De Økonomiske Råd

The Environmental Economic Conference 2022

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Agri-environmental scheme design: Insights from integrated environmental-economic modelling

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Abstract

Agri-environment schemes (AES) have become a major policy instrument for protecting farmland biodiversity and improving environmental quality (eg water quality) world-wide. AES provide financial support for farmers and landowners to implement specific actions that benefit the environment. A key question for improving AES is how to design payments to farmers in a way that improves cost-effectiveness. By cost-effective, we mean that an ecological benefit is maximised for a given total cost or conservation budget; or that the aggregate costs of meeting a specific ecological target are minimised. Integrated ecological-economic modelling is one tool that allows us to explore how we can achieve cost-effective AES.

In economics and ecology, models play an important role in developing management and policy recommendations. A typical ecological-economic model in this context consists of ecological, economic and landscape components, which interact with each other. In AES design, ecological-economic modelling allows us to link actions undertaken by farmers to predicted environmental outcomes. The economic component usually starts from a theoretically and behaviourally consistent assumption that farmers are profit or utility maximisers. The ecological aspect focuses on the environmental outcomes that benefit a measure of biodiversity, or for example changes in water quality. The integrated ecological-economic model allows us to explore trade-offs and complementarities between changes in land use and environmental outcomes, and to trace out how the aggregate costs of meeting some environmental target change with *how* the AES is designed.

In this paper, we focus on AES design for water quality improvements using a spatially explicit integrated model. We compare the performance of AES with different design features; we compare *i)* AES with payments for practices versus payments for results, *ii)* AES based om spatial targeting through zoning, and iii) schemes based on trading mechanisms to achieve a catchment level goal. Uniform payments for implementation of practices serves as a baseline to evaluate the performance of more novel design mechanisms.

We test alternative AES by further developing *TargetEconN*, a high resolution spatially specific integrated model, to model farmer responses to AES. The paper uses Odense catchment as a case study to explore the cost-effectiveness of alternative schemes.