Effects of ungulate browsing on forest regeneration and silviculture

Special implications for palatable tree species such as *Abies alba*

Ungulate browsing is one of the many factors that affect tree establishment, growth and mortality and thus both structure and species composition of forests. Tree saplings are part of the usual food of ungulate species and palatable tree species, like *Abies alba* (European silver fir), are often browsed by ungulates. At the same time, natural regeneration of a mixture of species is valued in mountain protection forests to mitigate damages of snow avalanches, rockfall, mass flow and wind storms. Thereby, species with deep rooting systems (like *Abies alba* and *Acer pseudoplatanus*) are particularly important.
Measuring and monitoring the effects of ungulates on forest regeneration pose however major challenges because leader shoot browsing rate linearly correlates neither with tree density nor with species composition. The conference intends to present the current state of knowledge on ungulate impacts on tree regeneration and their implications for forest stand dynamics. We specifically focus on sustainable natural tree regeneration under current and predicted future climate.

Conference Goals

The main goal of the conference is to summarize the state of knowledge on tree – ungulate interactions, with a particular emphasis on
(1) measuring the impact of ungulates at the scale of the individuals to the scale of the landscape, in terms of timber quality, stand composition, stand structure and forest dynamics, … and
(2) silvicultural management techniques to mitigate ungulate effects on natural regeneration, particularly on preferred tree species such as *Abies alba*.
A further goal is to discuss the difficulties of managing forests that simultaneously face climate change, increasing impacts of ungulates and cascading effects of carnivores and human hunting on forest regeneration.

Conference Topics

Monitoring the effects of ungulates on forest regeneration

How can the effects of ungulates on forest dynamics be assessed at both stand and landscape scales? We will discuss methodological considerations of measuring the impact of ungulates in relation to other influencing factors, as well as the opportunity to exploit the results from forest regeneration inventories and browsing impact assessments to help define new monitoring tools. Thereby the role of indicator species such as very palatable tree species (like *Abies alba*) or non-forest objective goal species when recording browsing impacts will come up for discussion.

Reference values for tree regeneration with and without ungulate influence

How much tree regeneration of different species is needed to achieve specific management goals (such as protection against hazards, timber production, biodiversity…) in a forest stand? Target values for tree regeneration are needed to properly evaluate the ungulate impact, as the success of forest management depends on the density of these saplings that survive and grow up.

Ungulate impacts and timber quality

What is the impact of ungulates on timber quality? Do individual saplings recover from being browsed, and thus does browsing mainly affect regeneration time, sapling densities and species composition? Are other long-term consequences expected? What are the economic consequences of ungulate impacts?

Interactions between silviculture and ungulate impacts

Can forest management help controlling ungulate impacts? Are there silvicultural techniques resulting in less vulnerable stand structures to browsing damage? What is the impact of canopy gaps on ungulate browsing? Does silviculture promoting shade tolerant tree species such as *Abies alba* result in stands more prone to browsing due to few alternative forage for ungulates? Are productive habitats generally less vulnerable to ungulate impacts (dilution effect and faster growth)? Which factors and mechanisms can be modified/modulated by silviculture to mitigate ungulate impacts and inversely, how do ungulates influence silviculture?

Combined impacts of ungulates and climate change on forest dynamics

Do ungulates modify the climate change related development of forests? Are climate change effects additive to browsing impacts or can this two effects outbalance each other? How can this be assessed? Can, for example, *Abies alba* be recommended to forest managers under changing climate regardless of its vulnerability to ungulate browsing? Experimental as well as modelling approaches to investigate the combined impacts will be discussed.

Ungulates, predation (human and carnivores) and tree regeneration

Are the impacts of ungulates on tree regeneration different in large Nature Reserves than in managed forests? What is the impact of human hunting on ungulate impacts? Are there cascading effects of large predators and human hunting on the interactions between ungulates and forest regeneration via ungulate population levels and the spatial distribution of herbivory also in Europe?

Venue and Date

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