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Designing space for wetland conservation by using a cost-effective site-selection model

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Wetlands constitute valuable ecological resources. Their existence is driven by site specific natural conditions and the economic environment. This study integrates both aspects by linking a GIS-based wetland model with the European Forest and Agricultural Sector Optimization Model (EUFASOM). EUFASOM is a partial equilibrium model which studies simultaneously synergies and tradeoffs between biodiversity conservation efforts, greenhouse gas mitigation options including carbon sinks and bioenergy, as well as traditional agriculture and forestry markets. Today, conservationists are also concerned that promotion of bioenergy plantations in the context of climate change mitigation policies could further threaten nature reserves.

This study evaluates both biophysical and economic potentials to preserve existing habitats, to restore formerly native habitats, and to create non-native managed habitats with respect to freshwater wetlands of the EU-25 states. Through a GIS-based model the distribution of existing wetland habitats and potential convertible sites is visualised at resolutions of 100 m and 1 km, respectively. The model distinguishes five wetland types and 6 structures. The biophysical suitability of a location as wetland is determined by a set of rules, which include climate, soil, slope, and vegetation parameters. Spatially explicit wetland distribution data are aggregated to country level and integrated into EUFASOM. For different policy scenarios, the optimization model computes the corresponding economic potential of wetlands, its effects on agricultural and forestry markets, and environmental impacts. The scenario specific total wetland

area per EU-country from EUFASOM is downscaled by a GIS-based site-selection model which uses environmental and socio-economic constraints. Landscape metrics build the base of this analysis by considering the spatial context as well. The final result is a dynamic wetland suitability map that shows potential convertible wetland sites levelled after its suitability and dependent on defined restoration goals and the EUFASOM scenarios. The model is useful to locate sites suitable for renaturational programs, for the introduction of faunistic corridors considering the NATURA2000 network, and favouring success in regional conservation planning. The EUFASOM results show that bioenergy plantations would have enormous consequences for wetland restoration efforts.