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DISTURBANCE ECOLOGY

Umeå University

Abisko, Sweden
Mountains & Sub-arctic Treeline

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Background and research challenges

Ecosystems in remote Scandinavian landscapes are driven by natural processes. Human populations density and impact is low. Human influence is mainly related to herding. Reindeer is of economic value, also for tourism, and of intrinsic value for the Sami people (Fig 1). Semi-domesticated herds browse dwarf shrubs and tree seedlings.

Abisko National Park is located at the ecotone between subarctic tundra and boreal forest, dominated by birch (*Betula pubescens*). This treeline is regularly controlled by autumnal moth (*Epirrita autumnata*) (Fig. 2). Ecotones are particularly sensitive to climate change. Today it is unclear, how global warming will effect the birch-moth-relationship.

Fig. 1: Reindeer herds are a major component of subarctic ecosystems (Foto Nicolas Dory).

Problem statement

Ecosystems in the tundra and the northern margins are very sensitive and species-poor. Thus they can be seen as sensitive instrument to indicate ecosystem responses to land use and climate change. The tree-line and transition zone are of large dimension in this region. Remote sensing applications are needed for long-term monitoring.

Drivers of Change

Pest Outbreaks: *Betula pubescens* is defoliated by *Epirrita autumnata* in a quasi-decadal rhythm. These rhythms are possibly changing.

Reindeer Grazing: Semi-domesticated herds graze tundra grasslands, dwarf shrubs and tree seedlings. Grazing intensity varies.

Climate Change: Global Warming is likely to increase the time span between leafout and litterfall, influencing biomass and species distributions. Trends in precipitation are highly uncertain.

Remote Sensing Approaches

Snow cover extent and duration are needed as important drivers.

Photosynthesis as an indicator of ecosystem performance at high spatial and temporal resolution (timespan between leafout and litterfall, pest outbreaks).

Vegetation cover and structure: through LIDAR and NDVI.

Biodiversity: indirect measurements of species composition and dominance patterns via spectral answers.

Anthropogenic impact: grazing intensity and herd movement.

Fig. 2: *Betula pubescens* defoliated by an outbreak of *Epirrita autumnata*. Will the birch or the moth profit from ongoing warming trends?

Site description

Abisko National Park represents mountain ecosystems; and the transition and ecotone between tundra and boreal biome.

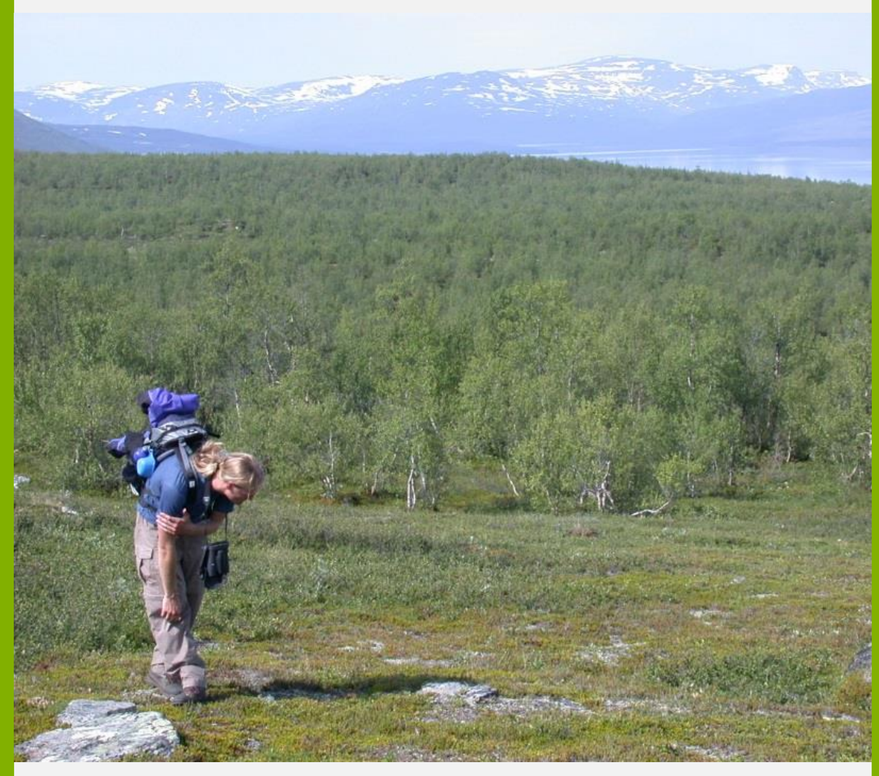

Fig. 3: Sub-arctic treeline at Abisko National Park. Will the treeline shift north during climate change because of better growth conditions for birch? Or will it shift south because of shortened outbreak circles? Which role plays browsing of tree seedlings through semi-domesticated reindeer?

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