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The Socio-Ecological Scales of Ecosystem Service Bundles in Denmark

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ABSTRACT

To better understand the interactions of multiple ecosystem services in the landscape, their modeling, opportunities and restraints, we examine the differences in the composition of multiple ecosystem services at different scales. This addresses the following questions: what are the composition, interaction and distribution of nationwide ecosystem services when aggregated on municipal and managerial boundaries? Furthermore, we study the composition of the services bundles as we aggregate data from fine scale to coarse scale in different ecosystem service-landscape types. The case study of Denmark is particularly relevant for ecosystem service trade-off analysis due to the high human population pressure (128 pers/km^2) and large fraction of agricultural land-uses putting pressure and creating demand for a diverse range of ecosystem services. We conduct the analysis at the scale of the municipality, which are approx. 400km^2 in average, to investigate ecosystem services' trade-offs and synergies at a scale relevant to the policy maker. Within selected municipalities we investigate how ecosystem service bundle types are distributed at a finer resolution (500mx500m; i.e. the land management decision scale). The services aggregated are separated into provisioning services (livestock, crops, and drinking water); cultural services (sense of place, nature appreciation, summer cottages, nature tourism); and the regulating services of carbon storage, wetlands water purification, and soil organic content. Earlier analyses found support for the existence of four distinct bundle types; coastal, agricultural, forested and multifunctional bundle types. We expect these general patterns to be consistent when aggregated to the municipality scale and become more specialized at the higher resolution as the finer detail in the landscape are uncovered.