

## ORIGINAL RESEARCH



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# Bioenergy with Carbon Capture and Storage (BECCS): Finding the win–wins for energy, negative emissions and ecosystem services—size matters

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## Abstract

Bioenergy with Carbon Capture and Storage (BECCS) features heavily in the energy scenarios designed to meet the Paris Agreement targets, but the models used to generate these scenarios do not address environmental and social implications of BECCS at the regional scale. We integrate ecosystem service values into a land-use optimization tool to determine the favourability of six potential UK locations for a 500 MW BECCS power plant operating on local biomass resources. Annually, each BECCS plant requires 2.33 Mt of biomass and generates 2.99 Mt CO<sub>2</sub> of negative emissions and 3.72 TWh of electricity. We make three important discoveries: (a) the impacts of BECCS on ecosystem services are spatially discrete, with the most favourable locations for UK BECCS identified at Drax and Easington, where net annual welfare values (from the basket of ecosystems services quantified) of £39 and £25 million were generated, respectively, with notably lower annual welfare values at Barrow (−£6 million) and Thames (£2 million); (b) larger BECCS deployment be-