

Integrated Assessment of FWLE Nexus Interactions and Potential Synergies and Trade-offs in Europe

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Abstract

Climate change and socio-economic development will have important implications on the long-term sustainability of natural resources supporting the human and ecological systems globally. These impacts also interact in complex and non-linear ways that transcend beyond traditional sectoral and regional boundaries with cascading and potentially pervasive implications. This is particularly relevant for the food-water-land-ecosystems (FWLE) nexus, as it is fundamental for achieving a number of the Sustainable Development Goals (SDGs). A holistic understanding of the FWLE nexus interactions and associated response to various exogenous drivers is crucial for developing robust cross-sectoral adaptation strategies that facilitate sustainable use and management of finite natural resources under uncertain future changing conditions.

This work presents the findings of a landscape-scale simulation of the complex cross-sectoral linkages and interactions between six key land- and water-based sectors in Europe (i.e., agriculture, biodiversity, coasts, forests, urban, and water). The study applies a widely used regional integrated assessment modelling (IAM) tool, taking into account a wide range climate change and socio-economic development scenarios. The results highlight the key climatic and non-climatic drivers of Europe's future landscape change dynamics, and provide quantitative insights into key FWLE nexus synergies and trade-offs and potential implications for sustainability and the SDGs. It also demonstrates the role of systematic integrated model-based analysis of nexus issues across scenarios and scales, providing a methodological framework that can facilitate future nexus studies.