

Policy perspective:

Ecosystem health and climate change

*“There is a widespread view that a 4°C future is incompatible with an organised global community, is likely to be beyond ‘adaptation’, is **devastating to the majority of ecosystems** and has a high probability of not being stable”¹ Prof. Kevin Anderson*

There is growing scientific consensus on the link between ecosystem damage and climate change - a link that would be expected to dramatically reduce the provision of the ecosystem services, or ‘public goods’, on which societies depend. Ecosystem damage (as a result of climate change) sets up a positive, or self-reinforcing, feedback loop whereby the capacity of ecosystems to absorb the causes (GHG emissions) and effects (impacts) of climate change are diminished, accelerating the rate of change.

While ecosystems (and the services that they provide to humans) are being damaged by climate change and its impacts, they are also one of the crucial answers to the question of how we can adapt to, and mitigate, climate change^{2,3}.

The potential role of ecosystem services in climate change mitigation and adaptation

At Rio+20, governments and the global business sector gave explicit recognition (perhaps for the first time) to the fact that ecosystems must play an essential role in managing climate change impacts on society⁴. Ecosystems deliver services to society that can contribute significantly toward climate change adaptation demands including disaster risk reduction (for example, storm surge and flood protection and alleviation), food security (from fisheries to agri-forestry), sustainable water management and livelihood diversification. Ecosystems-based adaptation to climate change also delivers ancillary benefits (social, economic, cultural)⁵. Ecosystem-based adaptation strategies cut across all sectors. Examples (at global level) include using wetlands for coastal defence, flood plain

¹ <http://www.slideshare.net/DFID/professor-kevin-anderson-climate-change-going-beyond-dangerous>

² Munang, R., Thiaw, I., Alverson, K., Mumba, M., Liu, J. & Rivington, M. Climate change and Ecosystem-based Adaptation: a new pragmatic approach to buffering climate change impacts. *Current Opinion in Environmental Sustainability* 5:67–71

³ *Managing the land in a changing climate. Adaptation Sub-Committee Progress Report 2013.*

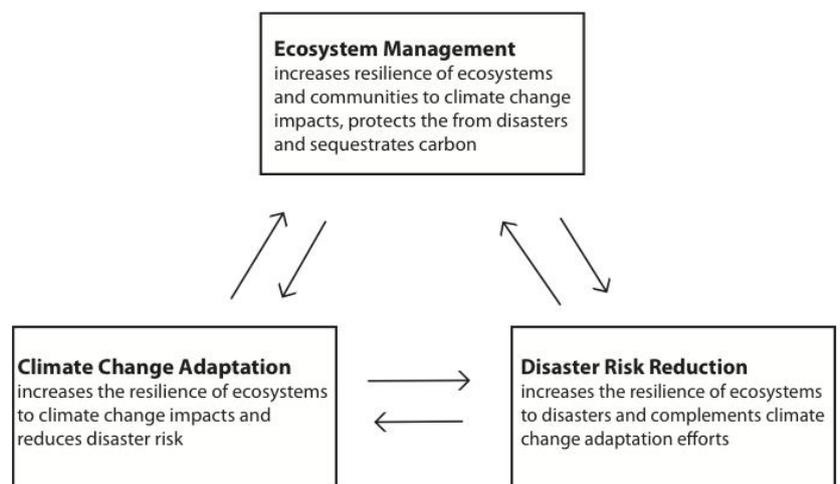
http://www.theccc.org.uk/wp-content/uploads/2013/07/ASC-2013-Book-singles_2.pdf

⁴ Munang, R., Thiaw, I., Alverson, K., Liu, J. & Han, Z. 2013. The role of ecosystem services in climate change adaptation and disaster risk reduction. *Current Opinion in Environmental Sustainability* 5:47-52

⁵ <http://www.nienvironmentlink.org/policy-hub/category.php?c=5>

management for flood defence, and even maintaining genetic diversity for adaptation potential within agriculture.

There is a clear vicious circle, or ‘downward spiral’, involved in the complex relationship between climate change, its impact on the functioning of ecosystems, and their capacity to deliver services to society (see Figure 1). To adapt to, and mitigate, climate change and its impacts, the management of ecosystems is (and will continue to be) crucial. Ecosystem management is “an integrated process to conserve and improve ecosystem health that sustains ecosystem services for human well-being”⁶. Approximately 60% of all ecosystem services across the globe (and up to 70% of regulating services) are being degraded as a result of human impact and mismanagement⁷. Abuse and exploitation of ecosystems by society exacerbates and accelerates the impacts of climate change on humans.



(After Munang et al. 2013)

Figure 1: The complex relationship between ecosystem management, climate change adaptation and disaster risk reduction.

How does the vicious circle work (Figure 2)?

1. Climate change exacerbates ecosystem degradation

The 2014 Intergovernmental Panel on Climate Change (IPCC) report⁸ noted that climate changes is causing impacts on natural and human systems on all continents and across all the oceans, including freshwater resources, terrestrial and coastal ecosystems, marine systems and food production systems. The link between climate change, environmental pressures and ecosystem degradation is scientific ‘mainstream’ and must be taken seriously.

⁶ Munang, R., Thiaw, I, Alverson, K., Liu, J. & Han, Z. 2013. The role of ecosystem services in climate change adaptation and disaster risk reduction. Current Opinion in Environmental Sustainability 5: p.50

⁷ Munang, R., Thiaw, I, Alverson, K., Liu, J. & Han, Z. 2013. The role of ecosystem services in climate change adaptation and disaster risk reduction. Current Opinion in Environmental Sustainability 5: p.47

⁸ <http://ipcc-wg2.gov/AR5/>

2. Ecosystem degradation triggers further extreme climate change impacts and reduces the resilience of natural systems in the face of climate change

Ecosystems can buffer against the impacts of climate change – but only if they are healthy and functioning. When the health of an ecosystem declines, that degradation increases the vulnerability of natural and human systems to climate change impacts (and may increase the intensity of the impacts themselves).

3. Ecosystem degradation reduces carbon sequestration potential in ecosystems

The IPCC has stated that *“the terrestrial biosphere is likely to become a net carbon source by 2100, while ocean buffering capacity begins saturating, thus amplifying climate change, given continued greenhouse gas emissions at or above current rates and other unmitigated global changes, such as land use changes (high confidence)”*⁹. Ecosystems can help to mitigate climate change through regulating services, but if the capacity of the ecosystem to deliver those services is compromised, climate change and its impacts will be exacerbated, thus setting up a positive, self-reinforcing, feedback loop (*begin again at 1*).

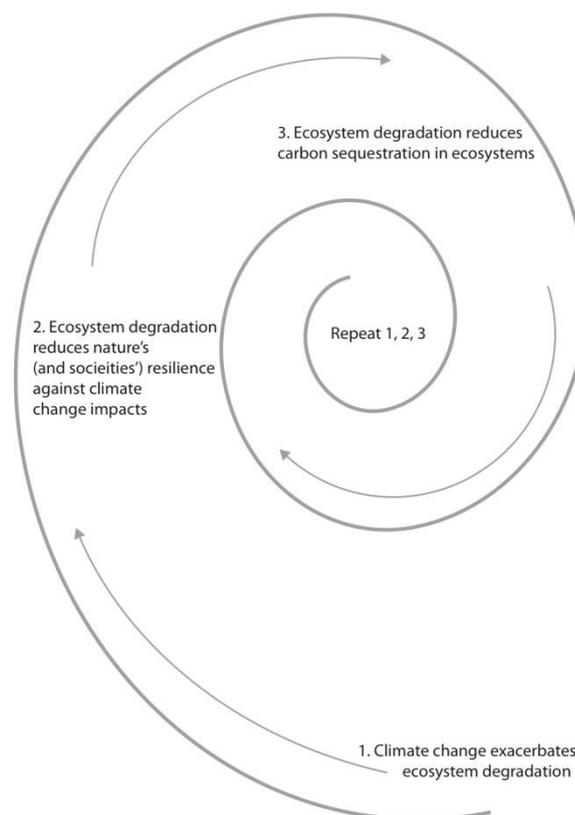


Figure 2: The vicious circle of climate change, climate change impacts, and ecosystem degradation.

⁹ http://www.ipcc.ch/publications_and_data/ar4/wg2/en/tssts-4-1-2-ecosystems.html

Climate change has been conceived of as a ‘wicked problem’¹⁰ – a term describing a category of public policy that defies rational and optimal solutions. Solutions to ‘wicked problems’ are difficult to isolate because of complex interdependencies in the natural and human systems affected – thus, an apparent ‘solution’ to one aspect of the problem can reveal or create the demand for more and deeper solutions. Ultimately there may be no elegant solution to the vicious circle set up between climate change, its impacts, and ecosystem degradation. There may also be a threshold, or ‘tipping point’, beyond which reversal becomes unlikely. However, if such a vicious circle exists, by understanding underlying physical controls, there may be ways of reversing it, or at least attempting to retard the positive feedbacks driving it. Such a framework is outlined by Munang et al. (2013)¹¹:

Reversing the vicious circle (Figure 3):

- 1. Appropriate ecosystem management increases the resilience of natural and human systems to climate change impacts**
The potential benefits from ecosystems resulting from the management of climate change impacts are invaluable.
- 2. Ecosystem management maximises additional benefits of mitigation of climate change**
The management of ecosystems to enhance carbon sequestration can contribute to mitigation of climate change and also support the achievement of other societal goals (for example, improvements in wellbeing, economy, and culture).
- 3. Ecosystem management provides physical defence from climate impacts and disasters**
Mountain meadows and uplands, bushes and forests protect society from, for example, flooding and landslides. Dunes systems and wetlands provide coastal protection.
- 4. Climate change adaptation and mitigation increases resilience of ecosystems**
Well-designed adaptation measures can increase the resilience of ecosystems, which in turn contribute to climate change adaptation and mitigation through regulating and supporting services.

¹⁰ Hulme, M. 2009. Why we disagree about climate change: understanding controversy, inaction and opportunity. Cambridge University Press, pp.334-340

¹¹ Munang, R., Thiaw, I, Alverson, K., Liu, J. & Han, Z. 2013. The role of ecosystem services in climate change adaptation and disaster risk reduction. Current Opinion in Environmental Sustainability 5:47-52

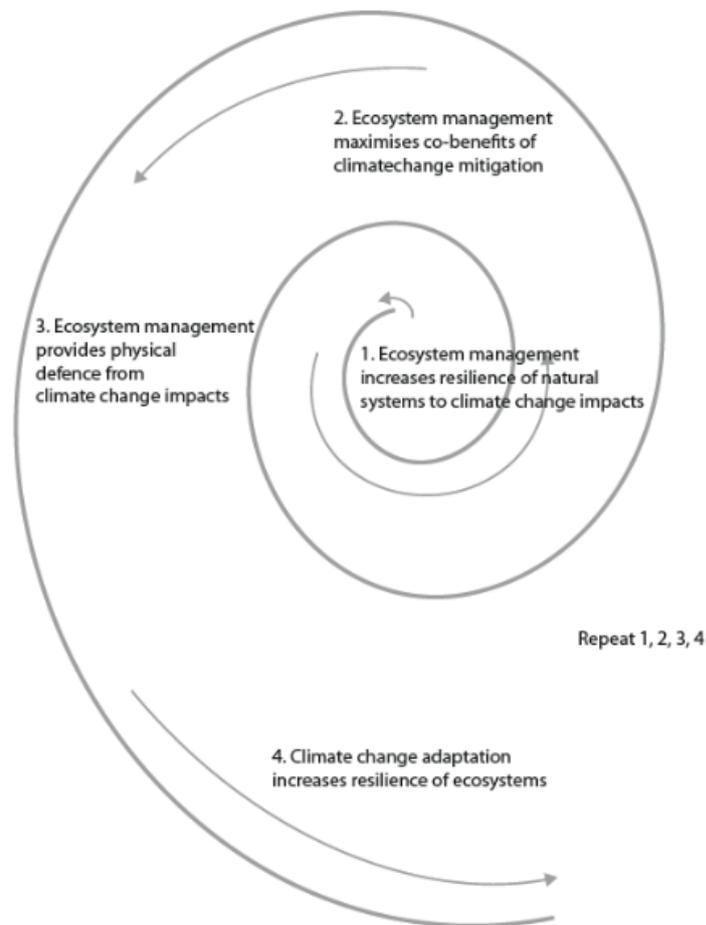


Figure 3: Reversing the vicious circle of climate change impacts and ecosystem degradation

Given the importance of ecosystem services and their management in the face of climate change, NIEL recommends political commitment at the highest level. While the science is clear (though the systems are complex), the policy and resulting action need to be more explicit and driven.

Recommendations (adapted from¹²):

- **Recognise, identify, inventory and map multiple functions and services provided by ecosystems across different scales in Northern Ireland.**
- **Link ecosystem management with sustainable livelihoods and development (i.e. demonstrate clear social and economic benefits for investing in ecosystem management).**
- **Assess risk of climate change impact on ecosystem service provision and put in place measures to reduce the impacts.**
- **Involve local communities at all stages.**

¹² Munang, R., Thiaw, I, Alverson, K., Liu, J. & Han, Z. 2013. The role of ecosystem services in climate change adaptation and disaster risk reduction. *Current Opinion in Environmental Sustainability* 5:47-52