



Is heavy browsing a threat to biodiversity in a boreal ecosystem?

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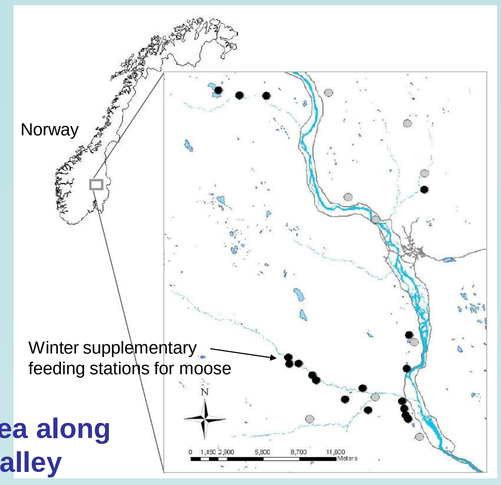


Fig. 1. Study area along Glomma river valley

Rational:

Herbivore numbers have been increasing across Europe and North America in recent decades, with implications for whole ecosystems, including impacts on biodiversity. Moose populations in Scandinavia are no exception, leading to intense browsing of commercially important boreal forests.

Aim:

To examine the impact of moose browsing in relation to supplementary feeding stations on species richness and abundance of 4 functional groups of plants (grasses, herbs, dwarf shrubs and canopy trees) and 2 functional groups of passerine birds (seed-eaters and insect-eaters).

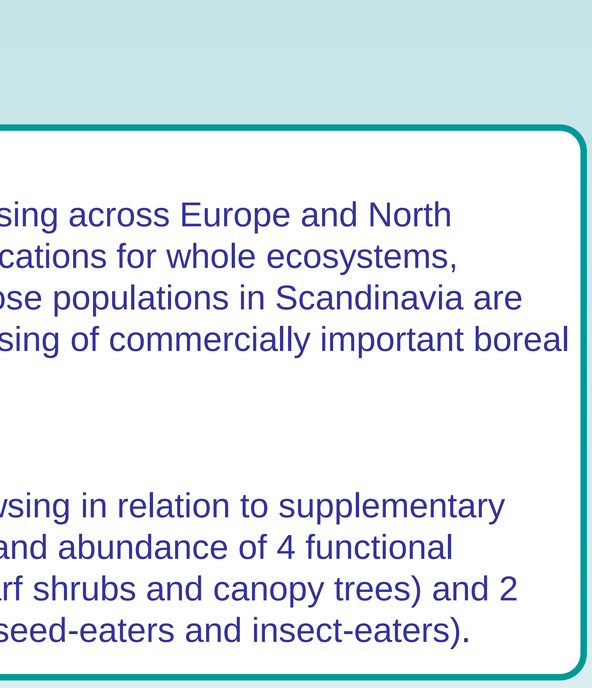
Methods:

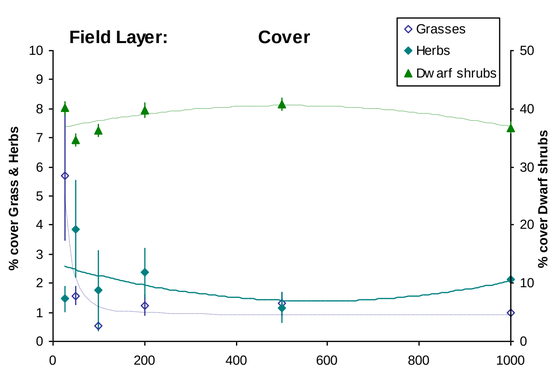
1) The study area was boreal forest dominated by Scots pine (*Pinus sylvestris*), Norway spruce (*Picea abies*) & birch (*Betula* spp.) in SE Norway (Fig. 1).
2) Replicated point counts of passerine birds were made in May & June at 11 pairs of high and low browsing pressure plots (around winter supplementary feeding stations for moose and paired control sites). Moose browsing pressure was estimated as % of shoots within browsing height (0.5 – 3 m) that were browsed.
3) Canopy trees were counted & identified in seven 50 m^2 plots along 2 transects on a browsing gradient up to 1000 m from 59 feeding stations.
4) Species diversity and % cover of field layer vegetation was assessed in July in six 1 m^2 plots along a browsing gradient up to 1000 m from 8 feeding stations.

Vegetation Results:

Patterns of abundance / cover & species richness were similar in all growth forms. Abundance & diversity of canopy trees decreased along a browsing gradient from feeding stations (Fig. 2). 13 tree species were recorded, with smaller individuals occurring close to feeding stations.

Fig. 2 Effect of distance from feeding station on abundance and species richness of canopy trees





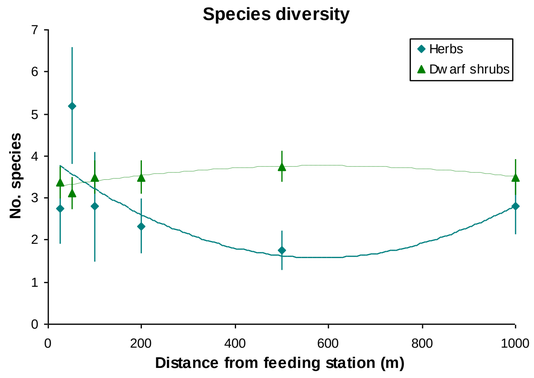


Fig. 3 Effect of distance from feeding station on abundance & species richness of field layer.

Cover of grasses, dominated by *Deschampsia flexuosa,* increased sharply close to feeding stations. (Fig. 3) while there was an inverse relationship between cover & diversity of herbs & dwarf shrubs. Cover & diversity of herbs was relatively low at 25 m from feeding stations, peaked at 50 m & was lowest at 500 m from feeding stations. Dwarf shrubs showed the opposite pattern.

Bird Results:

32 species of male territorial passerine birds were recorded. Species richness decreased with increasing birch browsing, but was higher at feeding stations than at control sites with similar browsing pressure, due to nutrient input (Fig. 4a).

Abundance of seed-eaters was positively correlated with birch browsing, whilst abundance of insect-eaters was negatively correlated (Fig. 4b).

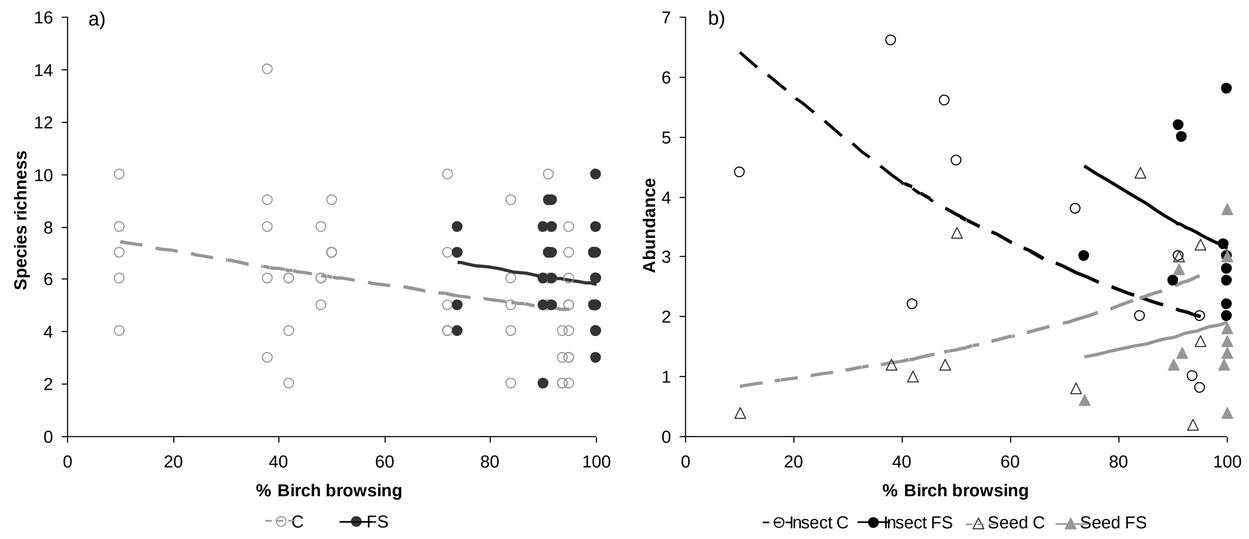


Fig. 4 Effect of browsing pressure on a) species richness and b) abundance of passerines at feeding station (FS) and control (C) sites. Abundance differed between insect-eating and seed-eating species.

Discussion:

Browsing pressure adversely affected abundance & diversity of dwarf shrubs & insect-feeding birds but positively affected grasses, herbs, canopy trees & seed-eating birds. Shade-intolerant field layer species (e.g. *Deschampsia flexuosa*) benefited from the open canopy in areas of intense browsing and probably also from the high nutrient input associated with feeding stations. The high diversity and abundance of canopy trees at high browsing pressure is probably due to regeneration of small trees of browsing-tolerant species (deciduous trees).

Decomposing species diversity by functional groups shows that while overall diversity may be unaffected by browsing, some groups perform better than others. As species that benefit from heavy browsing may be common, weedy or ephemeral species, managing browsing pressure to maximise total biodiversity may not be the best option for conservation in general.

Acknowledgements:

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