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Increased resilience in managed boreal forests: Controlling damage by spruce bark beetle and moose in Sweden

Matilda Lindmark

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Abstract

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Most of the forests growing in Europe today have been planted, or heavily affected, by humans. This is because the forest industry provides crucial raw materials for diverse products, including timber, pulp and paper, cellulose-based substances and renewable energy sources. However, forest management has turned heterogenic natural forests into homogenous forest stands that are highly susceptible to various kinds of damage.

This thesis focuses on moose (*Alces alces* L.) browsing and attacks by spruce bark beetle (*Ips typographus* L.), both of which cause large economic losses. Empirically, it is based on field experiments conducted in managed forests in Sweden.

Moose browsing on vulnerable top shoots of young pines during wintertime is a substantial problem in northern Europe. My colleagues and I (hereafter we) found that extracts of spruce trees (which moose prefer less than pine) can act as efficient natural browsing repellents.

Spruce bark beetles attack spruce (*Picea abies*) trees throughout Europe. Thus, we also evaluated the field behavior of the beetles exposed to non-host- and fungal volatiles in efforts to identify more efficient ways to protect susceptible spruce stands. In addition, we evaluated the predator:prey ratio between the beetles and

Thanasimus predators in representative forest stands, to assist efforts to enhance the biological control of spruce bark beetles in managed forests. Finally, we investigated changes in bacterial communities in wood after attacks by spruce bark beetles to improve knowledge of their ecology. Changes in forest management regime are needed to increase structural and tree species diversity, and thus raise forests' resilience and ability to cope with ongoing climate change. Results presented in this thesis indicate that changing forest management to increase the variation in tree species variation will enhance the resilience of managed forests, thereby reducing damaging by both moose and spruce bark beetle

Keywords

Browsing repellent, pheromone traps, biological control, site specific management