

Synergies in land use measures to improve water quality and climate regulation

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Land-use change measures have implications for a number of environmental outcomes and are often suggested as means to reach different environmental targets. For decades, improving water quality and climate regulation have both been critical environmental issues. Land use changes that have a positive effect on one of these policy targets tend to also have a positive effect towards the other. However, the spillover effects are relatively small when the two are not addressed simultaneously. Consequently, the spillover effect from a land use policy intended to improve water quality is not extensive enough to sufficiently provide climate regulation and vice versa.

Using spatially explicit data from Limfjorden catchment, we explore the synergies between these two services when they are simultaneously addressed in land use policy. Land conversions to set-a-side and reforestation are considered. We parameterize the effects of land use based on spatially specific data on soil quality, nitrogen retention, forests growth conditions and existing land cover. For illustration purposes, we focus on a scenario, in which the marginal cost equates the marginal benefits for water quality and climate regulation. We estimate the marginal benefits based on policies or governmental estimates from the past few years. For climate regulation, we use marginal abatement cost estimates for CO₂. For water quality we rely on past nutrient reduction target to reveal the demand for water quality in different sub-catchments. The outcome of the analysis is an illustration of the optimal land use pattern for reaching the two environmental targets. An important factor for provision of both is soil characteristics, but the services depend on soils in different ways. Furthermore, different land use measures have differential impacts on different policy targets. The analysis illustrates the potential synergy in addressing the two targets simultaneously, opposed to individual targeting, and analyse the determining factors of the magnitude of the synergy/trade-off.