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Trade-offs in the multi-use potential of managed boreal forests

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1. Implementing multi-use forest management to account for both commercial and non-commercial ecosystem services is gaining increased global recognition. Despite its spatial extent, and great economic and ecological values, few studies have evaluated the boreal forest and its management to assess the potential for simultaneous delivery of a suite of ecosystem services.
2. Using data from a Swedish long-term experiment this study explores how biodiversity of the ground vegetation and potential delivery of multiple ecosystem services (timber production, carbon (C) storage and non-timber forest products) are influenced by two common silvicultural practices (thinning, fertilization and their interaction).
3. Diversity (diversity indices and species richness) of the ground vegetation was higher in thinned than in unthinned forest, something partly explained by six species of lichens that only occurred in thinned forest. In addition, supply of lichens for reindeer forage was three times higher in thinned forest. Fertilization negatively affected the lingonberry shrub (Vaccinium vitis-idaea). Timber production increased with fertilization, but decreased with thinning. The potential for C storage was highest in fertilized forests, which, apart from having the highest timber production, also supported the highest standing tree biomass.
4. The silvicultural practices evaluated induced trade-offs among the ecosystem features studied as thinning increased biodiversity of the ground vegetation, production potential of wild berries and lichens, but reduced timber production and the forest's potential for C storage. Fertilization, had the opposite effect, promoting the potential for C storage at the expense of biodiversity and the ecosystem services delivered by the ground vegetation.
5. Choice of silvicultural practice had a pronounced effect on the multi-use output from managed boreal forest, and trade-offs among outputs were common. Nevertheless, our study demonstrates that silvicultural practices currently adopted in Sweden can be used to adjust the multi-use potential output of forests, suggesting that commonly used practices can be applied to maintain, or even increase the multi-use potential of the boreal forest biome, if management objectives are allowed to vary across the landscape. A prerequisite for this is management objectives that clearly determine the desired output.