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The Nature of Climate Change

Reunite International Climate Change Mitigation Efforts with Biodiversity Conservation and Wilderness Protection

BY HARVEY LOCKE and BRENDAN MACKEY

For the good of the climate, the time has come for a major initiative to reunite climate change mitigation efforts with biodiversity conservation and wilderness protection. Recent scientific research has shown clearly that protecting primary ecosystems such as forests, wetlands, and peatlands (whether they be tropical, temperate, or boreal) keeps their carbon stocks intact, avoids emissions from deforestation and degradation, and is a necessary part of solving the climate change problem (Lyssaert et al. 2008; Lewis et al. 2009; Phillips et al. 2008; Keith et al. 2009). This new understanding provides a way to make important advances to mitigate both climate change and the biodiversity extinction crisis.

Climate change has emerged as the leading environmental issue of our time with good reason (IPCC 2007a). The rapid rise in Earth's temperature threatens human well-being in several ways: rising sea levels will render millions homeless, populations of malaria-bearing mosquitoes will reach millions of African people who live in areas that were once too cool for these insects, and there will be an increase in the frequency of extreme climatic events such as droughts, fires, floods, and hurricanes. Freshwater will get scarcer in some areas, which will lead to increasing tensions and potentially armed conflict about access to this basic resource. It is even possible that we could experience "climate surprises"—rapid, large-scale, and difficult-to-predict changes in the climate system that we know have occurred in the geological past. For example, ocean currents such as the North Atlantic Gulf Stream could change, rendering the climate of western Europe cooler and less agriculturally productive.

Climate change also threatens other forms of life with which we share Earth. Coral reefs are bleaching, thus destroying critical fish habitat; climate shifts will result in the extinction of populations of many temperature-sensitive species such as mountain-dwelling pikas; and the habitats of other species such as cold-water trout and polar bears will

shift or disappear. These changes are already underway, and they threaten many wildlife species.

Carbon Dioxide

The general problem that has led to rapid climate change is that we humans are releasing carbon dioxide (and other greenhouse gases) into the atmosphere faster than natural processes can remove it. A certain amount of heat in the atmosphere is good and gives us a livable climate, but now the increasing concentration of carbon dioxide in the atmosphere is causing a rise in global temperature with disastrous consequences.

The cause of the rapid climate change we are now experiencing is primarily the result of two main kinds of human actions: burning fossil fuels and clearing or degrading natural ecosystems. These activities release carbon dioxide into the atmosphere from places on or under the Earth's surface where it was previously stored harmlessly or sequestered as one of a number of forms of carbon we call fossil fuels. The burning of carbon-dense oil, coal, and gas stocks is widely known as the primary source of carbon dioxide.



Figure 1—Boreal forest in the Nahanni, Canada. Photo by Harvey Locke.



Figure 2—Increased fires from human activities will make natural forests more vulnerable to climate change. Photo by Vance G. Martin.

The second human action that releases large amounts of carbon dioxide into the atmosphere is the conversion and degradation of natural forests and other carbon-dense ecosystems. A substantial amount of carbon dioxide is stored in natural ecosystems, especially forests, wetlands, and peatlands, which act as a vital buffer regulating the atmospheric level of carbon dioxide. There is the equivalent of more than 7 trillion tons of carbon dioxide stored in forests and other terrestrial ecosystems such as wetlands and peatlands. Humans are depleting these green carbon stocks (Mackey et al. 2008a) and releasing the carbon dioxide into the atmosphere at an alarming rate: about half the world's forests have already been cleared, and rates of land conversion and degradation continue to increase (Millennium Ecosystem Assessment 2005; Shearman et al. 2009). Similarly, about half of the world's wetlands have been degraded in the last century (Finlayson and Davidson 1999). Unfortunately, around 25% of the carbon dioxide

released from burning fossil fuel or clearing and degrading natural ecosystems will continue to interact with the atmosphere for many thousands of years before it is incorporated into the sediment at the bottom of the ocean through deposition and weathering processes (Archer 2005).

It is obvious that efforts to address climate change should go toward identifying sources of carbon release and then rapid action to prevent or reduce such release. We need to do two things simultaneously: (1) achieve deep cuts in emissions from using fossil fuel as a major source of energy, and (2) protect the carbon stored in forests and other ecosystems by leaving them undisturbed. Both tasks are important, as about 70% of the total historic increase in greenhouse gas levels in the atmosphere due to human activity is from burning fossil fuel, and about 30% is from deforestation. And, on an ongoing basis, about 18% of annual global emissions comes from disturbing forests (IPCC 2007b).

Despite the scientific evidence,

there is no coordinated attack on both root causes. The ongoing destruction of the world's remaining natural habitats and associated biodiversity, and the climate change problem are being treated as two distinct and largely unrelated problems. This current state of affairs is clearly off course. But it was not always so.

Global Conventions for an Integrated Solution

The United Nations Framework Convention on Climate Change (UNFCCC) and the Convention on Biological Diversity (CBD) were both negotiated at the Earth Summit in Rio de Janeiro in 1992. UNFCCC seeks to limit emissions of carbon dioxide and other greenhouse gases that cause dangerous levels of climate change. The CBD seeks to halt the loss of biodiversity through protected areas and other means. Both conventions have been charged with development goals for poorer countries. Their respective implementation mechanisms include the Kyoto Protocol and the Program of Work on Protected Areas.



Figure 3—Central highlands forest, Victoria, Australia. Photo by Peter Halasz.



Figure 4—High altitude mammals such as this pika in Yoho National Park, Canada, have few options as their habitat warms. Photo by Harvey Locke.

Sixteen years after these two treaties were developed together as complementary strategies to safeguard the future of life on Earth, a strange thing has happened—they have become separated. Politicians, policy experts, technicians, financiers, entrepreneurs, scientists, Nongovernmental organizations (NGOs), and the general public consider the two conventions as addressing unrelated problems. Whereas the importance of forests is acknowledged by both treaties, the UNFCCC process has yet to accept the significance of the carbon stored in natural forests and other ecosystems such as wetlands and peatlands, the resilience provided by their biodiversity, and the need for whole-of-ecosystem carbon accounting. Consequently, programs can occur under the Kyoto Protocol that actually harm the goals of the CBD—such as clearing natural forests to plant palm oil for biofuels. And no credit is given under the Kyoto Protocol for protecting wildlands and the vast stocks of biomass carbon they store.

Unlike UNFCCC and the Kyoto Protocol, the CBD gets scant attention. Governments that are signatory

to both conventions often assign responsibilities for the conventions to different departments, with CBD efforts being under-resourced and ignored compared to much better resourced climate change programs that are focused on fossil fuel emissions. Since the United States is not yet a signatory to the CBD, many U.S. NGOs are either unaware of it or simply ignore its potential. Ironically,

the same NGOs make much of the fact that the United States has yet to ratify the Kyoto Protocol. Even in Canada, which is a signatory to both conventions and which houses the CBD Secretariat, the CBD has a very low profile. Further, many environmentalists working on climate change are fearful that allowing for the protection of nature in the Kyoto Protocol rules will undermine efforts at reducing emissions from wealthy countries that burn fossil fuels.

The separation of the UNFCCC and CBD is bad for the goals of both conventions, but current structures and mindsets are preventing them from working together. Both climate change and the extinction crisis are getting worse, and to date efforts have failed to meet even modest goals of slowing the rate of change and loss, let alone turning things around. Science has now made clear that the protection of natural ecosystems—and especially primary forests and other wildlands such as wetlands and peatlands—will help achieve climate change goals. This separation of the conventions must end.



Figure 5—Lowland forest in the lower Kikori catchment, Gulf Province, Papua New Guinea. Photo by Rocky Roe Photographics and UPNG Remote Sensing Centre.



Figure 6—Mt. Albert Strickland Ridge, North East Highlands, Tasmania. Photo by Geoff Law.

Nature Protection for Climate Change Mitigation and Adaptation

There is widespread agreement that to address climate change, both mitigation and adaptation are necessary. In climate change parlance, *mitigation* means efforts to prevent or reduce release of carbon dioxide into the atmosphere, and *adaptation* means coming to grips with the fact that climate change is underway and that some harmful climate change is now unavoidable. Adaptation involves doing what we can to adjust to the changes, as well as doing our best to anticipate what things will be like in the future, and putting plans in place with that in mind.

In a forest ecosystem, carbon is stored in living and dead biomass and in the soil. In the tropics, more of the organic carbon is stored in the living trees. In boreal forests, there is proportionally more found below ground due to slower decomposition rates. Temperate forests store large amounts of carbon in living trees, dead biomass, and the soil. Most of the living biomass carbon is found in big, old trees. Protecting mature, primary forest in all biomes (tropical, temperate, or boreal) from human activities that deplete carbon stocks by removing, in

particular, large, old trees and disturbing dead biomass and soil carbon, must be recognized as part of the climate change solution in economically developed as well as developing countries. Similarly, wetland conservation is important to prevent release of greenhouse gases (CUIBA 2008). And the vast peatlands in northern boreal ecosys-

tems have been shown to be cooling the climate through the uptake of carbon and will continue to do so if left undisturbed (Frolking and Roulet 2007). Wilderness and intact habitat conservation efforts are good for the climate as well as for biodiversity and associated ecosystem services.

In addition to mitigation, intact natural ecosystems and wildlands are critical to adaptation efforts. In different regions and in different ways, climate change will place stress on ecosystems and the environmental services they provide, especially the provision of food and freshwater. Many communities, especially in poorer countries, will be affected. Intact, natural ecosystems with their biodiversity fully functioning are more resilient to stresses than degraded lands. Healthy ecosystems will prove an invaluable resource for helping communities adapt to unavoidable climate change. Leaving extensive wild areas intact will enable those natural processes to operate by which species can adapt and persist through changing conditions (Fischlin et al. 2007; Mackey et al. 2008b). Connectivity conservation initiatives—vast systems of protected areas connected by conservation management in the intervening lands that

span elevations and altitudes—are the best strategy to allow terrestrial species to adapt and ecosystems to remain resilient to climate change (World Conservation Congress 2008; Heller and Zavaleta 2009). The Program of Work on Protected Areas under the CBD recognizes these tools.

Unfortunately, attempts to educate people about the important roles played by healthy natural ecosystems in mitigation and adaptation are being undermined by various climate change myths. One widespread myth is that old growth forests are not helpful in mitigating climate change because they are sources rather than sinks of carbon dioxide. This view of primary forests has led some commentators to argue that they should be cut down and replaced with younger trees that absorb carbon dioxide from the atmosphere at a faster rate than old trees. This argument is wrong for a number of reasons. For a start, it ignores the fact that old forests have very large stocks of carbon in place. Mobilizing and releasing this carbon into the atmosphere through deforestation and degradation creates a carbon debt that takes hundreds of years to recover through new plantings (Righelato and Spracklen 2007). Furthermore, the underlying assumption is simply incorrect because mature and very old natural forests in boreal, temperate, and tropical forests have been shown to be more likely to be sinks than sources (i.e., actively sequestering more carbon dioxide than they emit) (Luyssaert et al. 2008). In other words, primary forest, and especially old growth forest, should be kept intact for the good of the climate.

Biodiversity and Natural Ecosystems

Efforts under the climate change convention will have perverse effects unless

they recognize biodiversity and natural ecosystems. Under the UNFCCC process at present, the role in mitigation of natural ecosystems and wildlands, including primary forests and wetlands, is not acknowledged. This worldview is manifested in several of the key decisions and rules that have been developed since this convention came into effect. The Kyoto Protocol definition of forest is blind to biodiversity and does not distinguish between a natural primary forest, a heavily logged forest, and a monoculture plantation. This is self-defeating because the current carbon stocks of a forest ecosystem vary enormously depending on its condition as the result of land-use history (Gibbs et al. 2007; Mackey et al. 2008a).

There is the potential for perverse outcomes from active mitigation efforts. Some renewable energy technologies could fragment wilderness areas, leading to further deforestation, degradation, and associated emissions. Road infrastructure designed to serve windmills, or new hydroelectric reservoirs and associated power-line corridors, perturb natural ecosystems, release green carbon, reduce the resilience of ecosystems, and disrupt the natural processes that enable species to adapt to and persist in the face of climate change. Such outcomes would be self-defeating. Renewable energy facilities should be located in already disturbed areas of which there is no shortage.

Similarly, there is increasing talk of “geoengineering” to address climate change (Victor et al. 2009). Instead of relying on emissions reductions only, geoengineering would endeavor to cool the climate by human intervention on a planetary scale. One idea is to attempt to increase oceanic uptake of carbon dioxide from the atmosphere by fer-

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tilizing the ocean with nutrients to stimulate plankton growth. Another idea involves sending particles into the upper atmosphere as “albedo enhancers” to reflect the sun’s warming rays back into outer space. These kinds of solutions assume Earth is a simple, linear system—like a clock—amenable to conventional engineering thinking. But, Earth is a complex adaptive system, driven by nonlinear feedbacks, and full of climate surprises. The risk to biodiversity and the goals of both the CBD and climate change treaty from such large-scale meddling with natural sys-

tems is great. If these activities had unanticipated negative effects it would be nearly impossible reverse them. The real solutions—reducing emissions from burning fossil fuel and prevention of deforestation and degradation of natural ecosystems and wilderness areas—are more prosaic but have a high probability of success with no negative consequences to Earth’s natural systems.

Nature Conservation

The UNFCCC process needs a fundamental reorientation that integrates CBD goals. The word *biodiversity* does even not warrant a mention in the Bali Action Plan. Although biodiversity does get a mention in the decision text to some of the Kyoto Protocol, that process is very clearly not designed to focus on its conservation (see discussion below). The concept of ecosystem-based management—which implies biodiversity—is on the adaptation agenda. But when nature is discussed during climate change negotiating sessions, it is usually in the context of impacts, not mitigation.



Figure 7—Old growth forest, Haida Gwaii, British Columbia, Canada. Photo by Harvey Locke.

The lack of focus on mitigating impacts through protecting natural carbon-rich ecosystems can be seen in the approach taken to land management in wealthy countries. Under the Kyoto Protocol, land management issues for such countries are considered under the policy theme of “Land Use, Land-Use Change and Forestry” (LULUCF) (Kyoto Protocol, Article

or poor countries. Indeed the current rules tend to the opposite in wealthy countries—“The mere fact of carbon presence [shall] be excluded from accounting” (LULUCF Decision 16/CMP. 1). However, if we are serious about mitigating the second largest source of emissions then we need to find ways of avoiding emissions and maintaining carbon stocks in all

Emissions from Deforestation and Forest Degradation in Developing Countries [REDD]). This is an important step in the right direction to protect carbon stored in the natural ecosystems of poorer countries. However, discussions to date are focused on a narrow subset of issues such as how current rates of emissions can be reduced, implying that significant deforestation and degradation must occur before financial rewards can be received. Such deforestation and degradation is clearly important to reverse. But, where are the rewards for nations who have already been doing the right thing by protecting their primary forests? Often they struggle to adequately resource their protected areas with adequate enforcement that is critical to prevent their carbon stocks from being disturbed by illegal activities such as logging.

A key issue being debated is which approaches and mechanisms should be adopted to fund REDD action. Very prominent are discussions concerning the potential to use carbon credit schemes whereby wealthy countries can offset some of their industrial emissions through the transfer of funds from rich to poor countries—the proposition is that emitters from wealthy countries will be able to offset a percentage of carbon dioxide emissions from factories and utilities by paying poor countries to keep an equivalent amount of green carbon in place through reducing the rate of deforestation and degradation. Although it is essential to find mechanisms that can finance nature protection in developing countries, it is not clear that such purchased offsets will be the most efficient, fair, and ecologically appropriate. We need to reduce fossil fuel emissions and green carbon emissions simultaneously—one



Figure 8—Upper Florentine, Australia. Photo by Rob Blakers.

3.3). Wealthy countries are required under Article 3.3 to report on emissions from deforestation, but under Article 3.4 reporting on emissions from forest management is optional. The definition of *forest* adopted by the Kyoto Protocol is very general and allows for outcomes such as permitting a biodiverse natural forest to be converted to a monoculture plantation, even though in reality deforestation and degradation (i.e., depletion) of carbon stocks has occurred (Mackey et al. 2008a).

Consistent with the Kyoto Protocol’s focus on reporting changes in emissions, current rules do not emphasize the mitigation value of protecting intact carbon stocks in natural ecosystems in either wealthy

countries. This can be done through public policy with no exchange of funds because it is in the interests of wealthy nations to act by protecting their own natural ecosystems to prevent climate change, or it can be done through financial incentives such as “payment for ecosystem services” (Costa 2009; Costa and Wilson 2000).

REDD—A Necessary but Insufficient First Step

Recently a fledgling effort has been launched that recognizes the mitigation value of reducing the rate at which emissions are released from deforestation and degradation in tropical forests (i.e., United Nations Collaborative Program on Reducing

is not really a substitute for the other.

In developing countries that are struggling to eliminate poverty and provide the basic needs for all their people, rich countries could and should be helping by exploring all options, including through integration of the UNFCCC and CBD as part of their international cooperation activities. For example, wealthy countries could use the Program of Work under the CBD to transfer funds to poorer countries for programs aimed at protecting their natural ecosystems. This can be justified because of the other multiple and reinforcing benefits to climate, biodiversity, and sustainable livelihoods that result. Tradable “carbon credits” is but one of a range of approaches that should be tested as we work toward finding sustainable solutions.

A major concern with current discussions of REDD is the narrow focus on the tropics. The result is that the large amounts of carbon stored in undisturbed temperate and boreal ecosystems are not being considered in the REDD process because most of these forest biomes are located in wealthy countries. We need immediate global action to protect carbon-rich ecosystems wherever they occur.

The Convention on Biological Diversity (2009) process has established an Ad Hoc Technical Expert Group on Biodiversity and Climate Change that is exploring the relationships between actions under the two conventions. Although this is an important initiative, it is a technical working group informing the CBD and through it the UNFCCC process, and needs to be complemented by new thinking in the policy arena.

Current activities such as REDD and the CBD Ad Hoc Technical Expert Group are necessary but not sufficient. There is a pressing higher level need for

politicians and NGOs in all countries to show leadership in recognizing that the climate change problem, the biodiversity extinction crisis, and the destruction of wilderness have the same root cause and that coordinated, holistic solutions are required.

A Call to Action

Large-scale nature conservation is a first-order climate change strategy for both mitigation and adaptation. Keeping green carbon stored in large intact natural landscapes is a mitigation strategy. Connectivity conservation is an adaptation strategy. Both are needed. Such action is necessary to address the biodiversity extinction crisis and preserve the ecosystem services such as freshwater on which all humans rely. It is time to take a holistic view of the CBD and UNFCCC by bringing them back together to ensure that actions under the one help the other, rather than cause harm. We must ensure that the carbon already stored in primary forests, wetlands, peatlands, and other intact ecosystems stays there. The UNFCCC and the CBD should be seen as two parts of an inseparable whole.

The need for a coherent strategy to address climate change that simultaneously keeps in place the green carbon stored in natural wild ecosystems and meets emissions reduction goals will be a major focus of WILD9, the 9th World Wilderness Congress in Mérida, Mexico, in November 2009.

We have no illusions that the message from WILD9 alone will be sufficient to return international efforts to protect our environment to their Rio Earth Summit origins. But, we can all add our voices to the growing international call for a more integrated approach. We encourage anyone interested in the future of our climate and the fate of wild nature to begin disseminating and debating

these ideas now and to join us at WILD9 (www.wild9.org).

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