).
- ▷ Make eco-labelling compulsory for all products by 2000.
- ▷ Promote commercialisation of sanitary landfill and incinerators.
- ▷ Encourage citizen empowerment in pollution control.
- ▷ Introduce green technologies and promote Environmental Management Systems (EMS) in all industrial facilities.
- ▷ Create an environment fund for soft loans as economic incentives for environmentally friendly industries.
- ▷ Promote tax rebates for industries installing pollution abatement facilities.

As ambitious as the outlined plans appear, implementation has remained largely a mirage. The Nigerian urban and natural environment has witnessed greater pollution than ever before. For example, the amount of greenhouse gases generated has escalated with more sectors depending excessively on generators for electricity since hydro-electricity output has dwindled in recent years. In today's Nigeria, it is not only fashionable to own and run generators but it makes business sense as well as it reduces the stigma of being lower on the economic ladder. Recent years have witnessed massive efforts to re-invigorate the hydro-electric sector but

The blame for this appalling situation can not be put on Nigeria alone but on all countries, bilateral and multilateral organisations, religions and cultures that have largely refused, or remain complacent, in contributing their quotas or responsibilities in the ecological chain of collective environmental protection.

efforts have largely been submerged by endemic corruption in high places. The plans to develop and harness solar energy have remained largely elusive. Nigeria also has many "over-aged" second-hand automobiles that have high carbon emissions which are rejected in the west but shipped to Nigeria despite import restrictions. Such "outdated" vehicles emit obnoxious gases such as carbon dioxide, nitrous, and sulphur oxides (CO, NO_x, SO_x), volatile organic compounds (VOC), hydrocarbon, ODS, smoke and particulates.

The blame for this appalling situation can not be put on Nigeria alone but on all countries, bilateral and multilateral organisations, religions and cultures that have largely refused, or remain complacent, in contributing their quotas or responsibilities in the ecological chain of collective environmental protection.

A similar trend can be seen in Nigeria's future strategy for the petroleum sector, which aims to:

- Develop and implement environmental assessment methodologies, taking into account economic, socio-cultural and conservation values of the environment.
- Develop a comprehensive set of measures to mitigate negative impacts.
- Ensure strict compliance with Environmental Laws.
- Implement Health, Safety and Environmental Management Systems and Quality Assurance Control.
- Establish comprehensive waste management programmes.
- Implement and continually update fully operational oil spill prevention programmes.
- Enforce environmental risk assessment, to predict eventual consequences of accidents and take mitigation measures.
- Design appropriate facility and operational procedures.
- Implement and continually update the national oil spill contingency plan for control, containment, and cleanup.
- Review and implement procedures to adequately address in timely manner damage to third parties.
- Encourage the general public to report emergency incidents to regulatory bodies.
- Ensure an internal and external market for gas.
- Stop gas flaring.
- Create public awareness programmes.
- Ensure full compliance with legislations, regulations and standards of the Ministry of Environment and Department of Petroleum Resources.
- Plan long-term rational exploitation of both oil and gas reserves and draw up investment strategies.

To date, reduction in gas flaring has remain a mirage with little hope to attain this dream in the near future. The issue of oil spillages and preparations to contain its associated hazards in the event of such incidents remains highly elusive. It will be absurd for the world to blame

Nigeria alone for failing in this onerous task; rather the blame should go to all nations involved in the oil business (from prospecting to final consumption). Education is fundamental to sustainable development; and no meaningful environmental conservation can be achieved in West Africa except through effective conservation education at all levels.

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Progress towards a sustainable future

Some progress however has been made, as noted above the phasing out of ODS in Nigeria has been given priority among the programmes being implemented by the Federal Ministry of Environment. On-going activities include: a) preparation of a programme for ODS phase-out with a grant of US$l20,000 from the Multilateral Fund (MF); b) chlorofluorocarbons (CFC) phased-out by targeted companies, with a grant of US$2,840,598 from the MF; c) CFC phased-out in four flexible and rigid foam industries, with a grant of US$540,000 from MF; and d) institutional strengthening for the phase-out of ODS with a US$3,000,000 grant from MF spread over three years to assist Nigeria setting up an effective and lasting institutional mechanism for coordinating national efforts for the protection of the ozone layer.

In 1993, Nigeria established a Regional Environmental Monitoring Station at Oshogbo under the auspices of Global Atmospheric Watch (GAW) programme of the World Meteorological Organisation (WMO). The station monitors background atmospheric pollution, covering 15 elements including surface ozone carbon dioxide, chemical composition of rain water, dry and wet depositions, dust loading, solar radiation, and other conventional meteorological elements. The station has the potential of being upgraded to a global station capable of monitoring other greenhouse gases, such as nitrous oxides (NO_2, NO), methane (CH_4), and sulphur; but the need for capacity remains.

GEMS/Air Nigeria is a component of the Global and regional Earth-system (Atmosphere) Monitoring using Satellite and in-situ data (GEMS) project whose specific goal is to monitor and assess urban air quality. The programme, which commenced in 1995, focuses on: a) air pollution in major cities; b) capacity building through training and provision of laboratory equipment; and c)

Picture 2. Djoudj National Park, Senegal, a low-lying area of wetland close to the border of Mauritania, which will be profoundly affected by climate change. The nearby town of St Louis is one of the places in Africa believed to be more threatened by sea-level rise. (*Courtesy Nigel Dudley, Equilibrium Research*)

establishment of emission pathways in order to evolve spatial and temporal emission models for urban centres in Nigeria.

Government developed environment friendly technologies in the energy sector includes plans to produce and distribute 15,000 solar water heaters, 450 solar stills, 225 solar dryers,1,000 village wind energy projects, 11,000 photo-voltaic water pumping stations, 2,000 village solar projects and 20,000 solar powered refrigerators for rural health centres. However, while these are all laudable steps in the right direction they amount to a drop in the ocean given the impending climate change impacts.

Sharing responsibilities—the need for a common 'energy' language

Wood, petroleum, coal, gas and water are the main energy sources in the country. The bulk of Nigeria's population still depends extensively on wood for energy, despite the countries many other resources. The principal mineral resources include fossil fuels (petroleum, natural gas, coal and lignite), metallic minerals (tin, columbite, zinc, gold), radioactive minerals (*e.g.* uranium and monazite), among others. The oil and gas sector is the backbone of Nigerian economy, contributing over 90 per cent of the nation's foreign exchange earnings and at least 80 per cent of GDP. However, harnessing and trading this mineral wealth has often been to the detriment of Nigeria's agricultural productivity until expelled farmers from Zimbabwe arrived on the scene.

Consequently, food imports worth billions of US dollars have continued to increase with attendant price rises.

Yet Nigeria dived without caution into biofuel production in the guise of pursuing green energy. Many industries promoting biofuels have emerged boasting of creating employment and are converting large areas of natural ecosystems for oil palm plantations, cassava and other commercial farms. Community lands have been taken over by these projects leaving local people with no viable options to survive the increasing cost of food except but to invade protected areas and their buffer zones for survival. Nigerian protected areas are bound to face a major challenge from increasing illegal activities by communities, but the country is in dire need of a system of protected well-managed landscapes to naturally mitigate and adapt to the impending impacts of global climate change.

Apart from the large scale conversion of natural ecosystems, an unpleasant side effect of biofuel industrialisation is the use of arable land for food production, the conversion of potential human food resources to biofuel and the waste (liquid, gaseous, noise, heat and solid) generated from industrial processes. Several reports confirm the non-inclusion of waste management provisions in projects and associated industries within Nigeria.[6]

One cannot sincerely expect Nigeria alone to abandon its quest for national income in the face of environmental challenges.

One cannot sincerely expect Nigeria alone to abandon its quest for national income in the face of environmental challenges. Thus, the issues highlighted above are likely to continue unchallenged into the future unless all parties involved in the "Energy Chain"

begin to make conscious and practical efforts to speak a common language based on common concerns and understanding.

Conclusion

Generally speaking, an indepth consideration of Nigeria's preparation and readiness to adapt or mitigate climate change impacts will show that it is strategically disadvantaged and far from ready to fulfil its expected role as a signatory nation to global environmental conventions. However, climate change and its associated negative impacts are glaring realities in all continents. The need to determine and foster integrated strategies for ameliorating and mitigating its impacts has never been greater than it is today.

One way to commence the long arduous journey to climate change mitigation and adaptation is for IUCN to use its 'intellectual muscles' and its connections across the globe to strategically pursue capacity-building, education, training and awareness-raising in a more proactive manner.

IUCN can play a role in the development of these strategies. One way to commence the long arduous journey to climate change mitigation and adaptation is for IUCN to use its 'intellectual muscles' and its connections across the globe to strategically pursue capacity-building, education, training and awareness-raising in a more proactive manner, carefully carrying along divergent views, opinions and stakeholders from all nations and peoples.

Specifically, IUCN must work to ensure that biofuels proponents and collaborating governments come to understand the consequences of using potential human foods and farmlands to produce biofuels at the expense of human nutrition. They should work to encourage biofuel businesses to use non-food plants like the invasive Nypa palms (*Nypa fruticans*) and Water Hyacinth (*Eichornia gracipes*), as well as crop residues, biogas from household and livestock wastes, industrial waste and food company by-products which are cheaper yet yield high quantity and quality biofuel.

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Regarding the need to ensure the future of our protected areas, in the face of the many challenges elaborated above, IUCN should shift a 'policy gear' and form a Working Group to develop a "*World Protected Area Conservation Barometer*", functioning in a similar manner to the Red Data List. It could categorise the world's protected areas in accordance with their functional conservation achievements or values, conservation status, threats and level of management, protection and funding. This publication could be called the "*IUCN Red Data List of Threatened Protected Areas*" and could be placed at the disposal of governments, donors, NGOS, bilateral and multilateral organisations, all protected areas stakeholders and general public to engender effective and integrated protected area conservation around the world.

With help from the international community, Nigeria, and indeed all West Africa countries, could then become ready before the 6th World Parks Congress, to answer daunting questions such as:

- How can IUCN and its Commissions encourage or facilitate the implementation of key global environmental mandates by nations who ratified them?
- Who plays what role/s, at whose expense and at what costs?
- What types of early warning systems are needed to better predict environmentally-linked disasters and to mitigate their most harmful effects?
- How can environmental restoration be promoted as part of disaster prevention strategies, particularly in the face of climate change?

Edem A. Eniang (eniangedem@yahoo.co.uk)is affiliated to the Dept. of Forestry and Wildlife, University of Uyo, Nigeria; the Dept. of Animal, Rangeland and Wildlife Sciences. Mekelle University, Ethiopia and Biodiversity Preservation Center (BPC), Cross River State, Nigeria.

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1 UNEP 2001.

2 IUCN 2000.

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Land-use in Wales under a zero-carbon strategy—the role of bioenergy and carbon sequestration

Peter Harper

Abstract. 'Decarbonisation' will necessitate a rapid and radical reorganisation of priorities in many aspects of economy and culture, including farming and land-use. But how will this be achieved? The following paper discusses such a change in the context of Wales, a small country in the West of the UK with a relatively low population and large areas of farmland and mountains. It attempts to map out some principles for resolving conflicts, first by seeking synergies, then by a reasoned ranking of priorities. There is also a clarion call for a range of research programmes that should be brought urgently forward as a kind of insurance policy against the possibility that the results are suddenly be needed.

Introduction

It is increasingly acknowledged that rapid 'decarbonisation' of the world economy is necessary to avoid risks of triggering runaway feedback effects in the global climate system. Less widely acknowledged is the sheer scale and pace of change this would entail for the rich countries, which would have to decarbonise more rapidly than the world average, perhaps by 100 per cent. There is a compelling case for rapid and radical reorganisation of priorities in many aspects of economy and culture, including farming and land-use. In practice of course this is unlikely to happen until some dramatic event convinces everyone that there is no alternative, and precipitates a general realignment of purpose.

Unfortunately, if and when this 'event' occurs, much important information will be missing because research priorities by and large reflect those of the wider community. Poor decisions will be made on account of a lack of reliable data regarding the new methods and systems that will be required in a radically low-carbon economy. The research community has some responsibility to anticipate the likely needs and start exploring the implications of the new low-carbon world, at least as a kind of insurance policy.

A report from the Centre for Alternative Technology (CAT) in Wales, UK, *ZeroCarbonBritain,* looks at some of the options, looking in particular at the consequences for Wales (a small country in the West of the UK with a relatively low population and large areas of farmland and mountains), where CAT in based. In particular the report identifies a hugely increased role for bio-energy sources, although paradoxically large sections of the environment movement are now calling for a moratorium on the production of liquid biofuels. Under almost any conceivable economic scenario in the future carbon prices will rise, and there will be financial incentives for low-energy, low-carbon, carbon-displacing or carbon-sequestering activities, and many of these activities have a bearing on agriculture, forestry, land use generally, and the food system.

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Possibly the most radical and disruptive conclusion to emerge from the *ZeroCarbonBritain* analysis is the need for a major reduction of livestock. The reasons are twofold. First, that the ruminants are net emitters of greenhouse gases (GHGs), particularly the disproportionately powerful pair, methane and nitrous oxide, and there is little prospect of reducing emissions per kg of product by more than 30 per cent, and probably much less. Although their contribution is 'only' between 5 and 10 per cent of current emissions (depending on assumptions and methods of calculation: the Food and Agricultural Organisation of the UN gives >20 per cent at a world level) this proportion will obviously grow as other sources are reduced, and would eventually become a bizarre barrier to the achievement of the zero-carbon state. Second, animals are rather inefficient converters of crops to other products, and the intense demand for land for many purposes will tend to price them out of all but a few special agricultural and economic niches.

Let us hasten to say this will not happen immediately, nor even very quickly. The non-CO_2 GHGs tend to be ignored in international negotiations, and are hard to measure and control (especially in agriculture). Further, animals are so embedded in culture, diet, heritage and farming systems that there would be extreme reluctance to follow the logic. We simply like them too much. And a higher consumption of animal products has historically gone hand in hand with the modernisation process that the majority of humanity is still undergoing. So in accepting (and, in effect, advocating) a major reduction of ruminants we are going against both sentiment and history.

Nevertheless we (the author's research community) feel it necessary to follow the logic ourselves, or carbon-mitigation policy remains a fatally leaky vessel. Even if, in the event, we (the UK policy-making community) do not have to implement it, **we should *plan for* an essentially post-livestock pattern of land-use in the UK**, even in traditionally livestock-specialist areas such as Wales. In the more extreme low-carbon scenarios, land will have to be used very intensively, probably with the following ranked purposes:

We should plan for an essentially post-livestock pattern of land-use in the UK, even in traditionally livestock-specialist areas such as Wales.

1. Conservation of intact forest and other vulnerable GHG reservoirs
2. Production of low-emission foodstuffs
3. Renewable production of carbon-sequestering raw materials
4. Sequestration in biomass and soils
5. Production of low-carbon materials and energy
6. Habitat creation and conservation of biodiversity
7. Recreation and landscape values

There are many potential synergies here, and they should always be sought through intelligent planning and technology. But there will also be competition for land for different uses. I do not want to over-emphasise the competitive aspect, but I think this slightly provocative approach will better stimulate debate.

The result of following these re-ordered priorities would be a substantial revolution in land-use, in farming practice, in the appearance of the countryside, and in the food system as a whole. It could be driven by regulation, but more likely by an international emissions-pricing system that we might call 'carbonomics'.

There will be a particularly important role for sequestration processes. The reason for this is that achieving zero-GHG emissions is extremely difficult, and many processes would remain net emitters. The only way zero-GHG could be achieved would be through the balancing of sources with sinks. Natural sinks appear to be declining, and will have to be replaced by engineered or managed sinks. Presently the only effective managed sinks are those based on photosynthesis, and they are primarily terrestrial. The rate of photosynthesis is limited and the generation of products for either energy or sequestration requires large areas (relative to, say wind generators or photovoltaics on the same site). Therefore photosynthesis for sequestration would tend to compete with other demands for photosynthetic products. Nevertheless these managed sinks are mathematically essential and under the new carbonomic regime would be extremely valuable.

The only way zero-GHG could be achieved would be through the balancing of sources with sinks.

Let us review the ranked land uses one by one, considering the broader world picture followed by application to the UK and more specifically Wales.

Conservation of forests and other natural reservoirs

Note the distinction between 'sink' and 'reservoir' in this paper. A reservoir is a natural repository of GHGs, mostly pre-existing. A sink is an active process that absorbs GHGs, becoming also a reservoir.

Release of CO_2 and other GHGs from natural reservoirs through processes such as clearing forests and disturbing peatlands accounts for up to a quarter of current world GHG emissions. In their intact state they also have important value for biodiversity and might also be active sinks. Further, they play a large and incompletely-known role in local, and possibly global, climate regulation. It is imperative that these reservoirs are conserved, and incentives found for maintaining their integrity.

This is particularly true for the tropics, but temperate forests also have value as reservoirs. There are of course virtually no primary forests in the UK, but there are important areas of peat that need careful consideration. Across Wales we would need to identify the vulnerable reservoirs and take steps to safeguard them.

Production of low-emission raw materials for food

By this convoluted phrase I mean to cover both obvious food crops and other inputs to the food industry such as oils and starches. Clearly food has to rank high in the priority list, although in the globalised world of the early 21st century that is not a foregone conclusion for every country. For most European countries and Japan, agriculture accounts for such a small percentage of GDP that in strict economic terms it could easily be dispensed with, and all food imported.

If the logic of my argument is accepted there is likely to be strongly increasing pressure on land, with consequent rises in food prices. Tropical systems and soils are often fragile and prone to disruption by extreme weather events. There will be a premium on robust temperate soils, and in the UK it would be as well to look after them. There probably will be risks to food security in the coming decades, and

There will be a premium on robust temperate soils, and in the UK it would be as well to look after them.

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

it would be good insurance for the UK to reduce its dependency on imported foods. In fact in some circumstances the UK might become a net exporter.

All this assumes a very substantial reduction in livestock. Animals are not low-emission sources of food, and neither do they use land efficiently, so (assuming that the broad climate change analysis is sound) 'carbonomics' will tend to drive them out of the system. Where might they survive? Here are some suggestions (not ranked):

- Where stock can be shown to improve overall performance of farms under carbonomic rules. Mixed farming is rightly considered to be a cornerstone of organic practice, and its loss would be one of the harshest consequences of the new carbonomics. We would have to look carefully whether in specific cases rotations that include stock actually improved the overall performance of a farm in carbonomic terms. Sometimes, they might. Another possibility might be non-ruminants in agroforestry systems.
- Non-ruminant stock fed on by-products. This is more feasible, since pigs and poultry are not high emitters of methane, although there is still a potential problem of manure management and nitrous oxide. If this latter problem can be solved there is scope for animal production from say press-cake, fermentation wastes, catering wastes etc. A school for instance might have a pig, fed on animal-free food waste, consumed at one almighty annual feast. Backyard poultry might make a comeback. And the dove-cote perhaps. One imagines that under these radically different circumstances legislation such as the UK Animal By-Products Regulations restricting the use of food waste for animal feeds will have been amended or rescinded altogether.
- Managed grazing of habitats for conservation and other values. The local benefits and non-local disbenefits would have to evaluated in each case.
- In marginal areas where absolutely nothing else is feasible. This might be thought to apply to upland sheep, but if (according to carbonomic rules) each livestock unit needs to be balanced by an active sink, even these might not be economically viable. The same argument applies to small numbers of ruminants kept by farmers for domestic use and fed off by-products such as press-cake from fuel crops. In principle, farmers could provide their own balancing sinks on the farm, but these sinks are likely to be so valuable that they would be 'bought out' by other demands.
- As conserved populations of 'rare breeds'. Perhaps in towns where they could be seen and appreciated, as in 'City Farms'. Paradoxically people might have *more* contact with farm animals under this arrangement.
- As status symbols for extremely wealthy owners who can afford to buy offsetting sinks.

- Wild animals. Currently wild animals are not widely used, but if farm animals become rare there is likely to be greater pressure on deer, boar, rabbits, hares and even squirrels. And wild fish of course. Eventually regulation and conservation measures might be necessary, as presently for game birds.

A more food-self-reliant Britain would easily produce enough basic foodstuffs. Presently less than 25 per cent of UK agricultural land is devoted to crops, and of this some is forage for animals. The reduction of livestock would free large areas of land for other uses. In Wales, and the west generally, agriculture is dominated by grass and grazing, and these would be the areas most strongly affected by low-carbon drivers. There would be a question of regional as well as national self-reliance in foods, given that transport fuels would be expensive. New food industries might well emerge to process raw materials into more acceptable forms. High-tech meat-like materials (*in vitro* production of muscle tissue using plant-protein feedstocks for example) are a strong possibility, posing a curious choice for some vegetarians.

Should low-carbon agriculture be organic? It is widely claimed (and assumed as a given in the movement itself) that organic production has lower GHG production than conventional farming. This is disputed, and it is difficult to disentangle the real evidence from the inevitable biases. Broadly, organic practice avoids the energy penalty, and some of the nitrous-oxide emissions, of the production of Haber-Bosch nitrogen, but has lower yields. Therefore although the inputs are lower, so are the outputs, and in consequence emissions per kg of useful product are often little better than conventional levels, and in some cases worse. This needs further study.

We also need further study of the nitrous oxide implications of various manuring processes including animal manures, compost of various kinds, green manures and the use of legumes to fix atmospheric nitrogen. This is urgent for the guidance of sound low-GHG policy.

There is also a suggestion in the available data that organic *plant crops* tend to have lower emissions per kg than their conventional counterparts, whereas organic *animal products* have higher emissions. If this link is robust, it also has policy implications. Again, more research needed.

Renewable production of carbon-sequestering raw materials

This has a high rank for land use because potentially at least, it both displaces high-carbon raw materials *and* locks up photosynthate in a stable solid form. The phrase 'renewable' is used to indicate a continuous process. Thus plant materials are grown, absorbing carbon dioxide, harvested and converted into some stable and useful form, then replaced by further crops on the same land. An obvious example is wood used in building and furniture, but many other fibrous materials can be envisaged such as hemp, cereal straw, oilseed rape straw, miscanthus etc. The new low energy building currently being constructed at CAT for example, is built largely of timber and a hemp-lime composite embodying hundreds of tonnes of CO_2.

Such materials will be favoured by the new carbonomic rules, and will become profitable crops. Intensive research is called for, in such areas as:

- Widening the range of potential crops
- Widening the range of potential uses
- By-products and other synergies
- Breeding for higher yields, disease resistance etc

- ▷ 'Organic' or low-input production
- ▷ Risks to, or synergies with, other desiderata such as biodiversity

Sequestration of carbon in soils

Sequestration is destined to be a crucial part of a low-carbon strategy. It is most commonly spoken of in the context of 'Carbon Capture and Storage' of CO_2 from the combustion of fossil fuels. While this is a step in the right direction, it does no more than cancel out the emissions from the fossil fuels and might be termed 'passive sequestration'. It does not actively withdraw CO_2 from the atmosphere.

Various chemical options ($Ca_2SiO_4 + CO_2 \rightarrow 2CaCO_3 + SiO_2$ for example) have been explored for active CO_2 removal and conversion into stable solids, and justify continuing and vigorous research. For the time being however, the only practical technology we have is natural photosynthesis. This creates carbon-rich molecules in various forms, some of which can be stored permanently, either through practical and industrial processes as discussed above, or in the biosphere itself in the form of standing biomass, litter, or resistant forms of carbon in the soil.

'Farming for sequestration credits' could become an important part of the agricultural economy.

A defining feature of organic practice is the addition of organic matter to the soil, and if this results in a permanent increase in soil carbon, should attract a carbonomic credit. In fact 'farming for sequestration credits' could become an important part of the agricultural economy. It could have further benefits in biodiversity, erosion-resistance, plant health and so on.

Strong interest has arisen recently in another resistant form of carbon, elemental carbon in the form of charcoal, sometimes known as 'biochar'. This is produced in various ways from biomass or certain other waste materials, and can apparently be incorporated in large quantities into natural soils without damaging their fertility or other properties. In fact under some circumstances there might be improvements in soil fertility, and this might render the conversion of grazing land into arable a practical possibility.

Biochar research is only beginning, but it has so many potential properties and synergies that it deserves much greater attention. Through its large cation-exchange capacity it is capable of adsorbing large quantities of other substances, and might be able subsequently to release them to plants via mycorrhizas. This suggests for example, the use of Biochar to absorb potentially polluting nitrogen compounds from sewage and industrial processes, later to provide slow-release nutrients for bioenergy crops while sequestering carbon.

Production of low-carbon materials and energy

'Biofuels' are much in the news and have attracted a bad press from many sections of the environmental movement. A few simple back-of-the envelope calculations are enough to show that with current technology the UK could never produce enough liquid fuel for its existing transport fleet. So biofuels are being imported from overseas, possibly with serious consequences for local ecology and livelihoods, and in some cases causing more emissions than they save.

There is a serious and continuing danger. As rich societies strive to escape from the problems posed by climate change, they are doing so— perhaps inadvertently— at the cost of poorer societies. It was partly for these reasons that *ZeroCarbonBritain* postulated self-reliance in both energy and food for the

UK. In practice this is probably an unreasonable constraint. Within Europe for example, the distribution of wind energy and biomass resources are disjunct and complementary; it would make sense to 'exchange' surpluses of wind-electricity for biomass energy in various forms.

Nevertheless it is probably a good principle that each region tries to produce as much bio-energy as it can, within an overall low- or zero-carbon framework. Storable and 'dispatchable' sources such as biomass will play an important role in balancing demand and supply, but cannot simply replace conventional fossil fuel consumption litre for litre. So the framework is vital: within it we can develop a meaningful bio-energy sector in the UK, and especially in areas such as Wales currently dominated by livestock.

There is an important distinction between 'biofuels', generally taken to mean liquid fuels suitable for the transport sector, and 'biomass', generally taken to mean solid energy-rich material typically used for heating. There is a third category of 'wet biomass', usually derived from waste products, used to generate biogas by anaerobic digestion. The gas can be used to generate electricity and heat.

Part of the reason for the brouhaha over biofuels is the mismatch between the enormous and growing demand for transport fuels and the distinctive inefficiencies of trying to produce liquid fuels from arable crops, most commonly biodiesel from oilseed rape and bio-alcohol from wheat and sugar beet. The energy-losses and incidental GHG emissions from preparing, fertilising, harvesting, processing and transporting the crops and fuels are so great that the overall reduction in emissions is small or even non-existent, and rarely more than 30 per cent. At the same time, the land-take is depressingly high relative to other space-consuming sources of energy, as previously remarked. Critics ask, is it worth all the trouble for such paltry gains?

It is probably a good principle that each region tries to produce as much bio-energy as it can, within an overall low- or zero-carbon framework.

In the present circumstances we would surely have to agree with the critics. However we are not trying to deal with the present circumstances, but what we take to be possible, even likely, circumstances between 2012 and 2020. The context would be different in the following ways:

- There would be continual reductions of livestock
- Energy of all kinds will be expensive, high-emission energy especially so
- There would be reductions of demand for liquid fuels
- There could be considerable technological improvements
- The so called 'second-generation' biofuel technologies might be increasingly available

Picture 2. A typical hill-farming landscape in mid-Wales (*Courtesy Nigel Dudley, Equilibrium Research*)

The implications of these changes are worth a brief discussion. The reduction of livestock does free up a lot of land, potentially over 50 per cent, although in general not the best land. High energy costs mean that the economics of alternative sources are favourable, although transporting bulky materials will be relatively expensive. There will be pressure for local supply to meet local needs. The high costs of liquid fuels will curtail private motoring and unnecessary journeys. Technological advance might reduce the production and processing penalties for some biofuels, or for example by allowing raw vegetable oil to be used directly in diesel engines.

More likely, in my view, is that bioenergy production will focus on high-cellulose crops (such as grasses, miscanthus, hemp, trees) used for heating or combined heat and power (CHP). Complementarily, the wet/biogas route deserves re-examination, using dedicated feedstocks such as fresh grasses harvested at different times of the year, as well as non-farm biological wastes. These technologies are twice to three times as efficient as the biofuel crops in terms of land take and offer much larger reductions in GHGs, including possible net sequestration. In an overall low-carbon economy, their efficiency can be further boosted by the addition of hydrogen produced by the expected periodic surpluses of variable renewable energy systems. At the same time the 'second generation' technology of converting cellulose to sugar and thence alcohols will offer a modest but disproportionately useful source of liquid fuels. It is this direction that Wales should principally take.

In *ZeroCarbonBritain* the possibility is discussed of farms producing their own fuels for machinery and processing. If food is given the high priority it deserves, then the modest quantities of energy required to produce the raw materials should also be favoured, and possibly protected by special incentives, much as red diesel currently is. It would probably be a good idea if farms could produce their own biofuels directly wherever possible, or perhaps one suitable farm could specialise and supply locally. The processing of bio-oils can be done on a small scale. The glycerol generated as a by-product is itself a high-energy product and acts as a highly effective booster in anaerobic digesters. Bioethanol can also be produced locally, as thousands of local distilleries, legal and otherwise, attest.

In addition to energy, dedicated crops can provide useful industrial feedstocks that displace those from high carbon (principally petrochemical) sources. At present of course biological sources are not competitive, but all this would change in a low-carbon dispensation.

The foregoing discussion suggests great challenges, but also enormous new opportunities, for farmers in Wales. And, as always, there is lot of research to be done.

Habitat creation and the protection of biodiversity

It might seem odd that this is given a relatively low rank in my priority list, since biodiversity is certainly threatened by the climate change situation, and shares with it an obvious element of irreversibility. I assume however that most land in Britain will continue to be 'useful' and that wildlife of all kinds will be expected to fit in wherever it can, while certain special areas and habitats remain protected.

My general assumption is that there will be much more pressure on land. *Prima facie* this is bad news for wildlife. But human activities, even farming, do not seem to be intrinsically inimical to biodiversity, and with careful design

we could probably ensure that habitats are created and diversified rather than destroyed. In other words, there might well be synergies between biodiversity and low-carbon desiderata if we work at them. If biodiversity is recognised as important it should attract financial support and become another income stream for farmers and local communities. A lot of diligent research work of a generic kind is urgently needed here, because a rapid transition might not leave enough time for investigations in every specific case.

We also need to think about conserving cultivated crop varieties, especially in view of climatic uncertainties.

Recreation and landscape values

For most city people and those with second homes in rural areas, the scenic and amenity value of the countryside is paramount. The detailed aesthetics are usually arbitrary: for example the industrial structures of a century ago are regarded as charming, while those of more recent vintage are an abomination. Nevertheless these voices speak loudly, and the money in their pockets louder still.

Under the 'new rules' of carbonomics attention is inevitably focussed on coarser values, and bourgeois canons of rural taste are likely to be transformed. The countryside would look different. There would be more trees, more crops, and relatively few animals. It would be less 'open'. Many views would be cluttered. There would be energy processing going on, power lines, wind generators, chippers, biogas digesters, distilleries, more tanks and silos, trucks hauling bulky materials, and so on.

Under the 'new rules' of carbonomics attention is inevitably focussed on coarser values, and bourgeois canons of rural taste are likely to be transformed.

The change of aesthetic required is similar to that which obtained in wartime, when it was considered bad form to complain about airfields on farmland or barbed wire on the beaches. These were— and would be— temporary states of affairs to address a pressing emergency, with a hope of return to 'normality' at some future date. In the zero-carbon world, NIMBYism ("Not in My Back Yard") will be a thought-crime.

Concluding remarks

Most of us who worry about the 'environment' like to think of ourselves as having sophisticated and consistent values. But the climate change situation forces us to recognise that there are many different values masquerading under the environmental rubric, and they can conflict. This paper has attempted to map out some principles for resolving conflicts, first by seeking synergies, then by a reasoned ranking of priorities. Between the lines there are implications for research programmes that should be brought forward as a kind of insurance policy against the possibility that the results would suddenly be needed. Many of these issues require further debate.

Climate change situation forces us to recognise that there are many different values masquerading under the environmental rubric, and they can conflict.

Peter Harper (Peter.Harper@cat.org.uk) is Director of Research and Innovation at the Centre for Alternative Technology, a community based project in Wales researching renewable energy and sustainable agriculture that has been in existence since 1974.

Time to replace globalisation with localisation

Colin Hines

Abstract. Current trade patterns are predicated on the fast and efficient movement of goods around the world. Do we need a fundamental change in approach? Instead of globalisation, should we be looking at a conscious move towards localisation for many products currently traded internationally. A set of seven policy steps are outlined that together would help to develop more localised production systems to address global trade inequality, fuel shortages and environmental degradation.

Economic globalisation has a clear end goal: maximum trade and money flows for maximum profit. From this goal comes a clear set of policies and trade rules supporting this approach. The adverse effects of this economic priority have become increasingly evident and include growing global inequality, job insecurity and adverse environmental effects.[1]

Picture 1. Can we achieve a re-localisation of the world economy? (*Courtesy Nigel Dudley, Equilibrium Research*)

There is now growing support for a radical alternative, that of **localisation.**[2] This has at its heart the protection and rebuilding of local economies rather than gearing them to ruthlessly outcompete each other internationally. Depending on the context, the 'local' is predominantly defined as part of the nation state, although it can be the nation state itself or occasionally a regional grouping of nation states. Everything that can sensibly be produced within a nation or a region should be. Long-distance trade is then reduced to supplying what could not come from within one country or geographical grouping of countries; the historic role of such trade.

Localisation is not about restricting the flow of information, technology, management and legal structures, but it is about a different end goal for such activities. Localisation could help to ensure a more just, secure, environmentally sustainable future.

The route to localisation consists of a set of seven interrelated and self-reinforcing policy areas. The basic steps are:

- Reintroduction of protective safeguards such as tariffs and quotas for domestic economies;
- A site-here-to-sell-here policy for manufacturing and services domestically or regionally;
- Localising money such that the majority stays within its place of origin;
- Local competition policy to eliminate monopolies from the more protected economies;
- Introduction of resource taxes to increase environmental improvements and help fund the transition to localisation;
- Increased democratic involvement both politically and economically to ensure the effectiveness and equity of the movement to more diverse local economies;
- Reorientation of the end goals of aid and trade rules such that they contribute to the rebuilding of local economies and local control.

The prerequisite for achieving such a re-localisation of the world economy is to replace globalisation with a plausible alternative. The policies involved must reverse the instability and insecurity created by trade liberalisation. Their essence should be to allow nations, local governments and communities to reclaim control over their local economies; to make them as diverse as possible; and to rebuild stability into community life.

This does not mean a return to overpowering state control, merely that governments provide the policy framework which allows people and businesses to re-diversify their own local economies. It would ensure a transition from the present situation to one where goods and services are provided locally wherever possible. Reducing product or service miles is also an environmental goal. In short, there is a positive discrimination in favour of the local.[3]

Localisation has at its heart the protection and rebuilding of local economies rather than gearing them to ruthlessly outcompete each other internationally... The prerequisite for achieving relocalisation is to replace globalisation with a plausible alternative... that allows nations, local governments and communities to reclaim control over their local economies; to make them as diverse as possible; and to rebuild stability into community life.

Picture 2. Reducing product or service miles is an environmental goal
(*Courtesy Nigel Dudley, Equilibrium Research*)

Under these circumstances, beggar-your-neighbour globalisation gives way to the potentially more cooperative better-your-neighbour localisation.

In response to their restive and increasingly insecure populations, governments will have no choice but to return to protective barriers. A catalyst for this change could be the collapse of the colonial delusion that the future for jobs in rich countries lies in their dominance in the global high tech sector. This ignores the fact that China and India are fast developing their own highly-skilled but low cost expertise in the high value added areas that the west is supposed to dominate in the future.

At present the localisation alternative features nowhere in the thinking of most leading politicians. However globalisation's increasingly adverse effects are likely eventually to result in massive public support for political parties that offer protection and security from this process and replace it with the protection and rebuilding of local economies. It is time that those wanting a fairer, more environmentally sustainable world, where everyone's basic hopes are met, had a radical rethink.

They must stop pinning their hopes of campaign success on tweaking the direction of globalisation or acting as if trade rules were governed by some kind of Olympian logic that comes down from on high. Instead, trade rules should be seen for what they are: a grubby set of global guidelines drawn up at the behest of the powerful for the benefit of the powerful. It is time for a radical change.

Colin Hines is an Associate of the International Forum on Globalisation and an advisor to the UK Green MEP.

Notes

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2 Hines, C., 2000.

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A green new deal

Colin Hines and Caroline Lucas

Abstract. The global economy is facing a 'triple crunch'; a combination of a credit-fuelled financial crisis, accelerating climate change and soaring energy prices underpinned by an encroaching peak in oil production. These three overlapping events threaten to develop into a perfect storm, the like of which has not been seen since the Great Depression. Addressing climate change and changing energy futures will both cost money. At a time when economists are gloomier about the future than they have been for decades, perhaps lessons can be drawn from responses to the Depression in the twentieth century, updated to create a Green New Deal.

Introduction

Joseph Stiglitz was right when he wrote at the present economic downturn could be the worst since the Depression. In the coverage of the causes and likely future effects of the credit crunch, such grim parallels are becoming commonplace. But it is time to move from problems to solutions, and here too the Depression can form a useful reference point. Franklin Roosevelt's action programme for dealing with the aftermath of the late 1920s credit crunch was threefold. First, strictly regulate the cause of the problem— the greedy and feckless finance sector. Second, get people back to work, and generate business opportunities by a New Deal. This invested billions of dollars in training, better working conditions and a huge range of infrastructural projects such as highways, dams and bridges. Finally, fund this in part by an increase in taxes on big business and the rich— a measure which also had the positive effect of dramatically decreasing inequality.

A Green New Deal for the UK

Today the re-regulation of finance is even being discussed in the columns of the *Financial Times*. The concept of a Green New Deal[1] which could help re-boot the economy after a credit crash, while putting serious money into addressing climate change, is now being seriously discussed. Given that the reduction of carbon emissions will become an ever more urgent international priority, investing in such programmes will also provide a safer haven for pensions and savings.

The concept of a Green New Deal which could help re-boot the economy after a credit crash, while putting serious money into addressing climate change, is now being seriously discussed.

As in the Roosevelt case, this too would be partly paid for by increased taxation of big business and the rich, but would today also require the elimination of tax havens.

In addition to state money, the Green New Deal would encourage the use of savings in banks and building societies to fund measures to cut carbon emissions. These savings are at present guaranteed up to £35,000 in the UK, and such a guarantee could be extended to a Green New Deal investment. This would carry the proviso that such funds would be earmarked solely for investments that

reduce carbon use through energy efficiency and renewable energy sources. Savers could also be exempt from taxes on gains for investment in carbon-reducing infrastructure, as is the case for infrastructural investment in the US municipal bonds market.

Governments like to steer clear of the constraints put upon them by such hypothecation, but the Stern Report showed the level of serious economic constraints that inadequately-checked climate change will pose for the economy. There is a significant amount of money in pensions and other savings, plus a recognised need by the government for people to save much more. Guaranteed investments via a Green New Deal programme will help provide the upfront funding needed for the low-carbon future, and should therefore be the way to square this circle.

Local authority bonds could be the major vehicle for the funds raised for this programme. In the US there is a trillion dollar Municipal Bond market. In the UK, Transport for London's recently successful £600 million bond issues for improving the capital's transport infrastructure is another example. This source of funding— and local democracy— could be promoted relatively easily if the net returns on the money saved from the low-carbon investments were used to repay the bonds.

Floating of bonds initially to improve the energy efficiency of the more than 80,000 council dwellings in need of refurbishment.

Picture 1. Local food will be part of a New Green Deal (*Courtesy Nigel Dudley, Equilibrium Research*)

Such an approach is being called for in the UK by the Birmingham-based group, Localise West Midlands. It has proposed the floating of bonds initially to improve the energy efficiency of the more than 80,000 council dwellings in need of refurbishment. The city is the biggest public sector landlord in Europe, but has a housing stock that requires major investment and energy efficiency measures to comply with UK and EU law and combat fuel poverty. Part of such a programme would ensure both high standards of insulation and extensive use of combined heat and power programmes, and encourage the use of renewable energy sources to meet a new goal of "every building a power station".

Another important advantage emphasised by Localise West Midlands is that the vast

A "carbon army", recruited from those in the region who are at present unemployed or wanting to improve their existing skills, could be trained for the low to high skilled jobs required.

majority of jobs created will be located where people actually live. Bonds could therefore help develop the local skills, technologies and enterprises that will be needed for the new, low-carbon economy. A "carbon army", recruited from those in the region who are at present unemployed or wanting to improve their existing skills, could be trained for the low to high skilled jobs required. To reduce carbon dramatically will require skills ranging from energy analysis, design and production of hi-tech renewable alternatives, large-scale engineering projects such as combined heat and power and offshore wind, through to work in making every building "energy tight", fitting more efficient energy systems in homes, offices and factories.

For recently laid-off bankers, a carbon finance sector will also be needed to publicise, to advise and to put into practice the range of funding packages inherent in the Green New Deal. The immediate economic advantages of this energy transition will be that hundreds of thousands of jobs can be created, a large number of new and existing businesses and services can benefit, and a large increase in tax revenue can be generated from this new economic activity.

A new Green New Deal for everyone

Stiglitz is also right that there is at present, a leadership deficit in the US, unlike the case in the 1930s. However, as Europe's economy slows in the wake of the US-initiated credit crunch, the EU could take a much-needed lead. The NGO The Green Alliance recently proposed a European budget for climate security that would involve Brussels re-orienting its public investment programme to set up a dedicated low-carbon fund for energy and transport infrastructure, an investment fund to help move China and India towards low-carbon economies, and a budget to help the poorest countries adapt to climate change.

The focus should be on smart investments that not only finance the development of new, efficient energy infrastructure but also help reduce demand for energy.

A consolidated approach would involve some or all of the following:

- Executing a bold new vision for a low-carbon energy system that will include making "every building a power station", by maximizing their energy efficiency and using renewable wherever possible to generate electricity.
- Creating and training a "carbon army" of workers to provide the human resources for a vast environmental reconstruction programme. This will be part of a

Picture 2. Every building can be a power station (*Courtesy Nigel Dudley, Equilibrium Research*)

wider shift from an economy narrowly focused on financial services and shopping to one that is an engine of environmental transformation.

- Ensuring more realistic fossil fuel prices that include the cost to the environment, and are high enough to tackle climate change effectively by creating the economic incentive to drive efficiency and bring alternative fuels to market.
- Developing a wide-ranging package of other financial innovations and incentives to assemble the tens of billions of pounds that need to be spent: the focus should be on smart investments that not only finance the development of new, efficient energy infrastructure but also help reduce demand for energy, particularly among low-income groups.
- Re-regulating domestic financial systems to ensure that the creation of money at low rates of interest is consistent with democratic aims, financial stability, social justice and environmental sustainability. Our proposals for financial renewal are inspired by those implemented in the 1930s.
- Breaking up the discredited financial institutions that have needed so much public money to prop them up in the latest credit crunch, including for the forced demerger of large banking and finance groups. Retail banking should be split from both corporate finance (merchant banking) and from securities dealing. Instead of institutions that are "too big to fail", we need institutions that are small enough to fail without creating problems for depositors and the wider public.
- Re-regulating and restricting the international finance sector to transform national economies and the global economy. Regulation of finance, and the restoration of policy autonomy to democratic government, implies the re-introduction of capital controls.
- Subjecting all derivative products and other exotic instruments to official inspection. Only those approved should be permitted to be traded.
- Minimising corporate tax evasion by clamping down on tax havens and corporate financial reporting. Tax should be deducted at source (*i.e.* from the country from which payment is made) for all income paid to financial institutions in tax havens.

As the credit crunch fells the Anglo-American economic model, it's time to champion a Green New Deal for everyone.

Colin Hines (chines@dial.pipex.com) is an independent researcher working on policies encouraging localisation of the economy. He formerly worked for Greenpeace in the UK. **Caroline Lucas** is a green Member of the European Parliament.

A shorter version of this paper appeared on the Guardian Website *Comment is Free*.

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Energy/Climate security— 2050 goal

Richard Steiner

Abstract. What are the key priorities in addressing climate change? How should IUCN react? The following paper summarises some policy options as was presented by Richard Steiner to the IUCN council on behalf of CEESP in 2007, looking at issues relating to energy efficiency, some energy alternatives to avoid, the role of NGOs and finally a proposal that IUCN establish a special commission on climate change.

A proposed goal for 2050

Some clear and necessary goals emerge from our current understanding about the extent and speed of climate change, which mean that we need to:

- Stabilise atmospheric temperatures at less than 2° C above historic baseline
- Hold atmospheric CO_2 levels below 450-500 ppm
- Reduce global anthropogenic greenhouse gas emissions by 80 per cent below 1990 levels by 2050
- Cap carbon emissions by 2010, reduce by 2 per cent per year between 2010 and 2020 and then reduce by 5 per cent per year after 2020, to a total reduction of 80 per cent below 1990 level
- Reduce global carbon emissions from current 8 billion tons per year to 2 billion tons per year by 2050.

This means that we need to "decarbonise" the energy economy with an aggressive initiative in energy efficiency, substantial increase in low/no carbon energy alternatives, eliminating deforestation, reducing or eliminating livestock agriculture, and enhancing carbon capture / sequestration.

Energy efficiency

The most immediate goal should be a *5-fold increase in energy efficiency* (*i.e.* a 5-fold reduction in energy intensity of GDP) *in all sectors of economy*: including automobiles (subsidise hybrid-electric vehicles, high-efficiency vehicles); airline efficiency; mass transit systems in urban and rural areas; power utility efficiency; commercial and residential building energy efficiency; efficiency of appliances; efficiency of manufacturing processes; etc.

The most immediate goal should be a 5-fold increase in energy efficiency in all sectors of economy.

Policy approach

Five areas of policy change will be critical to success:

1. *Transfer all government subsidies* currently paid to industries contributing carbon emissions— coal, oil, inefficient automobile, road building and other auto infrastructure, power generation, livestock agriculture, forestry, etc.— currently about US$1 trillion per year, to *energy efficiency and low carbon alternative energy industries* such as wind, solar, nuclear fusion research and development, forest sustenance (reforestation, product substitution, etc.), low-emission agricultural practices

Transfer all government subsidies currently paid to industries contributing carbon emissions to energy efficiency and low carbon alternative energy industries.

(no-till, grass planting, etc.); and landfill methane collection, etc.

2. *Impose substantial new taxes / royalties* on all fossil energy production and use; at minimum governments should immediately impose an additional *10 per cent tax/royalty* on all coal, oil, fossil-energy power generation, and/or additional end-use taxes.
3. Apply all revenues obtained from subsidy transfer and new taxes/royalties (target at least 5 per cent of total annual federal budget) toward aggressive *investment in energy efficiency, low/no carbon energy alternatives, forest conservation and restoration, non-livestock agriculture, carbon capture/storage initiatives.*
4. Impose substantial *economic/trade sanctions* (import duties / quotas, etc.) on countries that do not comply
5. Enhance *population stabilisation* initiatives, as this will better enable energy sufficiency of the global economy (*e.g.* it will be easier to provide energy/climate security for 7 billion people than for 10 billion).

Energy alternatives to avoid

Mounting concern about energy shortfalls will drive governments and others to grab at anything that looks like a possible alternative to oil. But some options carry high costs of their own. Some of the issues include:

- Avoid large-scale investment in *hydroelectric* generation, as it degrades river ecosystem function and causes significant habitat loss
- Avoid large-scale investment in *biofuel* production, as it contributes to extensive loss of biodiversity-rich habitat, often uses untested genetically modified (GM) crops, and is intensive in water / chemical use.
- Avoid large-scale investment in *nuclear fission*, as the technology is too un-forgiving of error, generates too much unmanageable high-level waste, and is terror- prone.

Mounting concern about energy shortfalls will drive governments and others to grab at anything that looks like a possible alternative to oil.

- Avoid any further investment in high-carbon energy resource production, particularly *coal, oil, tar sands, oil shale*.
- Avoid investment in large-scale *tidal* (near-shore) generation, as damming estuaries and bays is disruptive to coastal ecosystems.

NGO role

Non governmental organisations need to engage aggressively with the *private sector* and *governments* to achieve above energy/climate security goals:

Non governmental organisations need to engage aggressively with the private sector and governments to achieve above energy/climate security goals

- *Private Sector*: Target businesses on Global 500 list that contribute most greenhouse gas (GHG) emissions, coal, oil, auto, airline, power utilities, cement, forest products, agriculture, etc., write letters to and/or meet with CEO/ Directors asserting the above principles for energy/climate stabilisation. *Reward* those that meet established reduction targets, certify the company as sustainable, etc; *impose punitive consequences* on those who don't meet reduction targets, *i.e.* withhold partnership arrangements, "black-list", publish company progress on reduction targets, boycotts, etc.

- *Governments*: Aggressively advocate restructuring of economic policies to provide energy/climate stabilisation goals expressed above. Meet with administration and legislative officials. *Reward* those who achieve targets; *impose punitive consequences* (economic trade sanctions, tourism boycotts, etc.) on those that do not. Recommend parliamentary acts to achieve emission reduction targets. Recommend establishment of National Climate Change Commissions to advise government and industry on energy and climate stabilisation, and Citizens Advisory Councils to advise government and industry on climate change issues.

Establishing *Climate Change Commissions:* A Role for IUCN?

As noted in the summary recommendations above, it is necessary to restructure the architecture of governance to be responsive to threat of climate change. One approach is for governments to establish *Climate Change Commissions* (CCCs), which may be something that IUCN regional offices can help facilitate.

Climate Change Commissions should be formally constituted to advise government, industry, and civil society on all aspects of climate change.

The National *Climate Change Commissions* (task force, working group, committee, etc.) should be formally constituted to advise government, industry, and civil society on all aspects of climate change— impacts, costs, adaptation, mitigation, etc. They should comprise representatives of all main stakeholder groups, including government, private sector (agricultural, forestry, fisheries, health care, etc.) and citizens' organisations (indigenous, NGOs, etc.) (I proposed the establishment of such a Commission in Alaska in 2006, and even with a state politic dominated by oil and conservative interests, the proposal received unanimous consent from our State legislature and the Alaska CCC is now established and operating.)

Such Commissions could be established for each nation, as well as interregionally. For instance, there could be a CCC for each country in South Asia as well as a *South Asia Climate Change Commission*. Similarly there should be an Africa CCC, as well as more discreet geographic regions (west Africa CCC, northern Africa CCC, etc.), and they could be organised within the African Union; an Amazonian CCC, Pacific Islands CCC, Southeast Asia CCC, etc. The regional CCCs should provide coordination on climate change issues that are common to all states within the region— such things as agricultural policy, water, coastal erosion, storm protection, etc. The CCC should develop a *Climate Action Plan* to guide government climate change policy.

The CCCs should propose administrative and legislative actions that can be taken by governments, work with business, and so on. And, the Commissions could either be established as short-term bodies (*e.g.,* 2-years), or as permanent advisory bodies. The CCCs should meet at least annually, but preferably quarterly; should discuss, analyze, and respond to current information on climate change internationally and locally; and should have a sufficient budget with which to conduct their operations.

Rick Steiner (afrgs@uaa.alaska.edu) is a professor and environmental specialist at the University of Alaska, and a member of CEESP.

Fairtrade, air miles and climate change

The Fairtrade Foundation

Abstract. The issue of climate change is rising up the public agenda and consumers are increasingly considering how their behaviour can impact on the environment. An issue of growing importance relates to the impact of food miles (how far a product has travelled before it reaches the consumer) and air miles (whether and how far a product has been air freighted) upon the production of greenhouse gases. This attracts particular attention with respect to "fair trade" goods; consumers are choosing to buy these because of their perceived social and environmental benefits but how do these benefits balance against having them transported around the world? The Fairtrade Foundation in the UK summarises some common questions and supplies some answers.

The public concern around climate change and carbon emissions has been growing rapidly and there is no doubt that far-reaching global action has to be taken now to deal with global warming. However if the debate becomes overly obsessed with the question of food miles, this could severely damage opportunities for sustainable forms of export agriculture to contribute to the economic and social development of poor producers.

Agriculture can play a critical role in the economic and social development of developing countries. Increased agricultural growth is thought to be the most likely source of economic growth in Africa given that 70 per cent of the rural poor work on the land. Fairtrade certification ensures that the benefits of agriculture accrue to marginalised and disadvantaged producers.

▷ I want to help people in developing countries, but I'm also worried about climate change. Should we buy products like green beans or flowers from Africa that are more likely to be air freighted?

Whether or not a product has been air freighted is not an indicator of its overall sustainability and to reject products on this basis is to ignore the huge developmental and poverty reduction benefits that export agriculture and horticulture can bring to the continent of Africa and other developing nations. Over 1 million people in rural Africa are supported by the export of fresh fruit and vegetables to the UK, injecting an estimated £200m into rural economies in Africa as a result.[1] Further, air freighting of all fruit and vegetables from Sub-Saharan Africa represents less than 0.1 per cent of all UK carbon emissions.

All fruit and vegetables from Sub-Saharan Africa represents less than 0.1 per cent of all UK carbon emissions.

Those concerned about climate change should take a broad perspective that looks at the 'carbon footprint' of a product from plough to plate and beyond. This should take into account energy and water consumption required for farming processes, soil cultivation and agricultural inputs, packaging, UK transport, preparation and waste disposal. They should also weigh this carbon footprint against the economic, employment and livelihood benefits resulting from these activities.

Balancing all of these factors provides a much more accurate picture of the true sustainability of a product rather than a narrow focus on 'air miles.'

So before we consider stopping purchasing produce from Africa, we should ensure we have taken all other possible steps towards reducing our own emissions.

▷ **Is it true that a flower grown naturally in Africa has a lower carbon impact than a flower grown in a European greenhouse?**

Yes. There have been a number of studies which show that this is indeed the case. A 2005 study conducted by the University of Utrecht indicated that the energy required to grow a rose under glass in the Netherlands is around 9 MJ compared to around 2-3 MJ used to produce a rose in Kenya and air freight it to the UK.[2] A more recent study by the University of Cranfield, which compared the production and transportation of 12,000 roses from Kenya and Holland, demonstrated that the emissions from the Dutch roses were higher than the Kenyan emissions even taking air freight into account. This study found Kenyan emissions to be 5.8 times less than those of the Dutch roses.[3]

Emissions from the Dutch roses were higher than the Kenyan emissions even taking air freight into account.

▷ **How can buying Fairtrade products help to tackle climate change?**

All Fairtrade certified producers are required to comply with the international Fairtrade environmental standard as part of the requirements of certification. The standard requires producers to ensure that they protect the natural environment and make environmental protection a part of farm management. Producers are also encouraged to minimise the use of energy, especially energy from non-renewable sources.

By purchasing Fairtrade products, shoppers are ensuring that disadvantaged producers and workers receive a Fairtrade premium for investment in economic, social and environmental products. These premiums can enable farmers to implement a range of environmental protection programmes which will contribute to the range of solutions needed to address climate change and ultimately benefit all of us. To give two examples, tea workers in India have invested some of their Fairtrade premium into replacing the traditional wood-burning heating with a solar-panelled system. Coffee farmers in Costa Rica have used the premium to replant trees to prevent soil erosion and have invested in environmentally friendly ovens, fuelled by recycled coffee hulls and the dried shells of macadamia nuts. This means that they no longer need to cut forest trees and so can preserve the rainforest and the oxygen they produce

▷ **Should the Fairtrade Foundation refuse to certify products that have been air freighted? Should Fairtrade products carry additional labels to show whether or not they've been air freighted, as some supermarkets are now suggesting?**

We believe that it would be unfair and inappropriate to penalise poor producers and workers who depend upon exporting their produce to international markets by withholding the FAIRTRADE Mark on the basis of incomplete evidence, particularly when they have made the effort of putting in place necessary changes to comply with the international Fairtrade standards.

There is also the issue of equity for developing countries. Annual carbon emissions per person are 200kg in Kenya and 172kg in Bangladesh compared to

21,000 kg in the US and 9,000kg in the UK. Under these circumstances to deny poorer countries and people the opportunity to develop when their overall carbon footprint is so low is simply morally unfair and politically unsustainable. As those most to blame, rich countries have the responsibility to demonstrate leadership and cut their own emissions before expecting poorer nations to bear the brunt of change by reducing their relatively small emissions.

To deny poorer countries and people the opportunity to develop when their overall carbon footprint is so low is simply morally unfair and politically unsustainable.

▷ **Some people say 'buy local' rather than 'buy Fairtrade'. What is the Fairtrade Foundation's response?**

Fairtrade focuses by and large on tropical agricultural products such as coffee and bananas that can't be grown in temperate climates or products that can't be grown in sufficient quantities in the EU, *e.g.* grapes and oranges. For some items such as honey and flowers, local supply is not able to meet the total demand— it has been estimated that both UK flowers and honey account for less than one-third of the UK market— and so imports are necessary to keep up with consumers' shopping preferences. Other products, such as apples, are seasonal in both the UK and places like South Africa, and for as long as shoppers want to buy apples out of season, there is a demand for fruit from other countries.

▷ **Shouldn't people in Africa be growing food for themselves rather than be encouraged to grow products like flowers for export?**

The livelihoods of 2.6 billion people worldwide depend on agriculture. Most of them are poor farming families in the developing world and strengthening small-scale agriculture and related rural industries can bring vital benefits to their communities and the wider economy. Under the right conditions, agricultural exports can act as a dynamic force for poverty reduction, providing small farmers with opportunities to generate income, diversify their livelihoods, provide work for others in the community and reduce vulnerability. It also means that small farmers and their families are less likely to be forced to leave their land and migrate to urban centres in search of employment.

In parts of East Africa and Central America, small farmers have succeeded in entering markets for high-value-added fruit and vegetable exports.

In parts of East Africa and Central America, small farmers have succeeded in entering markets for high-value-added fruit and vegetable exports. Research shows that export agriculture has played a critical role in reducing rural poverty in Uganda and Vietnam. Far from displacing food production, export success in both countries has gone hand in hand with an increase in output of basic food staples.This doesn't mean that agricultural trade automatically generates

Picture 1. Small-scale agricultural producers in Kenya (*Courtesy Sue Stolton, Equilibrium Research*)

poverty reduction benefits. Small farmers often lack access to the land, capital, information, and marketing infrastructure needed to take advantage of export opportunities and this is where Fairtrade can provide a vital lifeline for marginalised farmers and their families. Once they are selling to Fairtrade markets, the increased stability, better price and support to farmers' organisations means they can implement their own projects to improve food security and nutrition for their own families and the wider community. As just one example, women cotton farmers in Mali have described how the better price they receive for their cotton has enabled them to buy vegetable seeds to feed their families. They have also used the Fairtrade premium to build a warehouse to store not just cotton but also maize and sorghum seeds for their own consumption and sale to local markets. The warehouse also acts as a food bank for families between harvest times when cash income is scarce to mitigate food security worries.

▷ **Aren't large-scale horticultural farms in Africa all owned by big foreign companies? Are Africans benefiting at all from this? Should we only buy the produce from Africa that carries the Fairtrade label?**

Fairtrade is about getting a better deal for producers and workers at the bottom of supply chains who are marginalised by international trading rules. While primarily known for supporting small farmers, Fairtrade has for many years engaged with plantations such as tea estates, whether foreign-owned or not, to bring benefits to the hired workforce. The reality is that these farms can provide much-needed employment opportunities for workers who have few or no other options open to them. Many of the flower workers on Kenyan flower farms for example have migrated specifically to the areas where the farms are located to find work and have limited alternative employment options. However it is also clear that workers on many plantations are amongst the most powerless people in global supply chains and so they also need the benefits that Fairtrade can bring such as decent working conditions, health and safety provision and access to trade unions. The Fairtrade standards for these types of farms are aimed at reinforcing international labour standards, as well as ensuring additional resources that the workers themselves can invest in projects to improve their own situation and services available to them. The Fairtrade premium has been used by farm workers to set up revolving loan schemes to fund small businesses, improve education and healthcare and build community centres.

Fairtrade is about getting a better deal for producers and workers at the bottom of supply chains who are marginalised by international trading rules.

This article was extracted from a longer piece by Fairtrade produced in response to concern about climate change. See http://www.fairtrade.org.uk/ for more information.

Notes

1 Vringer and Blok 2000.

2 Vringer and Blok 2000.

3 Williams 2007.

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Vringer, K. and K. Blok, The Energy Requirement of Cut Flowers and Consumer Options to Reduce It, *Resources, Conservation and Recycling* **28,** 2000: 3-28.

Williams, A., *Comparative study of cut roses for the British market produced in Kenya and the Netherlands*, Cranfield University, 2007

Getting to zero— defining corporate carbon neutrality

Clean Air-Cool Planet and Forum for the Future

Abstract. The concept of carbon neutrality is surrounded by controversy. But according to the two NGOs, Clean Air-Cool Planet and Forum for the Future, it remains a worthwhile goal for companies that seek to demonstrate climate leadership. For carbon neutrality claims to have any credence however, greater consensus is needed about the basis of such claims, along with more consistent approaches to application. This article comprises an excerpt from a recent report from the two organisations, *Getting to Zero: Defining Corporate Carbon Neutrality*, which tried to move towards such a consensus. Through exploration of a number of the claims that have been made so far, the organisations make a series of recommendations about what should lie behind any declaration of neutrality. It is intended to serve as a guide both to companies that have used— or are considering using— the language of neutrality; and to stakeholders that are trying to evaluate whether a particular claim is justified or not.

The concept of "carbon neutrality"

As concerns about climate change grow, the concept of "carbon neutrality" has captured the corporate imagination, being embraced by organisations as diverse as airlines, ice-cream makers and reinsurance giants. But this apparently simple concept— that a company, or one of its products or services, can have no net impact on climate— is surrounded by controversy, and a wide range of assumptions and actions lie behind the claims that have been made.

The concept of "carbon neutrality" has captured the corporate imagination, being embraced by organisations as diverse as airlines, ice-cream makers and reinsurance giants.

The ambition to have zero net impact on climate is a powerful one, and a goal of neutrality has the potential to drive ongoing change within an organisation— while also promoting shared responsibility with suppliers and customers for emissions beyond the organisation's immediate control. Greater consensus about what should lie behind any claim of neutrality, and more consistent application by those companies that have made claims, is, however, required for it to reach its potential.

Two key questions frame the debate about neutrality. Firstly, which emissions should an organisation accept responsibility for (the "boundary" question)? Should the organisation focus simply on the direct emissions caused by its operations? Or is it also responsible for neutralizing some or all of the emissions that arise in its supply chain or from the use of its products? Secondly, what strategy should an organisation use to achieve neutrality? How far must a company go in actually reducing its emissions baseline? And to what extent can neutrality be achieved through the purchase of carbon offsets or "green" energy?

Related to these are further questions about if and how any claim of neutrality should be linked to the organisation's broader performance on climate. A claim of climate neutrality is, after all, a statement of climate leadership. Should we therefore expect organisations that

A claim of climate neutrality is, after all, a statement of climate leadership.

claim neutrality to demonstrate broader climate leadership? As more and more companies make claims of neutrality we can expect increasing scrutiny to be paid to all these questions. Transparency, therefore, becomes an overarching issue in determining the credibility of any statement regarding neutrality.

Setting boundaries

Determining where exactly a company's carbon responsibilities begin and end is not easy. Regulated emission reduction schemes offer some guidance, but these tend to set boundaries as narrowly as possible, typically covering only Scope 1 and 2 emissions (see box 1) as defined by the Greenhouse Gas Protocol. The very nature of a claim of neutrality however— as an absolute assertion of zero net impact— implies that a broad boundary has been embraced. The boundary setting process for a neutrality claim is, therefore, better informed by that used in corporate sustainability reporting— where companies consider their broader indirect (or Scope 3) emissions alongside their more direct emissions. There might even be some legal risk to embracing a narrow boundary, with regulatory bodies such as the Advertising Standards Authority in the UK advising against companies making absolute claims of any kind.

Box 1. Greenhouse Gas Protocol Scopes

The concept of "scopes" is outlined in the Greenhouse Gas Protocol (GHG Protocol)[1]. This protocol, developed by the World Resources Institute and the World Business Council for Sustainable Development, has become the most widely used tool for quantifying greenhouse gas emissions. It classifies emissions as follows:

Scope 1: direct greenhouse gas emissions, from sources owned or controlled by the company;

Scope 2: indirect emissions, caused by the generation of purchased electricity consumed by the company;

Scope 3: other indirect emissions that are a consequence of the company's activities, but are from sources neither owned nor controlled by the company. These include business travel, outsourced activities, the extraction and processing of purchased materials, and the use of sold products and services.

Embracing a broad boundary poses a number of practical problems however. Measuring emissions up and down the value-chain remains an inexact science, and attempting to trace every last gram of carbon uses up time and resources more valuably spent understanding— and reducing— a company's most significant emissions.

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One company's Scope 3 emissions are also inevitably another company's Scope 1 emissions, and questions can be raised about the appropriateness of one company taking on responsibility for another company's direct emissions. Unfortunately, there is no clear boundary-setting precedent to be found in the claims that have been made so far. Most companies that have embraced the concept have adopted relatively narrow boundaries (focused on Scope 1 and 2 emissions, along with business travel from Scope 3), but some have accepted responsibility for a variety of indirect emissions.

Expectations are also likely to change over time as our understanding of emissions throughout the value-chain improves and carbon footprinting methodologies develop. Rather than representing a fixed goal, therefore, it seems more sensible to view achieving carbon neutrality as a dynamic, ongoing process. Transparency about what is, and what is not, covered by any claim is, therefore, absolutely essential.

It seems sensible to view achieving carbon neutrality as a dynamic, ongoing process.

A credible strategy

Once an organisation has established an inventory of emissions and set an appropriate boundary, the next key question surrounds the strategy that should be used to achieve neutrality. Many companies have embraced the concept of a hierarchy of carbon reduction options in developing their neutrality strategies. Forum for the Future's own hierarchy prioritises the avoidance of emissions, their reduction through energy efficiency, the replacement of high-carbon energy sources with low- or zero-carbon alternatives, and then the use of high quality carbon offsets, as the preferred means for an organisation to address its contribution to climate change.

Offsetting will play an important role in any neutrality strategy— if only for the simple fact that it is currently impossible to become carbon neutral without it. Clean Air-Cool Planet and Forum for the Future believe that high-quality offsets do result in genuine emissions reductions. However, the emphasis of any neutrality strategy must be to reduce baseline emissions, and organisations should, therefore, look for permanent emissions reduction options higher up the hierarchy.

Because a claim of neutrality is essentially an assertion of leadership, companies that make such claims should be able to demonstrate broad climate leadership. While it would be counterproductive to insist that only those companies that can demonstrate best-in-sector emissions relative to their peers can declare themselves carbon neutral, claims from energy inefficient companies— or from companies that are inherently carbon-intensive— will inevitably engender scepticism. Claims of neutrality should meet the spirit, as well as the letter, of the claim.

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A Definition

After careful consideration of the concept of carbon neutrality, we believe that:

True corporate carbon neutrality means there is no net increase of atmospheric greenhouse gases from the existence of the company – or from a clearly-defined part of the company that accounts for a significant portion of the company's overall climate impact. If a company makes a claim regarding a specific product, then there should be no net increase of atmospheric greenhouse gases from the existence of that product.

The process for achieving neutrality should begin with an inventory of the company's entire carbon footprint (or a full life-cycle analysis of a particular product) and the setting of a clear boundary. The company should then embrace a neutralisation strategy that prioritises the avoidance of emissions, their reduction through energy efficiency, the replacement of high-carbon energy sources with low- or zero-carbon alternatives, and then the use of high-quality carbon offsets.

Every claim must be backed up by easily accessible, clearly communicated

information regarding the company's full carbon footprint; the boundaries it has applied; and the strategy that has been embraced to achieve neutrality.

Recommendations

The many questions raised above, and the variety of approaches adopted by different companies, make it difficult to set out definitive guidance as to what should lie behind a claim of neutrality. Nevertheless, in an attempt to highlight best practice, we offer the following advice to companies that have made claims— or who are considering making claims.

Every claim must be backed up by easily accessible, clearly communicated information regarding the company's full carbon footprint; the boundaries it has applied; and the strategy that has been embraced to achieve neutrality.

1. Embrace a stretching boundary

The key tension surrounding any claim of neutrality remains reconciling the absolute nature of the claim— implying zero net impact— with a practical boundary-setting process. In the spirit of the term, we recommend that companies accept that claiming neutrality implies some responsibility to consider and address broader value-chain emissions. This is not to suggest that companies accept legal responsibility for the direct emissions of others, but rather that indirect emissions be explicitly considered as part of the neutrality process.

2. Demonstrate a broad understanding of your entire carbon footprint prior to making any claim of neutrality— and ensure that your claim covers a relatively significant set of emissions

A transparent understanding of the company's full carbon footprint is essential as a prerequisite for any claim of neutrality, regardless of what boundary is set. This does not mean that companies should chase every gram of carbon in their value-chain, but rather that they are able to broadly disclose and discuss where their biggest indirect emissions lie. Questions remain about the appropriateness of a company making a limited claim of neutrality (*i.e.*, regarding its "manufacturing operations") when the associated emissions are relatively trivial compared to other emissions in its value-chain. If companies claim neutrality for relatively insignificant sets of emissions, the concept risks losing its legitimacy.

3. Exhibit caution in making blanket corporate-wide claims of neutrality

Any claim of neutrality brings with it some risk, but unqualified claims are riskier than others. Unless the company in question can clearly demonstrate a full understanding and subsequent "neutralisation" of its entire climate footprint, blanket claims are likely to mislead and should not be made.

Picture 1. Marks & Spencer has goals to achieve a 20 percent improvement in fuel efficiency and in energy use in its UK warehouses (*Courtesy Nigel Dudley, Equilibrium Research*)

4. Consider whether a claim of neutrality will resonate with your stakeholders

Some companies will always find it difficult to convince stakeholders of the sincerity of any neutrality claim— either because the use of their product or service leads to emissions that dwarf their direct emissions, or because they are seen as fundamentally unsustainable. For those companies, we recommend that they avoid the use of the language of carbon neutrality, and instead seek to show climate change leadership in other ways.

5. Use the carbon management hierarchy to inform your neutralisation strategy

The strategy used to achieve neutrality should be informed by a hierarchy that prioritises the avoidance of emissions, their reduction through energy efficiency, the replacement of high-carbon energy sources with low- or zero-carbon alternatives, and then the use of high-quality carbon offsets. Offsetting will play an important role in any neutrality strategy, but a claim of neutrality will ultimately be judged on the company in question being able to demonstrate a declining emissions baseline.

6. Be completely transparent

Given the complexity of the issues and assumptions surrounding any claim of neutrality, absolute transparency regarding all aspects of the claim is essential. Every claim should be backed up by easily accessible information regarding the company's full carbon footprint; the boundaries it has applied; and the strategy that has been embraced to achieve neutrality.

7. Exhibit and sustain broad leadership on climate change

While it would be technically feasible for a company to achieve neutrality through a strategy of 100 percent offsetting, this would not represent the spirit of leadership embedded in the term. True climate leadership is indicated by companies rethinking their business strategy; engaging deeply with their suppliers, customers and peers; and developing products and services that will thrive in, and help bring about, a low-carbon economy. While linking such actions directly to a claim of neutrality remains problematic, any company that wishes to position itself as a leader on climate change needs to embrace them.

True climate leadership is indicated by companies rethinking their business strategy; engaging deeply with their suppliers, customers and peers; and developing products and services that will thrive in, and help bring about, a low-carbon economy.

8. Treat neutrality as a long-term commitment— and an ongoing, dynamic challenge

As stakeholder interest in full life-cycle emissions grows— and methodologies for measuring and allocating responsibility for such emissions develop— we can expect the rules of the game for claims of neutrality to change. Companies should embrace this challenge and use any commitment, or aspiration, to neutrality to drive ongoing change. A commitment to neutrality must therefore be a long-term commitment.

Bill Burtis (bburtis@cleanair-coolplanet.org) is Manager of Communications and Special Projects for US NGO the Clean Air-Cool Planet (CA-CP) whose Climate Policy Center develops and promotes economically efficient and innovative climate policies.
Iain Watt (i.watt@forumforthefuture.org.uk) is Principal Sustainability Advisor at Forum for the Future and coordinates the Forum Business Programme's activity on climate change.

Notes

1 www.ghgprotocol.org

Box 2. Company Case Studies

Marks & Spencer's

Climate change is one of the "Five Pillars" in Plan A— Marks & Spencer's five-year, 100-point "eco" plan to tackle "some of the biggest challenges facing our business and our world." As part of this plan, Marks & Spencer has a goal to make its UK and Irish operations carbon neutral by 2012. The company also identifies developing "plans to reduce the carbon footprint of our supply chains; and to continue finding ways to engage our customers in tackling climate change" as main challenges for 2008.

Marks & Spencer has developed a carbon footprint of its entire food business. This quantifies the emissions generated by the production of raw materials, manufacturing, transport, sale, use and final disposal of the food the company sells. The company has announced it will set targets to reduce this footprint— and has committed to doubling regional food sourcing, and offsetting the CO_2 emissions from air-freighted food within 12 months.

To meet its specific carbon neutral goal, the company has prioritised reducing its energy consumption and increasing its use of renewable energy, and states it will only use offsetting as a "last resort." In the last four years, the company has reduced CO_2 emissions from its UK and Irish stores by 30 percent per square foot. It has also reduced emissions from its lorries by 25 percent, despite opening 130 new stores.

Marks & Spencer has goals to achieve a 20 percent improvement in fuel efficiency and in energy use in its UK warehouses; to reduce the amount of energy used in UK and Irish stores by a further 25 percent; and to buy or generate 100 percent "green" electricity for its stores, offices and distribution centres. The company also plans to open a model "green" clothing factory.

As well as tackling its supply chain emissions, Marks & Spencer states its intent to help its customers reduce their emissions. It has committed to developing low carbon products and encourages customers to wash clothing at 30°C by printing the message "'Think Climate - Wash at 30°C" on the garment care labels of its clothing.

Ben & Jerry's

Ben & Jerry's bid to "Lick Global Warming" began in the USA in 2002, with a target to reduce carbon dioxide emissions from manufacturing operations by 10 percent by 2007. Its operations there now produce 32 percent less carbon dioxide emissions per gallon of ice cream than in 2002. In Europe the company has achieved a 26 percent improvement in energy efficiency during production since 2004, and an 89 percent reduction of climate impact during production as a result of a switch to "green" electricity.

In April 2007, Ben & Jerry's went "Climate Neutral from cow to cone on all our flavours produced in Europe." In analyzing its associated climate "hoofprint," Ben & Jerry's includes emissions from dairy farming; the sourcing of ingredients; factory production; packaging; transport; and freezers with a range of reduction projects across each part of the supply chain.

The company's methodology for achieving neutrality uses a three step approach focused on maximizing energy efficiency, moving to renewable energy sources and offsetting unavoidable climate impact by investing in Gold Standard Verified Emission Reduction certificates. Having already reduced its climate impact by 10 percent, Ben & Jerry's is committing 2.4 million euros over five years to reduce it by a further 10 percent.

Ben & Jerry's has a "Sustainable Dairy" program that actively works to reduce the climate impact of dairy farming by reducing the use of fertilisers, concentrate and energy used on farms, as well as converting farmers to green energy. The company has also established the Ben & Jerry's Climate Change College to support young environmental entrepreneurs.

Mountain area research and management integrated approaches

By Martin F. Price (ed.)
Earthscan (London), 2007. 302pp.

Short review by David Pitt

One of the essential elements in understanding (and even more coping with) climate change is for all the actors and stakeholders to work together. This book which arises from a conference at the Banff Centre Canada, under the direction of Martin Price (University of Highlands and Islands Scotland), is an excellent compilation (with many very instructive case studies) of how scientists, legislators and local people can cooperate, in the quest for sustainable development. Mountains (and the cryosphere generally) has long been the ecosystem where cutting edge debates have taken place especially about the vital issue of melting as a result of greenhouse warming, but also the periodic cooling too as may be happening this year as a result of La Nina.

The nub of the integrated approach analysed in the book is the so called 13 principles which revolve around common sense, transparent sharing and mutual trust in networks starting at the planning stage of research, and proceeding through to policies and implementation. Best of all there is a "bottom up" thrust which links the local to the global. The flagship chapter from the Messerlis at the University of Bern describes how the famous Obergurgl work in an Alpine valley, (the template for much of UNESCO's Man and the Biosphere project) led to the transformation of interdisciplinary into *transdisciplinary* approaches applied to development policy and conservation at every step. Tradition, which governments from colonial times have largely dismissed, becomes central including adaptation to climate change as Ramkrishnan from the Jawaharlal Nehru University in India shows in the Himalaya using the illustration of the Jhum (slash and burn) system. Matson (Northern Arizona University) and Merrill (Institute of Landscape Ecology Idaho) argue that a unity of purpose as well as a theoretical focus might best be achieved by concentrating on a pressing problem, a point well demonstrated in the essay on innovation in watershed management by Brown and Schreier from the University of British Columbia.

After the general chapters there are series of case studies from around the world which extol the virtues of the integrated approach. Of particular interest is the chapter by Fagre, Petersen and McKenzie from the CLIMET project (Climate Landscape Interactions - Mountain Ecosystem Transect) which has many lessons for policy in protected areas. The CLIMET work followed a gradient in the Rockies, from coast to continental, moving through the national parks of Olympic, North Cascade to Glacier Waterton Lakes on the USA Canada Border. The last is a very useful success story which should be widely imitated since it is a rare peace park as well as a World Heritage site. A vital lesson is that conservation depends often on conflict resolution particularly across often irrational (and not only in ecological terms) national boundaries.

The book is well illustrated with succinct boxes, figures and tables and has very full bibliographies. Clearly a necessary text for the future there are nonetheless some points that should be made to make research and action ever more relevant for conservation and climate change policy (even if they were not in the brief of the authors). First and foremost ways need to be found urgently to bridge the gap between mountain and polar people. The ice *problematique* and its resolution is common to the whole cryopshere whether at altitude or latitude. A major issue, which has not been well addressed in either the conservation or climate communities (which themselves must work better together) is the resurgence of what can only be called an ugly nationalism based on a mercantilistic scramble for resources, if not a new cold war. Nations seem ready to carve up the Arctic and Antarctic both the oceans and much ice, hitherto regarded as an international preserve thus posing a very real threat to present and most of all potential protected areas if not the whole ethic of sustainable development. This together with an emerging and largely unrestrained capitalism is a deadly combination. The ultimate logic of a fully integrated approach must surely be towards more planning, even a law of the ice, or a cryosphere authority involving NGOs alongside governments, where the "constituencies" are ecosystems and the many thousands (often indigenous peoples) who live therein.

David Pitt (pittdelacure@bluewin.ch) is Coordinator (Mountains) IUCN/CEESP.

Climate Change and Trade on the Road to Copenhagen

Information Note Number 6, MAY 2008 - and up-coming policy paper

International Centre for Trade and Sustainable Development (ICTSD)

Produced by ICTSD for the Danish Ministry of Foreign Affairs, May 2008

The global effort to address climate change will require a fundamental transformation of our economies and the ways we use energy. The current phase of negotiations under the UN Framework Convention on Climate Change (UNFCCC) is set to lay the groundwork for the necessary policy reform, and will require concerted and cooperative efforts by individual countries, the business sector and civil society. Innovation— both with regard to the technologies of the future and the regulatory frameworks used to usher them in at the scale needed— will be key to success.

In this context, and as negotiations accelerate in the lead-up to the Copenhagen meeting in December 2009 and beyond, trade-related issues have emerged as elements of the discussions and trade-offs.

Many believe that the design of an effective climate change regime will imperatively include the use of trade policy tools. What specific tools constitute first best options,


INFORMATION NOTE NUMBER 8, MAY 2008

Climate Change and Trade on the Road to Copenhagen

Summary for Policymakers

Produced by ICTSD for the Danish Ministry of Foreign Affairs, May 2008

The global effort to address climate change will require a fundamental transformation of our economies and the ways we use energy. The current phase of negotiations under the UN Framework Convention on Climate Change (UNFCCC) is set to lay the groundwork for the necessary policy reform, and will require concerted and cooperative efforts by individual countries, the business sector and civil society. Innovation - both with regard to the technologies of the future and the regulatory frameworks used to usher them in at the scale needed - will be key to success.

In this context, and as negotiations accelerate in the lead-up to the Copenhagen meeting in December 2009 and beyond, trade-related issues have emerged as elements of the discussions and trade-offs. Many believe that the design of an effective climate change regime will imperatively include the use of trade policy tools. What specific tools constitute first best options, whether these tools need to be incorporated into a global climate change regime and if so, how best to go about it, are questions that the relevant policy communities need to navigate. They also need to consider whether there are other ways in which trade policy and existing regimes can be made supportive of climate change mitigation and adaptation efforts. In addition, some of the issues within the future climate regime will have direct repercussions in the trade realm, and need to be well understood and prepared for. In order to contribute to the challenge, this paper provides information on the most salient and pressing policy linkages. It addresses issues in the climate-trade interface that are relatively well known and emerging areas that need to be further researched.

The paper starts by focusing on competitiveness issues, which are at the centre of the current climate change and trade discussion. Countries are concerned that by taking on climate change commitments, they will put their industries - at least the energy and carbon-intensive ones - at a disadvantage on the international marketplace. The paper discusses the environmental, social and economic aspects of this debate. It then touches on proposed responses, such as erecting 'carbon barriers' against imports or the crafting of international sectoral agreements.

ICTSD

International Centre for Trade and Sustainable Development

The paper starts by focusing on competitiveness issues, which are at the centre of the current climate change and trade discussion. The paper discusses the environmental, social and economic aspects of this debate. It then touches on proposed responses, such as erecting 'carbon barriers' against imports or the crafting of international sectoral agreements. The paper provides information on the concept of 'embodied' carbon in trade. This refers to carbon emissions related to the production of a good, which are accounted for in the country of manufacture, not consumption, in national carbon inventories under the UNFCCC. The paper then discusses carbon labelling, a concept and practice at an early phase of development that could provide consumers with information on carbon emissions through the full lifecycle of traded products. Rapid global diffusion of clean technologies will be key to climate change mitigation. Two trade-related issues in this context are addressed— first, the potential for bringing down tariffs on environmental goods and services in the current WTO Doha Round; and second, the role of trade and trade rules with regard to technology transfer more generally. It focuses on intellectual property issues for low-carbon and mitigation technologies, a matter that is already emerging as a political bone of contention. Section 4 of the paper very briefly discusses energy and trade, given the cross-cutting nature of this topic. Section 5 focuses on the complex and multifaceted linkages between trade and land use, land-use change and forestry (LULUCF). The section includes a brief summary of some of the issues underlying the biofuels controversy. This defiant area will require further exploration.

The nuts and bolts of trade— the physical transport of goods around the world by water, land, and air— has until recently been off the radar screen of most climate policymakers. Section 6 of the paper provides an overview of current discussions in this area and their likely indirect implications for trade and climate mitigation. Finally, the paper provides an exploratory overview of the linkages between climate change adaptation and trade. More work is needed to shed light and explore possible needs for policy intervention in this area.

As a further contribution to analytical thinking on the linkages between trade and climate change on the road to Copenhagen 2009, ICTSD will be releasing a policy paper on trade and climate change providing an in-depth analysis of key policy issues likely to be part of the economic architecture a post-2012 global climate agreement.

Liberalisation of trade in environmental goods for climate change mitigation: the sustainable development context

International Centre for Trade and Sustainable Development (ICTSD)

The Stern Review on the economics of climate change has highlighted the potential contribution trade liberalisation in clean technologies could make to climate change mitigation. Such trade liberalisation could contribute positively towards moving economies onto "low-carbon" trajectories to the extent that it drives diffusion and access to lowcarbon and energy-efficient technologies as well as to renewable sources of energy.

Trade is an important channel for the diffusion of many climate mitigation technologies and goods. Few countries have the domestic capacities or know-how to produce all that they need. This is particularly true for developing countries, and although building domestic capacities may be their long-term goal, trade liberalisation can provide rapid access to key technologies. Trade liberalisation-whether locked in through negotiations at the WTO or elsewhere, or undertaken autonomously-can also lower the costs of environmental goods by allowing consumers (industries or households) to purchase them at world market prices.

A 2007 World Bank study, *International Trade and Climate Change*, points to the potential for liberalisation in the area of low-carbon goods to lead to real increases in trade flows. According to Bank estimates, the removal of tariffs for four basic clean energy technologies (wind, solar, clean coal and efficient lighting) in 18 developing countries with high greenhouse gas emissions would result in trade gains of up to seven per cent. The removal of both tariffs and non-tariff barriers could boost trade by as much as 13 per cent. The net effect would, however, vary across technologies and across countries, depending on existing barriers and the import elasticities of demand.

Coupled with appropriate supportive measures, trade liberalisation of climate technologies can also contribute towards fulfilling the technology transfer mandates contained within the UNFCCC. Similarly, trade liberalisation can complement negotiations within the WTO Working Group on Trade and Transfer of Technology, which is mandated to "examine the relationship between trade and transfer of technology, and of any possible recommendations on steps that might be taken within the mandate of the WTO to increase flows of technology to developing countries."

This ICTSD paper surveys the key issues surrounding liberalised trade in low-carbon goods. It begins with an overview of progress to date in the WTO's negotiations on environmental goods and services. The paper then asks what the limitations of the liberalisation approach are. If the final objective is contributing to climate change mitigation by increasing the dissemination of low-carbon goods and technologies (while also fostering an open multilateral system of trade), then are there other efforts that need to be considered as necessary or desirable complements to lowering tariff barriers? Clearly, trade barriers are only one of an array of factors from fiscal incentives, the nature of investment frameworks, availability of finance and intellectual property-rights-related costs that determine access to and affordability of climate mitigation technologies. To conclude, the paper asks what modalities are available for liberalizing trade in low-carbon goods, both within and outside the WTO.

Climate Change, Technology Transfer and Intellectual Property Rights

International Centre for Trade and Sustainable Development (ICTSD)

Technological solutions are imperative in meeting the challenges of climate change. A critical factor in greenhouse gas emissions, technology is also fundamental to enhancing existing abilities and lowering the costs of reducing these emissions.

In this context, the UNFCCC and the Kyoto Protocol require Parties to promote and cooperate in the development and diffusion, including transfer, of technologies that control, reduce or prevent GHG emissions. Enhanced action on technology development and transfer will also be central in enabling the full, effective and sustained implementation of the UNFCCC beyond 2012, as recognised in the Bali Action Plan.

As a legal and policy measure, intellectual property is potentially both an incentive and an obstacle to the transfer of technology. IP rights, as private rights, have been established and conceived as instruments to promote innovation and the dissemination of knowledge. Yet an excessive scope or level of protection of IP rights might stifle innovation or make access to knowledge more difficult or costly. In any policy context, including climate change, a balance between the protection of IP rights and the promotion of public objectives, such as the transfer of technology, is necessary.

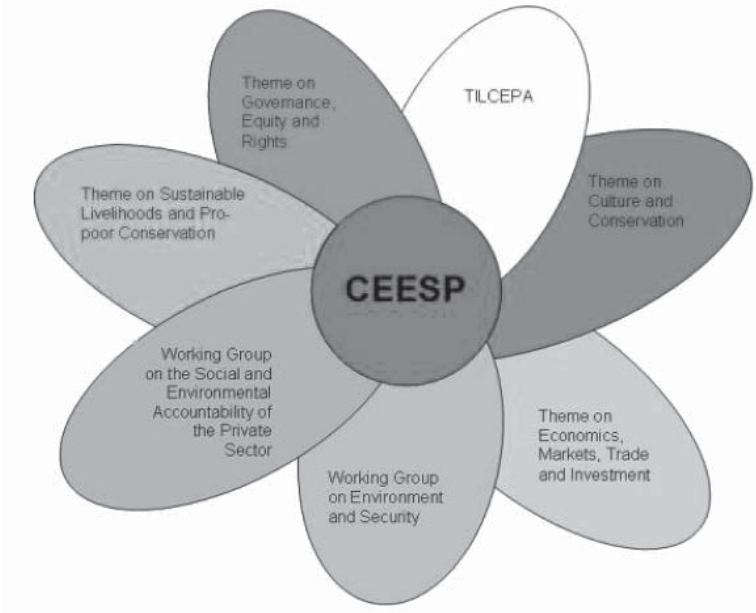
From discussions on the Bali Action Plan, it would seem that UNFCCC Parties disagree on whether such a balance exists under the current legal and policy framework governing IP and technology as it relates to climate change. As a result, they also appear to have diverse positions as to whether additional measures are necessary in the international IP system and beyond to ensure the transfer of the technologies needed for climate change mitigation and adaptation. The WTO Agreement on Trade-related Aspects of Intellectual Property Rights (TRIPS Agreement), which introduced IP rights into the international trading system and remains the most comprehensive international agreement on the topic, seems to have been of particular interest and concern in ongoing discussions on the transfer of climate-related technologies.

Increased research and analysis on the links between transfer of technology and IP will be fundamental to overcome these apparent differences, and to develop effective technology-related international cooperative action on climate change. Given the complexity of the topic, this ICTSD paper does not aim to comprehensively address the topic, but merely to provide an initial review of selected issues. In the context of ongoing work on trade and climate change, the objective of this paper is thus to briefly look at the relationship between IP and the transfer of climate-related technologies and outline some of the existing and prospective measures, primarily in the TRIPS Agreement, that could be considered in support of a post-Kyoto climate regime.

CEESP Activities 2005 - 2008

The mission of the IUCN Commission on Environmental, Economic and Social Policy (CEESP), adopted at the World Conservation Congress in Bangkok, is to "contribute to the IUCN Mission by providing insights and expertise on ways to harmonise biodiversity conservation with the crucial socioeconomic and cultural concerns of human communities, such as livelihoods, poverty eradication, development, equity, human rights, cultural identity, security and the fair and effective governance of natural resources." It was decided at the congress in Bangkok that CEESP would do this through four themes:

- Governance of natural resources, equity and human rights (TGER)
- Sustainable Livelihoods and Pro-poor Conservation (TSL)
- Culture and Conservation (TCC)
- Economics, Markets, Trade and Investment (TEMTI)
- Indigenous Peoples, Local Communities, Equity and Protected Areas (TILCEPA, jointly with WCPA),
- and two cross-cutting priorities:
- Social and Environmental Accountability of the Private Sector (SEAPRISE)
- Environment and Security (E&S)



With respect to prior years, the work of CEESP thus comprised some complementary thematic directions, while continuing to consolidate and build on the strong foundations of membership and expertise built in the previous quadrennial. The mission of CEESP is shared by all it working groups and themes, which thematically grow from and coalesce around the vision and core values of the Commission as illustrated by the corolla model to the right:

CEESP members deal with some of the most complex subjects that conservation faces today, in particular the dilemmas at the interface among governance of natural resources, equity (including gender equity) and human rights, and the questions around the economic and social root causes of environmental degradation. In this, they closely adhered to, and promoted, the vision and mission of IUCN.

Governance, Equity and Rights

In the 2005-2008 quadrennium, the Theme on Governance, Equity and Rights (TGER) built on the long-standing expertise of Commission members on co-management issues (developed by the Co-management Working Group, active since 1996) and extended its work to the broader field of governance of natural resources. The group also expanded its membership to some 600 people from more than 40 countries.

A first result of the group's work is the greatly enhanced visibility and knowledge about **governance of natural resources and protected areas** achieved through dedicated events and publications distributed at international meetings (*e.g.* at the **Convention on Biological Diversity**) and through topical analyses and **provision of technical support** at the local and national levels (*e.g.* in Australia, Cambodia, China, France, Iran, Italy, Madagascar, Malaysia, Morocco, Nepal, Philippines, Senegal, Thailand and Vietnam). Just one example: the government of **Madagascar** has been structuring its expanded system of protected areas on the **IUCN Matrix** developed by TGER/TILCEPA advisors. Regarding publications, the following:

http://cmsdata.iucn.org/downloads/governance_of_protected_areas_for_cbd_pow_briefing_note_08_1.pdf is the most comprehensive available document summarising governance of protected areas issues for policy makers and practitioners alike.

The group members have been in charge of organizing several international technical events, for instance the **Sharing Stewardship Stream at the First Marine Protected Areas Congress**, a symposium on **innovative governance** at the Society for Conservation Biology, a working group session at the Almeria Categories Summit, workshops at the Bariloche meeting on protected areas in Latin America, side events on Community Conserved Areas and governance issues at meetings of the **CBD Working Group on Protected Areas** (Montecatini, 2005 and Rome, 2008) and side events at **CBD COP 8 and 9** (Cutiriba 2006 and Bonn 2008), and many more.

One of the many training courses run with the technical support of TGER.

One of the proud "distinctive initiatives" of TGER are **Regional Learning Networks** (RLNs), whereby small multi-stakeholder groups from different countries in the same region gather regularly to learn form each other's experience and initiatives. The small teams report to each others on lessons learned on a specific topic, go through some formal training and field visits together, reflect on what they can improve in their work on the basis of their joint experience and help one

another to plan how to put that into practice. TGER has been for several years providing technical support to several such RLNs, including one on **co-management of marine protected areas in West Africa**, in cooperation with the Regional Programme on Marine and Coastal Conservation, and one on **co-management of protected areas with indigenous peoples in South East Asia**, in cooperation with the Asian People Pact Foundation (AIPP) and Swedbio.

Social communication for natural forest co-management in Sichuan, China.

Another distinctive signature of the group is participatory action research. In 2007-2008, in collaboration with CIFOR and Yangareko and a Consortium of European partners, TGER promoted in depth processes of **participatory action research on the governance of biodiversity** in Argentina, Bolivia, Ethiopia, Indonesia, Iran, Mongolia Nepal, Niger and Turkey. The results were synthesised in individual reports, a global report of lessons learned and some distilled recommendation for the EU aid policies. As part of that, TGER has also become interested in governance of the landscape/ seascape, and in effective and equitable ways to integrate a variety of management objectives and governance types, and omnipresent change. Taking inspiration from the participatory action research just mentioned, a workshop on the **landscape dynamic mosaic** has been organised for the World Conservation Congress in Barcelona.

In the current quadriennium TGER also initiated a new line of work for IUCN on **Conservation and Human Rights**. As part of this, it produced a dedicated issue of *Policy Matters* on Conservation and Human Rights (372 pages, more than 30 articles), which is a first on the topic. A **symposium at the meeting of the Society for Conservation Biology was also organised in July 2007 in tandem with a** dedicated 3-day **workshop in Baviaanskloof Megareserve (South Africa**), which produced a technical report with recommendations. A working paper collection, including a **discussion paper, example tools and mechanisms, and case studies on rights-based approaches to conservation** was developed with several partners (IUCN, CIFOR, ELP). It will be shared at a related workshop organised at the 2008 World Conservation Congress in Barcelona, and published by the end of 2008. The WCC workshop is part of a full "Journey" about the topic across several events at the Congress. A specific Task Force on the subject has been created and members are expected to meet and strategise further in Barcelona.

Last but not least, TGER has worked very closely with TILCEPA on a large number of initiatives and events on Indigenous and Community Conserved Areas, as reported below.

Indigenous Peoples, Local Communities and Protected Areas

The Strategic Direction on Governance, Communities, Equity and Livelihood Rights in Relation to Protected Areas (TILCEPA) is a joint theme between CEESP and WCPA. Having achieved significant progress at the international policy front—especially with the inclusion of Element 2 on Governance, Equity, Participation and Benefit Sharing in the **CBD Programme of Work (PoW) on Protected Areas**—TILCEPA has focused the quadrennial on the national and local implementation of progressive conservation policies. As an example, TILCEPA has initiated a survey of PoW progress in different countries and developed a database (available at http://www.iccaforum.org).

Also in collaboration with TGER, TILCEPA members have been active in refining the concept of **protected area governance**, through consideration of both "type" and "quality". A number of papers offer a basis for an IUCN position on governance of protected areas, currently included as part of a revised version of the **IUCN Best Practice Guidelines on protected areas categories (and governance types)**. As part of that, TILCEPA and TGER organised **numerous events on governance of protected areas**, one example being the **workshop stream on governance** for the First Marine Protected Areas Congress in Geelong (Australia) in 2005.

TILCEPA has further been working towards Understanding, Strengthening and Promoting **Indigenous and Community Conserved Areas (ICCAs)**. Since 2005, a **survey** has been developed to keep track of **policy/legal developments with respect to ICCAs**. A database of 15 countries is available on a dedicated page also accessible through the ICCA Forum mentioned above. **Regional reviews of ICCA status and needs** were carried out for Eastern Africa, South-West China, the Arctic and Mesoamerica and are underway for the South Pacific, North Africa, the Andes and West Asia. Specific **field-based initiatives to support CCAs** in need were undertaken in Mexico and Rwanda. TILCEPA has supported over **20 grassroots discussions** on ICCAs through a GTZ-funded project. An **international workshop on ICCAs** was organised in Turkey in October 2007, bringing forth the idea of a global alliance in support of ICCAs. The result of these studies and discussions are synthesised in a **Briefing Note** for the World Conservation Congress in Barcelona and an outline of a **Best Practice Guidelines** for the support of Indigenous and Community Conserved Areas. Papers, cases studies and information on various aspects of ICCAs are available from a new dedicated site: http://www.ICCAforum.org.

Co-management of protected areas with indigenous peoples— successful end of training in Thailand.

TILCEPA and TGER promoted the concept of ICCAs at various international meetings, most recently the second meeting of the **Working Group on Protected Areas of the CBD** (Rome,

February 2008) and the 9th Conference of the parties of the CBD (Bonn, May 2008). Several side events and meetings about ICCAs were held at these conferences. At the World Conservation Congress in Barcelona, TILCEPA and TGER are hosting an alliance workshop and a permanent exposition space on ICCAs at the Community Poble, in collaboration with the UNDP Equator Initiative. TILCEPA members have been active throughout the quadriennium as key organisers or resource persons in a number of regional and thematic workshops relating to PAs across various regions.

Participatory mapping in Morocco.

At CBD COP 9, TILCEPA facilitated a major **meeting between Indigenous Peoples, Local Community representatives and representatives of the largest Conservation NGOs**, to begin a dialogue process towards common understanding of various perspectives on conservation and protected areas, common principles and common actions. This dialogue will continue to be facilitated by TILCEPA and a small group of focal points from conservation NGOs and IP/LC representatives. Benchmarks for progress in the dialogue process will be COP 10 in 2010, and the next World Parks Congress in 2013.

A new **TILCEPA Task Force on Protected Areas, Equity and Livelihoods** is addressing social equity and poverty concerns in the conceptualisation and management of protected areas, and is helping to operationalise the recommendation on Protected Areas and Poverty endorsed by the 2003 World Parks Congress. The TF has held **3 regional meetings** and is consolidating its workplan for the next few years.

An **alert system** has been set up, whereby problems with issues of equity and rights in protected area management are followed by members and addressed trough letters and other means. Recent examples include letters sent by the TICLEPA Co-chairs to the President of Ethiopia and the Director of Protected Areas of Nepal.

TILCEPA is also the link point for collaborations between WCPA and the Commission on Environmental Law (CEL). A Task Force is directed to investigating the need to strengthen implementation and enforcement regimes for publicly owned, privately held and community-conserved areas, on a global, regional and national basis.

In mid 2008 TILCEPA initiated a process to identify new Co-chairs for the next quadriennium, and two excellent candidates have been identified through a participatory process.

Social and Environmental Accountability of the Private Sector

The Working Group on the Social and Environmental Accountability of the Private Sector (SEAPRISE) has supported civil society organisations and governments affected by **mining and gas operations** in many countries including Alaska, Gambia, Ghana, Guinea Bissau; Kenya, Lebanon, Mauritania, Nigeria, Peru, Philippines, Senegal, and Tanzania. The group helped organise lesson-learning trips to the Niger River Delta for senior government officials and civil society members from both East and West Africa. These trips were followed by training courses in Guinea Bissau, Kenya, Mauritania and Tanzania. Similar training was also organised in Peru in 2007. To help the training, the SEAPRISE team produced a publication, "Environmental Management of Offshore Oil Development and Maritime Oil Transport" (in English and French with a summary in Portuguese). SEAPRISE also worked with the Governments of Guinea Bissau, Kenya, Mauritania and Tanzania as well as with UNEP-WCMC on spatial planning and mapping. The combination of the training and spatial mapping had a major effect on the way in which a number of countries planned their oil and gas development.

Mining in the Philippines

One of SEAPRISE's biggest successes was its contribution to the 5th meeting of the Nairobi Convention in Johannesburg in November 2007, when 30 National Delegations from East and West Africa agreed to carry out **strategic environmental assessments** prior to allocating any further oil licenses. UNEP congratulated SEAPRISE members for their support during the meeting.

In response to a request from members in the Philippines and from the Catholic Bishops, SEPARISE provided technical support to a team led by Claire Short (MP and former UK Minister for Overseas Development), including a visit to the Philippines and the production of a report: "**Mining in the Philippines, Concerns and Conflicts**". The report was presented in Manila and circulated among both Philippines and UK Parliaments.

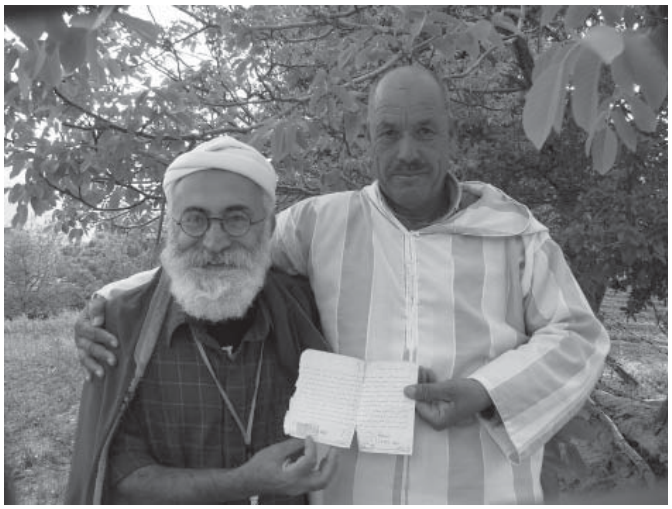
SEAPRISE also collaborated with the Nigerian Director of Biodiversity in the Ministry of Environment and a team of 20 local scientists and activists, during a **scoping mission on Oil Spills in the Niger Delta**. The affected areas and affected communities were visited, followed by a workshop. The scoping mission report highlighted the 4,000-6,000 oil spills that have taken place in the area over

the last 50 years. The team also produced a briefing/training film with Reuters and an oil spill map.

Other worldwide activities of SEAPRISE included an **assessment of the major oilspill that affected Lebanon after the war in 2006** and a subsequent follow-up mission one year later and advocacy work against activities of the Dutch **bottom fish dredging** fleet near the Park National du Banc d'Arguin in Mauritania.

Sustainable Livelihoods

The **Theme on Sustainable Livelihoods and Pro-Poor Conservation (TSL)** focused a great part of its work on supporting the organisation of social groups with critical impact on the governance of natural resources, reviving customary institutions for the conservation of nature and the sustainable management of natural resources and defending their customary rights to autonomous governance of their natural resources. **Food Sovereignty and pro-poor conservation** were new emphases brought in the 2005-2008 Mandate. So was the **IUCN Policy on Mobile Indigenous Peoples** (the "Mobile Peoples Resolution" of Bangkok 2004), which also constituted a major focus and achievement of this Theme. In line with this policy, TSL promoted, supported and facilitated the World Gathering of Nomadic Pastoralists, as well as the **First Congress of WAMIP** (**World Alliance of Mobile Indigenous Peoples**— a movement which owes its beginning to the World Parks Congress of 2003 in Durban). The Congress was held in Segovia, Spain in September 2007 and approved a revised version of the Statutes of the organisation, which now counts hundreds of members, in particular customary mobile indigenous institutions (tribes, clans, etc.) and supporting organisations and individuals. Also, as a result of the Gathering mentioned above, nomadic pastoralists of the world now have their own situation analysis of the state of their natural resources and development, a long term vision for conservation and sustainable livelihoods, and a strategy for moving forward in between the two.



Discussing traditional systems of natural resource management in the High Atlas Mountains.

TSL members actively participated in articulating the links between human well being, food security, human rights and the conservation of biodiversity and natural resources under the "food sovereignty" paradigm. Notable in this sense are the publication of a CEESP Occasional Paper on *Agro-ecology versus Eco-Agiculture*, and a book on *Agro-ecology and food sovereignty in the Americas*

Transboundary protected area planning in Mali and Burkina Faso.

with Yale University and IIED. Participation in a new IIED-run project on democratizing research and development in food production systems and agro-biodiversity, and the active role in organising and running workshops at the **World Forum on Food Sovereignty** (Nyeleni, Mali, February 2007) were other highlights. In the field of genetic resources, TSL supported an ICARDA/ International Centre for Irrigation Research/ CENESTA project on participatory plant breeding. It also engaged in the implementation of the **IUCN's Moratorium on GMOs Resolution** by setting up and maintaining the **IUCN web site** on the Moratorium,as requested by the IUCN Council. TSL also co-sponsored in 2007 the publication in a dozen languages of a CD on PGIS (Participatory Geographic Information Systems) together with a number of other institutions around the globe.

TSL has emphasised linkages and mutual learning among local organisations engaged in strengthening local food systems, livelihoods and agro-biodiversity. This has includes collaboration with indigenous Andean communities (Asociación ANDES, Peru), Dalit women in the Indian subcontinent (Deccan Development Society, India), rice farmers in Indonesia (Farmers IPM movement) and nomadic pastoralists in Iran (Centre for Sustainable Development, CENESTA) through a project of the International Institute for Environment and Development (IIED, UK). A great deal of mutual learning has enriched the base of experience concerning sustainable livelihoods in these usually marginalised communities. TSL has supported national and regional projects on pastoral stewardship of arid and semi-arid lands, sustainable livelihoods, indigenous peoples' rights and community-based natural resource management in Iran and neighbouring countries. TSL has also supported the secretariat of WAMIP, as an affiliated network of CEESP.

TSL has worked closely with other CEESP themes and Working Groups. With TGER and TILCEPA, it participated in a number of Community Conserved Areas (CCA) initiatives. With E&S, it supported the Conference on Forces for Sustainability (World Court Building, The Hague, March 2007). With E&S and SEAPRISE, it supported the Emergency Assessment of the marine pollution in Lebanon as a result of Israeli bombing of a power plant's oil deposits in Jiyyeh, including its assessment a year later.

TSL members engaged in field based training, awareness and policy work on desertification, co-management of natural resources, and common property

resource management systems in Afghanistan, Cambodia, China, Iran, Morocco and West Africa. It supported the **Caucasus Biodiversity Council** in the development of the Caucasus Eco-region Profile and the conservation programme of the six countries of the region (Armenia, Azerbaijan, Georgia, Iran, Russia and Turkey).

Environment and Security

The Environment and Security Working Group organised the European launch of the State of the World Report 2005 entitled "**Redefining Global Security**", in which the environmental dimension of security was analysed, described and illustrated with examples. The launch took place first in the Peace Palace, The Hague in March 2007, and the next day in the European Parliament, in Brussels, with the participation of high level speakers such as the Dutch ministers for Development Cooperation and for the Environment as well as Members of the European Parliament. In 2006 the group supported financially the mission of Professor Richard Steiner of CEESP SEAPRISE to assess the environmental impacts of the **oil spill in the Mediterranean** after the Israeli Air Force had bombed the oil tanks of the power station at Jiyyeh on the Lebanese coast. In July 2006, it financed his follow-up visit to Israel to discuss the report with the Israeli government. It also commissioned a report on the **legal (liability) aspects of the spill**, which was published in February 2007 and submitted to the IUCN Commission on Environmental Law (CEL).

Conference on Environment and Security at the Peace Palace, The Hague.

In March 2007, the group organised the **Conference on Forces for Sustainability**, in the **Peace Palace**, which focused on new roles for the military to promote environmental security and on the responsibility of the private sector, especially the extractive industries, to prevent the violation of human rights and the destruction of the environment and nature, to compensate for damage done and to accept the guidance of citizens councils in the areas of

operation. Many of the participants of the Conference have become new members of the expanding Working Group. On 10 December 2007 the chair of E&S, Wouter Veening, addressed a major side event at the **Bali Conference** of the Parties of the Climate Change Convention on the **security aspects of (on-going) climate change**, and preparations have being made to organise with the Polish government a major side event on that subject at the next Conference of the Parties in December 2008 in Poznan, Poland, following a combined event, jointly with the Commission on Education and Communication (CEC) on the same issue at the Fourth World Conservation Congress in October in Barcelona.

Environment, Macroeconomics, Trade and Investment

The Theme on Environment, Macroeconomics, Trade and Investment (TEMTI) evolved from the former Working Group on Environment, Trade and Investment. The chair of TEMTI assembled a new steering committee for the group and approached foundations with project proposals to support TEMTI's workplan. A project proposal was also submitted to IUCN's 3IC Fund, which was approved in October 2007. The project, "**The Macroeconomic Connection: Monetary and Fiscal Policies for Sustainability**" is focusing regionally on **Latin America** (Argentina, Brazil, Ecuador, Costa Rica and Mexico). Project activities have begun and preliminary results will be presented at the WCC in Barcelona.

Discovering a Community Conserved Area in Turkey.

Meanwhile, TEMTI continuously engaged in networking for membership and action-oriented research, starting at the Biannual Conference of the International Association of Ecological Economics in New Dehli, December 2006 and other subsequent international events. TEMTI's Chair Alejandro Nadal participated as a member of the drafting committee of the Memorandum on Natural Resource Governance for the XXIst century to the G8 Summit in Heiligendamm, Germany, organised by the Heinrich Boell Foundation. During this session new contacts were established with African colleagues and discussions for a regional strategy for TEMTI in Africa were undertaken. TEMTI was active in several national contexts, such as the jury of the Independent Peoples Tribunal of the World Bank Group in India, and the establishment of the Upland Maize Germplasm Sanctuary in Mexico.

Culture and Conservation

The Theme on Culture and Conservation (TCC) was convened in early 2005 with a core group of members drawn primarily from contributors to the publication of a dedicated volume of *Policy Matters*, "History, Culture and Conservation". This membership has expanded in this quadrennial and now includes culturally and nationally diverse members from all areas of the globe. The main objective of TCC is to improve knowledge, policy and practice through linking cultural and biological diversity, their common threats and by strengthening opportunities, and the group set out to achieve this through action in a number of areas.

Knowledge dissemination activities of TCC have included the organisation of a conference entitled **Sustaining Cultural and Biological Diversity in a Rapidly Changing World** to be held at the American Museum of Natural History in April 2008; the production of an edited volume entitled "**Conservation, Culture and History**" which contains case studies of the relations between cultural practice and biodiversity conservation; and the production of a "**Source Book on Bio-cultural Diversity**" in cooperation with Terralingua, a volume that provides case studies from communities around the world on relations between biological and cultural diversity.

Action-research activities included the engagement of Maori peoples in biodiversity and conservation genetics research of native New Zealand species through collaborative research and community outreach to *iwi* (tribes); the integration of traditional knowledge and advanced GIS/GPS technologies/techniques towards conservation of key wetland resources in Mauritania; continuing research examining discrepancies between cultural understandings of nature in northern Pakistan and market-based conservation incentives introduced by IUCN and other INGOs; research on the institutional dynamics that structure vulnerability to disaster in Kashmir; and the role of culture, traditional knowledge and local institutions of authority in the effective management of coastal resources in Ghana. Advocacy activities have included support for community biocultural diversity initiatives in Mexico, legal testimony on indigenous intellectual property rights in New Zealand, and the preparation of collective submissions on bio-prospecting to the New Zealand Government.

Role playing in Mauritania.

Chair contributions to Council and other areas

The Chair of CEESP, Dr. Taghi Farvar, was present and actively engaged during all sessions of the IUCN Council, focusing on upholding the **collegial spirit and form of the governance of the Union**. In addition, he continued his active engagement in regional issues in WESCANA and other regions of the world. Among his many contributions to the life of the Commission, he delivered key note addresses at the Mesoamerican Parks Congress, at the annual gathering of all North American foundations that support biodiversity, and at the Conference on Environment and Security at the Peace Palace in The Hague.

The life of the Commission

Overall, CEESP engaged in addressing the causes of environmental degradation and supporting the positive forces for conservation and sound environmental management through:

- ▷ fostering the engagement of society as a whole, and in particular indigenous peoples and local communities, not just conservation professionals;
- ▷ working to attain basic environmental justice and human rights;
- ▷ promoting the full valuation of nature accompanied by more equity in the sharing of the related benefits and burdens;
- ▷ peeling off of the myth of the only and overpowering "economic value" and revitalizing/ strengthening the multiplicity of other values– identity, health, security, cultural, spiritual, religious—that are also embedded in nature.

One of the CBD side events organised by TILCEPA and TGER.

Through its periodical journal "*Policy Matters*", CEESP has continued to explore emerging and controversial conservation topics, creating a precious space for real discussion and exchange of ideas. The journal is not "designed in advance", but built on the basis of the submissions by the members answering a series of questions on a set topic, often in conjunction with major international events. The editorial board then reflects upon the sum total of the submissions and develops an "editorial synthesis" of what the members have expressed, usually oriented towards

recommendations for both policy and practice. The Commission is particularly proud of the issues published in the last three years: on ***History, Culture and Conservation***; on ***Poverty, Wealth and Conservation***; and on ***Conservation and Human Rights***. This issue you have in your hands-- to be launched at the 2008 IUCN Congress – is on the topic of ***Climate Change, Energy Change and Conservation***, with other special issues in the offing.

CEESP members come from a wide variety of geographical, cultural and professional backgrounds, including indigenous peoples and academics, field-based practitioners and community elders, policy makers and young professionals (the Commission is the most "progressive" of IUCN in this sense, according to the last Commission Review). Members are well balanced between people in the North and the South (about 50/50) and more than one third of the members are women (a special achievement in gender balance among the IUCN Commissions). One of the strengths of CEESP has been its engagement with a variety of right-holders and stakeholders, which include IUCN members (governments and NGOs) but also direct representatives of civil society (indigenous peoples and local communities).

CEESP members worked in all continents through a flexible network with lean coordination, managing to take advantage of specific occasions for meetings and/or developing projects and obtaining funds for joint initiatives. Typically, and as a **hallmark of the Commission**, they dealt with the **critical links between practice and policy** (*e.g.* feeding local experiences into national and international policy processes and promoting the implementation of sound policy in specific contexts). This is crucial work towards "*a just world that values and conserves nature*".

CEESP STEERING COMMITTEE 2005-2008

Name and Affiliation	Role/Area of Responsibility	Nationality/ Residence
Themes and Working Groups & Focal Points for the Regions		
Taghi M. Farvar (taghi@cenesta.org) CENESTA, Chair of the Board of Directors	Chair of CEESP; Co-Chair for the Theme on Sustainable Livelihoods (**TSL**)	Iran
Wouter Justus Veening (wouter.veening@nciucn.nl) Institute for Environmental Security, Policy Director	Deputy Chair of CEESP; Vice Chair for the Working Group on Environment and Security (**E&S**)	The Netherlands
Thematic Vice Chairs		
Grazia Borrini-Feyerabend (gbf@cenesta.org), Independant consultant	Vice Chair for the Theme on Governance of Natural Resources, Equity and Rights (**TGER**); Vice Chair of joint CEESP/WCPA Theme on Indigenous and Local Communities, Equity and Protected Areas (**TILCEPA**)	Italy/ Switzerland
Steven R. Brechin (sbrechin@maxwell.syr.edu) Department of Sociology at the Maxwell School, Syracuse University, Professor of Sociology	Vice Chair for the Theme on Governance of Natural Resources, Equity and Rights (**TGER**)	USA
Chimere M. Diaw (c.diaw@cgiar.org) Centre for International Forestry Research (CIFOR) Scientist Regional Coordinator for West Central Africa	Vice Chair for the Theme on Governance of Natural Resources, Equity and Rights (**TGER**)	Senegal/ Cameroon
Sandra Kloff (srkloff@hotmail.com) Independent Consultant	Vice Chair for the Working Group on Social and Environmental Accountability of the Private Sector (**SEAPRISE**)	The Netherlands/ Spain
Ashish Kothari (ashish@nda.vsnl.net.in) Kalpavriksh Environment Action Group, Founder- member	Vice Chair for the Theme on Indigenous Peoples and Local Communities, Equity and Protected Areas (**TILCEPA**)	India
Ken MacDonald (kmacd@utsc.utoronto.ca) University of Toronto, Department of Geography, Interdisciplinary Programme in International Development Studies, Professor	Vice Chair for the Theme on Culture and Conservation (**TCC**)	Canada
Aroha Te Pareake Mead (aroha.mead@vuw.ac.nz) Victoria University of Wellington, Senior Lecturer, IUCN Councillor	Vice Chair for the Theme on Culture and Conservation (**TCC**); Senior Advisor for Indigenous Peoples Policy	New Zealand
Alejandro Nadal (anadal@colmex.mx) Colegio de Mexico, Professor of Economics	Vice Chair for the Theme on Economics, Markets, Trade and Investment (**TEMTI**)	Mexico
Emmanuel Asuquo Obot (ncf@hyperia.com) Nigerian Conservation Foundation (NCF), Acting Executive Director	Vice Chair for the Working Group on Social and Environmental Accountability of the Private Sector (**SEAPRISE**)	Nigeria
Michel Pimbert (michel.Pimbert@iied.org) International Institute for Environment and Development (IIED), Principal Associate Sustainable Agriculture and Livelihood Programme	Vice Chair for the Theme on Sustainable Livelihoods (**TSL**)	UK / France
Elizabeth Reichel-Dolmatoff (elizareichel@yahoo.fr) Independent Consultant	Vice Chair for the Theme on Culture and Conservation (**TCC**)	Colombia/ Switzerland
Clive Wicks (Clive.Wicks@wicksfamily.plus.com) Independent Consultant	Vice Chair for the Working Group on Social and Environmental Accountability of the Private Sector (**SEAPRISE**)	UK
Senior Advisors and Regional Vice Chairs		
Alejandro Argumedo (ipbn@web.net) The Indigenous Peoples' Biodiversity Network (IPBN), Coordinator	Vice Chair for Latin America; Senior Advisor for Indigenous Peoples Policy	Peru
Li Bo (qianhushan@gmail.com) Centre for Biodiversity and Indigenous Knowledge(CBIK), Affiliate	Vice Chair for China	China
JoJi Cariño (tongtong@gn.apc.org) Tebtebba Foundation, Indigenous Policy Adviser and European Desk Coordinator	Senior Advisor for Indigenous Peoples Policy	Philippines/ UK

Richard Cellarius (richard@cellarius.org) Sierra Club (USA), Vice President for International Affairs	Vice Chair for North America	USA
Michael Cernea (Mcernea@worldbank.org) George Washington University, Research Professor of Anthropology and International Affairs, Senior Adviser for GEF/ World Bank	Senior Advisor for Social Policy	Romania/ USA
Ali Darwish (ali@greenline.org.lb) Green Line Association, President	Vice Chair for the Arab Region	Lebanon
Chachu Ganya (cganya@pisp.org) Pastoralist Integrated Support Program (PISP) Executive Director; and World Alliance of Mobile Indigenous Peoples (WAMIP) Member, International Coordinating Council	Vice Chair for the East Africa; Senior Advisor for Indigenous Peoples Policy	Kenya
Augusta Henriques (augusta_sh@hotmail.com) Tiniguena (This Land is Ours), Secretary General	Vice Chair for West Africa	Guinea Bissau
Ricardo Melendez (melendez@ictsd.ch) International Centre for Trade and Sustainable Development (ICTSD), Executive Director	Senior Advisor for Trade and the Environment	Colombia/ Switzerland
Jurgenne Primavera (nykjprim@skyinet.net) Aquaculture Department of the Southeast Asian Fisheries Development Centre, Senior Scientist	Vice Chair for South East Asia	The Philippines
Marcela Villarreal (marcela.villarreal@fao.org) UN Food and Agriculture Organisation (FAO), Director of Gender and Population Division	Senior Advisor for Gender and Population Policy	Colombia/ Italy
Jacques Weber (weber@cirad.fr) Institut français de la biodiversité, Director	Vice Chair for Europe	France
Afriyie Allan Williams (landnetcaribbean@tstt.net.tt) Independent Consultant	Vice Chair for The Caribbean	Guyana/ Trinidad
CEESP Staff Contact Persons		
Tasneem Balasinorwala (tilcepa@vsnl.net); +91 20 25654239	Member Co-ordinating Team TILCEPA	India
Jessica Campese (jessica@cenesta.org)	TGER Focal Point for Conservation and Human Rights	USA/ Tanzania
Ron Kingham (rkingham@envirosecurity.org)	Executive Officer, Working Group on Environment and Security	The Netherlands
Barbara Lassen (barbara@cenesta.org)	Executive Officer, CEESP and Executive Officer, Theme on Governance, Equity and Rights (TGER)	Germany/ Switzerland
Nahid Naqizadeh (nahid@cenesta.org); +98 21 66-972-973	Programme Officer	Iran
Manjusha Mishra (manjusha@cenesta.org)	Programme Officer Theme on Sustainable Livelihoods (TSL)	Iran/ USA
Maryam Rahmanian (maryam@cenesta.org)	CEESP focal point for GMOs and Food Sovereignty	Iran
CEESP Main Office C/o CENESTA: Centre for Sustainable Development & Environment 142 Azerbaijan Avenue, 13169 Tehran, Iran Telephone: +98 21 66-972-973 Fax: +98 21 66-400-811 Email: ceesp@iucn.org; CEESP web site: http://www.iucn.org/themes/ceesp		
IUCN Secretariat Focal Points **Gonzalo Oviedo**, IUCN Senior Advisor, Social Policy (gonzalo.oviedoa@iucn.org); telephone: ++41 22 999 0287 **Joshua Bishop,** IUCN Senior Advisor, Economic Policy (Joshua.bishop@iucn.org); telephone: ++41 22 999 0266		

Policy Matters is the journal of the IUCN Commission on Environmental, Economic and Social Policy (CEESP). It is published approximately twice a year and distributed to CEESP's 1000 members and the IUCN Secretariat offices, as well as at relevant conferences and meetings throughout the world. When possible, it is published concurrently with major global events as a thematic contribution to them and to the civil society meetings around them.

IUCN, The World Conservation Union, is a unique Union of members from some 170 countries including nearly 90 States, over 200 government agencies, and some 1000 NGOs. Over 10,000 internationally-recognised scientists and experts from more than 180 countries volunteer their services to its six global Commissions. The vision of IUCN is "A just world that values and conserves nature".

IUCN's six Commissions are principal sources of guidance on conservation knowledge, policy and technical advice and are co-implementers of the IUCN programme. The Commissions are autonomous networks of expert volunteers entrusted by the World Conservation Congress to develop and advance the institutional knowledge, experience and objectives of IUCN.

CEESP, the IUCN Commission on Environmental, Economic and Social Policy, is an inter-disciplinary network of professionals whose mission is to act as a source of advice on the environmental, economic, social and cultural factors that affect natural resources and bio-cultural diversity and to provide guidance and support towards effective policies and practices in environmental conservation and sustainable development. Following the mandate approved by the **3td World Conservation Congress** in Bangkok, November 2004, CEESP contributes to the IUCN Programme and Mission with particular reference to seven thematic areas:

- Theme on Governance of Natural Resources, Equity and Rights (**TGER**),
- Theme on Sustainable Livelihoods (**TSL**, including poverty elimination and biodiversity conservation)
- Working Group on Environment and Security (**E&S**)
- Theme on Economics, Markets, Trade and Investments (**TEMTI**)
- Theme on Culture and Conservation (**TCC**)
- Working Group on the Social and Environmental Accountability of the Private Sector (**SEAPRISE**)
- Theme on Indigenous Peoples & Local Communities, Equity, and Protected Areas (**TILCEPA**, joint between CEESP and the IUCN World Commission for Protected Areas)

Each issue of ***Policy Matters*** focuses on a theme of particular importance to our members and is edited by one or more of our Themes/working groups focusing on the seven thematic areas. Past issues have focused on themes such as "Poverty, Wealth and Conservation", "Community Empowerment for Conservation", "Collaborative Management and Sustainable Livelihoods", "Trade and Environment", "Environment and Security" and the Caspian Sturgeon, including issues of trade, conflict, co-management, and sustainable livelihoods for communities of the Caspian Sea ("The Sturgeon" issue). For more information about CEESP and to view or download past issues of ***Policy Matters***, please visit our website: http://www.iucn.org/themes/ceesp.

CEESP is hosted by the Iranian Centre for Sustainable Development and Environment (**CENESTA**). For more information about CENESTA please visit http://www.cenesta.org.
Please send comments or queries to ceesp@iucn.org. We look forward to hearing from you!

Design and layout artist: Jeyran Farvar (Jeyran@cenesta.org).

Publisher: CENESTA

Prepress, Press and Binding: Saleh Graphics Printing Corporation

Photo Credits: front cover: © ephotocorp.com– Reality Information Systems Pvt. Ltd.;
inside front cover: courtesy PRCM West Africa; inside back cover: CENESTA; back cover: Clive Wicks.

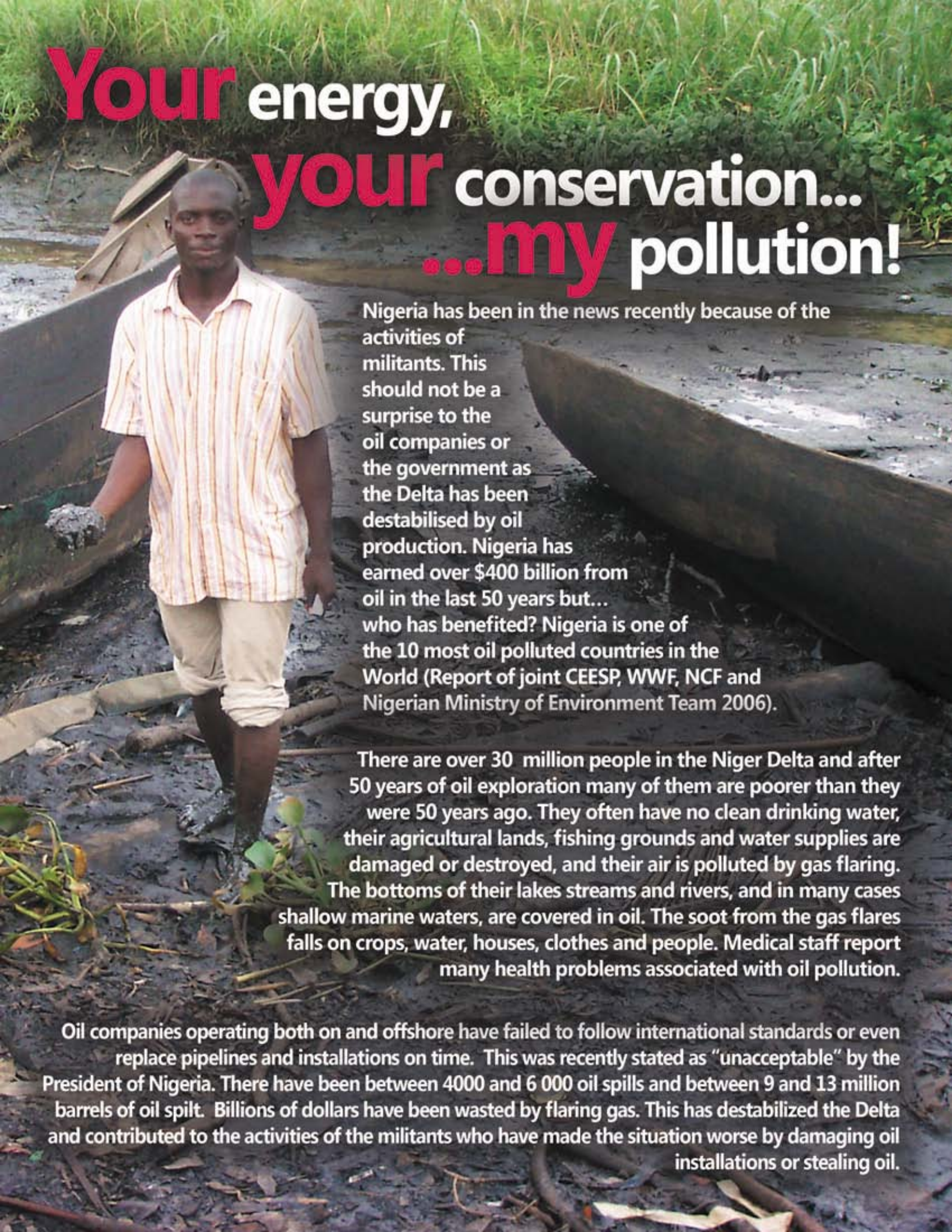
Stewards of drylands— nomadic pastoralists

- Indigenous nomadic peoples migrate so as to conserve nature & its resources for their sustainable livelihoods.
- Each tribe's territory acts as an Indigenous/ community conserved area (ICCA), often including unique landscapes and ecosystems.
- Empowering customary institutions is an effective way of restituting the rights of Mobile Indigenous Peoples over their customary territories and resources.

- In Segovia (Spain) September 2007, WAMIP (World Alliance of Mobile Indigenous Peoples) helped organise the World Gathering of Nomadic Pastoralists.
- They elaborated for the first time an analysis of their predicament, their visions of a desirable future, and a global strategy for nomadism.
- On 13 September 2007, half way through the WAMIP gathering, the UN General Assembly approved the UN Declaration on the Rights of Indigenous Peoples, bringing about a huge jubilation.

- CEESP has supported the work of its host institution CENESTA in bringing together Mobile Indigenous Peoples and government institutions of natural resource management. The latter have agreed to turn over— back to the customary institutions of the tribes— the management of nomadic territories and rangelands, including seasonal migration of the Indigenous tribes.
- IUCN's Resolution 3.018 gives policy support to nomadism as a force for conservation.

www.wamip.org www.cenesta.org



Your energy, your conservation... ...my pollution!

Nigeria has been in the news recently because of the activities of militants. This should not be a surprise to the oil companies or the government as the Delta has been destabilised by oil production. Nigeria has earned over $400 billion from oil in the last 50 years but... who has benefited? Nigeria is one of the 10 most oil polluted countries in the World (Report of joint CEESP, WWF, NCF and Nigerian Ministry of Environment Team 2006).

There are over 30 million people in the Niger Delta and after 50 years of oil exploration many of them are poorer than they were 50 years ago. They often have no clean drinking water, their agricultural lands, fishing grounds and water supplies are damaged or destroyed, and their air is polluted by gas flaring. The bottoms of their lakes streams and rivers, and in many cases shallow marine waters, are covered in oil. The soot from the gas flares falls on crops, water, houses, clothes and people. Medical staff report many health problems associated with oil pollution.

Oil companies operating both on and offshore have failed to follow international standards or even replace pipelines and installations on time. This was recently stated as "unacceptable" by the President of Nigeria. There have been between 4000 and 6 000 oil spills and between 9 and 13 million barrels of oil spilt. Billions of dollars have been wasted by flaring gas. This has destabilized the Delta and contributed to the activities of the militants who have made the situation worse by damaging oil installations or stealing oil.