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Future forest growth in the UK – a case study of supporting land use decisions for net zero

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The UK has committed to reaching net zero emissions by 2050, and the government plans to triple current tree planting rates over the next 25 years. This commitment brings up many questions – Where should the trees be planted? If they displace agriculture, where should the displaced food come from, and how should farmers be compensated? And how will future UK woodlands fare in a changing climate?

We are developing a suite of models to address the multifaceted implications of land use change in the UK. The aim is to empower decision makers to understand policy options that would lead to a desired outcome – for example tree planting incentives to maximize greenhouse gas removal. A core component of this modelling framework is forest carbon storage and its sensitivity to climate, CO_2, and management. Using km-scale climate forcing from an ensemble of projections, we model forest carbon with JULES, which typically represents the land surface in the UK/Hadley Centre climate models. We include developments to represent forest demography, multiple species, and management. Future climate in the UK is projected to be warmer with drier summers and wetter winters. Therefore, both drought and flooding are concerns for planning future land use.

This study highlights both the mitigation and adaptation potential of UK woodlands, focusing on a case study of locations illustrative of the climate change patterns seen in UKCP18 projections produced by the UK Met Office. We evaluate the potential for carbon removal, as well as impacts of the new woodlands on water resources (runoff and soil water retention) and local surface temperatures. Although higher CO_2 levels are expected to enhance growth, the potential for warmer and drier summers pose regional threats to future UK woodlands, even in high mitigation scenarios.