



Committed Ecosystem Changes in multiple DGVMs

C.D. Jones (1), J.A. Lowe (1), E. Robertson (1), S.A. Sitch (2), C. Huntingford (3), P. Ciais (4), P. Friedlingstein (2), P. Levy (5), M. Lomas (6), S. Piao (7), and F.I. Woodward (6)

(1) Met Office Hadley Centre, Climate Science, Exeter, United Kingdom (chris.d.jones@metoffice.gov.uk, +44 (0)1392 885681), (2) University of Exeter, Exeter, UK., (3) CEH, Wallingford, UK, (4) LSCE, Paris, France, (5) CEH, Edinburgh, UK, (6) Sheffield University, Sheffield, UK, (7) Peking University, Beijing, China

Terrestrial ecosystems may respond sensitively to climate change and have been identified as possible tipping elements. Moreover, components of the Earth System such as ecosystems and vegetation cover that are affected by climate change will respond on their own natural timescales. For some components these timescales are slow compared with the rate of climate change and hence the system response lags behind the degree of global warming. Thus when the climate is stabilised these systems are not yet in equilibrium and continue to respond for perhaps long into the future.

It has previously been shown for the Hadley Centre GCM that the global terrestrial biosphere continues to change for decades after climate stabilisation and may even be committed to long-term change before any response is observable. Here we explore this phenomenon in 5 dynamic vegetation models and find the concept to be robust – committed changes to ecosystems may be significantly greater than the changes realised during the period of changing climate.

Ecosystem commitments do not just include dieback. In addition to some committed loss of tropical forests, a warmer future climate may enable northward expansion of the Boreal forest into present tundra regions. We also find that in temperate latitudes the vegetation models disagree even on the sign of response (increased or decreased forest) for the same climate forcing. Given that large scale changes in ecosystem extent inevitably have a long timescale to fully adjust to a changed climate the concept of ecosystem commitments is robust although the magnitude and even sign of commitment will vary regionally and between models. This has significant implications for both ecosystem services and terrestrial carbon storage.