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28. Approaches to modelling ES, where are we now and new approaches (OPEN)

Site prioritisation for conservation of multiple ecosystem services: hotspots vs. heuristic optimisation with Marxan with Zones

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While there is some experience in conservation planning for biodiversity, considering ecosystem services in conservation is a fairly new practice. As there are trade-offs among services, management choices have to be made, for instance between timber harvest on the one hand and carbon sequestration and recreational services on the other. In addition, spatial distribution and abundance varies between services, which leads to different degrees of spatial overlap and increases the complexity of decision making. Hence, decision makers need guidance to determine priority sites for conservation of multiple ecosystem services. The definition of services hotspots has developed as one form of site prioritisation. While the interest in determining services hotspots has increased, clarity of definitions of hotspots is still missing. The first aim of this research is to create an overview of different definitions of ecosystem services hotspots. We test how different definitions influence delineation of hotspots on a datasets of five ecosystem services, including existence of wilderness-like areas, recreational hiking, carbon sequestration, carbon storage and snow slide prevention in forest areas of the County of Telemark, Norway. Basing site prioritisation on services hotspots only might neglect cost-efficiency and compactness of the spatial arrangements of selected sites. In a second step of our analysis we therefore compare the results of a hotspots based site selection approach with a heuristic optimisation approach that considers opportunity costs of conservation as well as compactness of the reserve network. We use the site selection software Marxan with Zones to prioritize a conservation network that contains the same amount of ecosystem services as the respective hotspots.
First results show that, when defining hotspots as cells with the highest values covering 30% of the total amount of the respective service, an area of about 262.000 ha was selected with an opportunity costs related to foregone timber harvest of 3.36 billion Norwegian kroner. In comparison, the most cost-effective output of Marxan led to a selected area of 394.000 ha (+50.4%) and opportunity costs of 1.29 billion Norwegian kroner (-61.6%). The results show that a site prioritisation scenario is able to find more cost-effective solutions while achieving a comparable amount of services protected. Marxan selects more land as the software primarily selects areas with low opportunity costs. We conclude that if the total quantity of services provided is more important than the intensity of ecosystem services provision, an optimisation approach is preferable for guiding decision making in land management.