ECOLOGICAL IMPACTS

Ecosystem transformation

Earth Syst. Dynam. **4,** 347–357 (2013)

Climate change has the potential to transform ecosystems as we know them with implications for the services they provide to humanity, including fundamental resources such as food and water. An understanding of how much change can be expected for a given level of climate warming can therefore inform climate mitigation targets and our understanding of how much we may need to adapt to cope with ecological changes.

Sebastian Ostberg from the Potsdam Institute for Climate Impact Research, Germany, and co-workers investigate the implications of a 1.5 to 5 °C increase in global mean temperature for terrestrial biogeochemical processes and land surface properties, and use this to indicate the chance of ecological shifts and/or transitions.

They find that the majority of ecosystems are likely to be profoundly altered worldwide unless climate change can be limited to around 2 °C above preindustrial levels. Even relatively modest 2 °C changes, which are widely regarded as an upper limit for 'safe' levels of climate change, have the potential to alter up to one fifth of the land surface. *AB*

MITIGATION

Climate policy benefits

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Mitigation of greenhouse gas emissions should reduce their concentration in the atmosphere and thereby reduce warming. It is not known how long after mitigation there would be a sufficient change in atmospheric concentration to affect surface temperature, and detection of the mitigation effort would be hampered by natural variability in the climate system.

Claudia Tebaldi, of Climate Central and the National Center for Atmospheric Research, USA, and Pierre Friedlingstein, of the University of Exeter, use climate projections to determine when mitigation efforts become detectable in surface temperature. They compare various emissions scenarios, from strong mitigation to business-as-usual, and the expected atmospheric CO_2 concentrations and surface temperatures.

Their findings suggest that it takes at least 25 years for there to be a detectable temperature signal globally, with regional signals measurable after even longer lead times. Atmospheric CO_2 concentrations, with smaller natural variability, can be detected within 10 years of mitigation. *BW*

GOVERNANCE

Boundary agency

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Under the Clean Development Mechanism (CDM), developed nations have mainly financed carbon-reduction projects in large emerging economies, such as China and Brazil. Less developed countries (LDCs) — including Cambodia, Bolivia and Uganda, among others — have had limited access to international carbon projects.

Eungkyoon Lee of Korea University, South Korea, and colleagues analyse the success story of the United Nations Environment Program (UNEP) Risø Centre in Denmark — an agency that has already helped eleven LDCs to join CDM projects. Formed under an agreement between UNEP, the Danish Ministry of Foreign Affairs and the Technical University of Denmark, the agency is a real example of a boundary organization that sits between science and policy-making. Its focus is to address LDCs' concerns over the investor countries' interests in the projects and the fear that host countries end up with little, if any, reward. With strong internal leadership, the agency generates usable information, works closely with LDCs and supports local capacity-building. *MC*

CRYOSCIENCE

Ice retreat

Cryosphere **7,** 1565–1577 (2013)

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With the warming climate, most glaciers and ice caps are retreating. However, a lack of observations, spatially and temporally, makes it difficult to draw global conclusions. Accumulation-area ratio (AAR) is a technique for projecting changes in global glacier volume. If a glacier is in balance with the climate — that is, not experiencing retreat or advance — it has an AAR value equal to the equilibrium value of AAR_0. Glaciers with values less than AAR_0 will retreat at lower altitudes until they reach equilibrium.

Sebastian Mernild, of Los Alamos National Laboratory, USA, and co-workers build on AAR assessments to address the global undersampling and to estimate committed ice losses due to the current climate. Using the available observations for 1971–2010, they find glaciers are further from equilibrium than previous work reported. Committed losses of 32±12% of area and 38±16% of volume are estimated if the climate remains as it is at present. The large uncertainties associated with these values could be reduced by more observations from undersampled regions. *BW*

ECOLOGICAL IMPACTS

Forest flattening

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When considering climate gradients, factors such as elevation and latitude usually spring to mind. For tree-dwelling organisms, however, the greatest climate gradient is vertical (from ground to tree top) — this very steep temperature profile is a strong driver of species organisation in tropical forests.

Brett Scheffers, from the University of Singapore, and co-workers investigate frogs in Philippine and Singaporean rainforests, finding that they tend to shift higher up in the trees as altitude increases to compensate for the cooler temperatures. These results suggest that vertical climate gradients in forests offer the potential for species to compensate for larger-scale climate changes that are driven by altitude and/or latitude, and occupy larger geographical areas.

An interesting implication of this hypothesis is that climate change could 'flatten' the biodiversity in rainforests by pushing tree-dwelling species towards the cooler and wetter ground. Such flattening could affect forest functioning and species survival. *AB*

Written by Alastair Brown, Monica Contestabile and Bronwyn Wake.