

Comparing productivity of old growth and production forests in Sweden

Paper in prep.

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Abstract

Forest ecosystems are an important component of the terrestrial carbon sink [1], and Sweden has a large forest area, including many old growth forest areas [2]. Forest management is expected to impact vegetation carbon uptake, but to which extent is largely unknown [3-6]. Forest harvest removes large quantities of biomass and impacts ecosystem functioning and structure, which may alter ecosystem productivity [7]. Meanwhile management activities such as fertilization, planting, and thinning may enhance productivity [8]. Here we investigated the effect of management on forest productivity by comparing production and old growth forest in Sweden. We produced a first digital map and dataset of 390 old growth forests in Sweden. We used this dataset to perform a pairwise comparison of remotely sensed vegetation indices of productivity, between old growth forests and adjacent managed production forests. We found that production forests have higher productivity on average, while the maximum productivity was found in several old growth forest sites. The higher average productivity in production forests cannot fully be explained by younger stand ages [9-11]. Rather, our analysis indicates that the effects of preferential cutting in the past have resulted in old growth forests remaining mostly in areas with less desirable site conditions such as steep slopes or wetlands. The few old growth forest sites with less adverse conditions are an exception to this pattern and these show the maximum productivity values found in this study. Results indicate that young, managed, production forests in Sweden are highly productive but may not reach the maximum productivity potential found in old growth stands under current management. At the same time, ecosystem productivity in sites with growth-inhibiting site conditions may benefit from management intervention.

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