Incorporating the value of nature into assessments of future energy pathways

Andrew Lovett¹, Brett Day², Greg Smith³, Gemma Delafield⁴, Nathan Owen⁴, Paolo Agnolucci⁴, Ian Bateman⁴, Nicola Beaumont⁵, Steve Carver⁶, Trudie Dockerty⁷, Caspar Donnison⁷, Felix Eigenbrod⁸, Henry Ferguson-Gow⁹, Astley Hastings⁹, Robert Holland⁹, Richard Pearson⁹, Gilla Sünnenberg¹, Gail Taylor⁷, and Guy Ziv⁶

¹School of Environmental Sciences, University of East Anglia, Norwich, UK (a.lovett@uea.ac.uk)
²Land, Environment, Economics and Policy Institute (LEEP), University of Exeter, Exeter, UK
³CSIRO, Hobart, Australia
⁴Institute for Sustainable Resources, University College London, London, UK
⁵Plymouth Marine Laboratory, Plymouth, UK
⁶School of Geography, University of Leeds, Leeds, UK
⁷Biological Sciences, University of Southampton, Southampton, UK
⁸Geography and Environmental Science, University of Southampton, Southampton, UK
⁹Centre for Biodiversity and Environment Research, University College London, London, UK
¹⁰School of Biological Sciences, University of Aberdeen, Aberdeen, UK

The UK government has made formal commitments to reduce GHG emissions (e.g. under the Climate Change Act 2008 and subsequent amendments) and to protect/improve natural capital and the environment (e.g. as part of the 25 Year Environment Plan published in 2018). Meeting these objectives requires an integrated approach to two parallel challenges i) decarbonising the energy system and ii) better understanding and valuation of natural capital and ecosystem services. From an academic perspective this involves bringing together two substantial, but rather weakly connected bodies of research, while also acknowledging that this integration in a UK setting needs to recognise the international context (i.e. a whole systems perspective).

The ADVENT project (ADdressing Valuation of Energy and Nature Together) has been funded by the UK National Environment Research Council to develop conceptual frameworks and modelling tools which integrate the analysis of prospective UK energy pathways with considerations relating to the value of natural capital. A methodology has been implemented to downscale the outputs of pathways from national energy system models and incorporate environmental impacts into the assessment of different options. This has required defining spatially-optimised distributions of investments in new energy infrastructure using a range of financial and welfare criteria. These distributions are then compared in terms of their construction, transport and land opportunity costs, as well as the implications for biodiversity, greenhouse gas emissions, recreation, visual amenity and water resources.

This paper will present results from comparing different UK energy pathways through to 2050 in
terms of the implications of electricity generation from three types of renewables (bioenergy, solar and onshore wind). The results illustrate that i) individual pathways can vary appreciably in their environmental impacts, ii) overall societal welfare can be enhanced by using spatial modelling to incorporate valuations of such impacts into implementation of pathways and iii) assessment outcomes can be sensitive to modelling assumptions (e.g. regarding the proportion of biomass feedstock from domestic or international sources). More broadly, the results demonstrate how important improvements can be achieved in the integration of environmental considerations into the assessment of future energy pathways at regional and national scales. The approach is now being further refined through the UK Energy Research Centre Phase 4 programme and ADVANCES Landscape Decisions project in the UK, as well as the five-country IRENES project funded by Interreg Europe.