

Biodiversity, climate change and complexity: An opportunity for securing co-benefits?

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Climate change and biodiversity loss are both major environmental concerns, yet the links between them often go unrecognised. Not only does the science of climate change and biodiversity share similar characteristics, but climate change both affects, and is affected by biodiversity. Diversity confers far greater resilience on natural systems, thus reducing their vulnerability – and the vulnerability of the people that depend upon them – to climate change. Yet climate adaptation and mitigation strategies that are blind to biodiversity can undermine this natural and social resilience. Ignoring the links between biodiversity and climate risks exacerbates the problems associated with climate change and represents a missed opportunity for maximising co-benefits.

1. Climate change is a big enough problem – why worry about biodiversity?

Climate change scientists have been warning of the dangers of global warming for the last few decades but it is only in the last few years that it has hit mainstream politics. The science of climate change is complex and confusing. There are more questions than answers, and as a result it has been easy to disregard the scientists and environmentalists until the impacts on the day-to-day lives of ordinary people have become too obvious to miss.

The science of biodiversity is equally complex, the state of knowledge uncertain and, once again, we are in danger of failing to act until the last minute. The Millennium Ecosystem Assessment (MA) is the most recent authoritative account of the current level of degradation of the world's ecosystems. Ecosystems provide a wide range of goods and services that are essential to human well-being. Biodiversity underpins the delivery of these goods and services and its conservation is thus a crucial activity.

The MA notes that climate change is likely to be the most significant driver of biodiversity loss by the end of this century. Thus the problems of climate change will be exacerbated by those associated with biodiversity loss. Conservation of biodiversity, on the other hand, can contribute to both climate change mitigation and adaptation activities. Thus attention to biodiversity can help international efforts to combat climate change.

2. How does climate change affect biodiversity?

Climate change does not have a uniform impact on biodiversity – different species respond differently and at varying rates. Some theories suggest there is a degree of redundancy in most ecosystems so a certain level of biodiversity loss can be tolerated with limited impacts on ecosystem structure and functioning. However where significant disruption occurs – such as loss of “keystone” species or loss of a high proportion of abundant species - then ecosystem collapse may occur.

The Convention on Biological Diversity (CBD) recognises that past changes in the global climate resulted in major shifts in species ranges and marked reorganization of biological communities, landscapes, and biomes. So should we be unduly concerned now? The difference today is that the natural landscape is already highly fragmented and subject to intense pressures from human activity. As a result many species are confined to small areas within their previous ranges, with reduced genetic variability. The IPCC anticipates that the effects of climate change will include a shifting in ecosystem boundaries, habitats moving further north, a greater risk of extinction for many species, and the loss of one-fifth of coastal wetlands before 2080. “Even with best-practice management it is inevitable that some species will be lost, some ecosystems irreversibly modified, and some environmental goods and services adversely affected.”

KEY MESSAGES:

- **An over-emphasis on carbon sequestration might come at the expense of other ecosystem services. Trade-offs need to be properly recognised and managed.**
- **Protected areas are the cornerstone of global biodiversity conservation strategies. Links should be created between these areas to allow greater freedom of movement.**
- **Diversity underpins resilience. Yet modern agriculture is based on a very limited genetic pool. Attention needs to be paid to revitalising “lost” varieties in order to reduce vulnerability.**
- **The climate change, desertification and biodiversity conventions have diverged with separate constituencies, administrations and implementation agencies. Reform is needed at both international and national levels to realign these conventions and to maximise the synergies between them.**

3. How does biodiversity conservation contribute to climate change adaptation and mitigation?

Ecosystems play a significant role in regulating global climate. Changes in biodiversity can affect this regulatory system. Forests, for example, are both a source and sink of carbon: carbon dioxide is fixed through photosynthesis but released into the atmosphere if forests are felled or burned. Biodiversity management can play an important role in mitigating climate change through:

- conservation of existing carbon sinks (eg forests and peatlands);
- regeneration of potential sinks (eg through afforestation and reforestation); and
- reduction of carbon emissions (eg through use of biofuels in place of fossil fuels).

Biodiversity can also make a contribution to climate change adaptation: mangrove systems, for example, are a highly effective natural flood control mechanism which will become increasingly important with sea level rise and the increasing frequency of extreme climatic events.

But are these contributions really a function of biodiversity? Could similar effects be achieved through, for example, monoculture plantations? Again we are back to the science of complexity. The CBD defines an “ecosystem” as a “dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.” The nature of these interactions can be direct and obvious or indirect and obscure. Changes in the constituents of an ecosystem will, however, change the nature of these interactions with sometimes unexpected results. The Intergovernmental Panel on Climate Change (IPCC) summarises these linkages: “Changes in biodiversity and the changes in ecosystem functioning associated with them may affect biological productivity. These changes may affect critical goods and services upon which human societies depend. They may also affect the total sequestration of carbon in ocean and terrestrial ecosystems which can affect the global carbon cycle and concentration of GHG in the atmosphere.”

There is also evidence that higher levels of diversity afford greater degrees of resilience to climate change impacts for both people and nature. A diversity of species and agricultural varieties, for example, means that farmers are able to adapt their agricultural practices in line with changing climatic conditions thus reducing their vulnerability to climate-related shocks. The CBD notes that “functionally diverse communities are more likely to adapt to climate change and climate variability than impoverished ones... This can have important implications for the design of activities aimed at mitigating and adapting to climate change. Therefore, conservation of genotypes, species and functional types, along with the reduction of habitat loss, fragmentation and degradation, may promote the long-term persistence of ecosystems and the provision of ecosystem goods and services.”

4. How can biodiversity and climate co-benefits best be secured?

At the international level, the links between climate change and biodiversity are well recognised. Within the UNFCCC, Article 2 emphasises that stabilization levels should be achieved within a time frame sufficient to allow ecosystems to adapt naturally; while in Article 4.1 all Parties commit themselves to protecting sinks and reservoirs. The Kyoto Protocol also refers to the importance of ensuring that carbon sequestration activities contribute to the objectives of the CBD, but does not explicitly exclude practices that have negative biodiversity impacts. The 8th CoP of the Ramsar Convention in 2002 called on parties to “take action to minimize the degradation as well as promote the restoration of those peatlands and other wetland types that are significant carbon stores” while the 7th CoP of the CBD (2004) encouraged Parties to “take measures to manage ecosystems so as to maintain their resilience extreme climate events and to help mitigate and adapt to climate change”.

Turning policy statements into practice, however, means adopting a mix of approaches:

- Controlling temperature increases to avoid ecological damage;
- Addressing the negative impacts of climate change strategies on biodiversity;
- Identifying opportunities for adopting biodiversity-friendly adaptation and mitigation strategies.

The first approach implies a significant reduction in emissions – over and above that required under the Kyoto Protocol. Given the political difficulties in agreeing existing emissions reductions, the probability of implementing stricter measures is very low. This implies even greater attention to the second and third approaches.

The Clean Development Mechanism (CDM) currently provides for carbon sequestration through afforestation and reforestation activities. Positive biodiversity impacts can be achieved if these activities take place on previously degraded lands and are based on natural regeneration and native species but not if native grasslands are converted to fast growing monocultures. Avoided deforestation is likely to provide the greatest biodiversity benefits but is not currently included within the CDM. A large-scale push towards bio-fuels is also likely to pose problems for biodiversity if it results in land clearance rather than occupying previously degraded land.

Many countries are now developing national policies and plans for adaptation, and it is probably here that biodiversity considerations can best be taken into account. Closer coordination between national agencies responsible for the implementation of the various international environmental agreements is a critical first step in this regard so that biodiversity strategies can be “climate-proofed” and vice versa.

