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## ABSTRACT

In this study, the impacts on the vegetation of grazing and browsing by sheep, goats and moose, and their effectiveness as a means of maintaining an open landscape were investigated. The BMBF-sponsored research group OFFENLAND ('Habitat Management in Military Training Bases in the Pleistocene Lowland Areas of Northeast Germany: Fundamentals of Nature Conservation and Practical Implementation') was formed with the aim of developing scientific principles and concepts for the creation, development and maintenance of valuable open landscapes in the 'cultural landscape' of Central Europe.

An integral part of this project was the study of mega-herbivores (moose) and domestic animals (sheep/goats) on an area of the former Dauban military training facility in the Oberlausitzer Heide- und Teichlandschaft MAB reserve (Saxony). The domestic animals were kept in small fenced pastures, where grazing could be controlled, whereas the wild animals were permitted to move freely across an area of 160 hectares. The main objective was to preserve the entire variety of precious non-wooded habitats on a dynamic basis. Furthermore, sites with dense scrub or woods arising from natural succession were to be re-opened and regenerated.

After the analysis of the historical development of the area, biotopes and species were inventoried on the scale of 1:1000 and the data was compiled in a GIS. The comparison of the current state with that described in 1996 served to highlight the development of the area, and formed the foundation for the evaluation with respect to the nature conservation aspects of the study. Subsequently, the objectives of the grazing system were formu-

lated and the location of the pastures was fixed. The 1:1000 map served as 'zero-point' before the moose browsing began.

The inventory revealed the very high degree of species richness and structural diversity of the former military training area, including a huge number of endangered species. The diversity of species and structures increased between 2000 to 2003 during the course of succession but the percentage of pioneer species adapted to nutrient poor habitats and dependent on high solar radiation rates declined markedly.

The further development of the area and the effects of the animals on the vegetation were investigated on different levels. Permanent plots with a standardised design facilitated the overall comparison of results in the OFFENLAND project. The patchy heterogeneity of the test area in Dauban was studied using vegetation transects and circular sample plots on small size levels. The effects of the animals were also measured on the basis of circular sample plots and by means of a complete inventory. The reactions of plants, especially the woody plants, were documented on the basis of studies of their vitality. Finally the effectiveness of the management was evaluated.

Grazing with sheep proved a very successful means of controlling *Calamagrostis epigejos*. Pastures grazed for several years showed a higher degree of diversity and richness in flowering species. Woody plants were browsed by sheep up to 1.20 metres, in some cases even up to 1.60 metres. Goats provided a very effective means of re-opening areas hosting woody development stages. *Pinus sylvestris* was the preferred forage and was mostly killed by severe browsing and bark stripping. *Betula pendula* was also reduced significantly, even trees with heights of up to four meters. In many cases the birch trees compensated the damage with stump sprouts and root suckers, as did *Populus tremula*.

*Pteridium aquilinum* and *Spiraea* spp. could not be controlled using goats, however. Overall, grazing with sheep and goats creates and maintains great species richness and structural diversity. The severity of the management and the effects on individual species can be controlled very well.

Moose (three animals) were observed for one year, across an area of 19 hectares. Over the seasons, they were found to prefer different plants, as has previously been described in the literature. Trees and shrubs were severely damaged after a few months. *Salix* spp., *Populus tremula* and *Pinus sylvestris* were browsed heavily and the bark was stripped or the whole plant cracked. *Betula* spp. were not amongst the favoured species but were also damaged occasionally. The height of willow woods was reduced to one metre. In June 2003 the moose were set free in the 160 hectare enclosure, where they were found to use the whole area. In some areas moose focused on browsing, others they preferred as resting places. Cracked and browsed trees and shrubs can be found everywhere in the enclosure. Seasonal aspects were the same as already observed. Up to now it has been difficult to estimate the extent to which the herbaceous vegetation will profit from the cracking and browsing activities of moose. Willow and birch have enormous sprouting capacity but long term repeated browsing affects their vitality and growth characteristics. Cracking creates gaps, opening up dense succession stands and guarantees a reduction of growth. Bark stripping also affects the vitality of trees. Trees will die sporadically, but a clear effect on the whole area is not certain. Other wild animals influence the structure and composition of the area in many different ways. A most impressive finding was the great diversity of species observed in places used by wild boar.

The prevention of the decline of the quality of the heathland as a habitat and the conservation of legally protected biotopes can only be realised through a combination of management tools. Apart from grazing using different animals, mowing, controlled burning, flooding, sod cutting and the maintenance of ditches should be considered.

The results of grazing by sheep and goats on the biotope scale are transferable to areas with similar vegetation types. The effects of management employing wild animals, as well as the combination of several other methods, cannot be judged as yet. Long term monitoring and comparisons with other regions are lacking. The transfer of the results to other military training zones is very problematic because of the unique character of each such area. It is difficult to evaluate the benefits for nature conservation because all of the criteria used normally appear to be inapplicable in this context. Very often a snapshot of the current situation, including singular precious elements and protected objects, is seen as the unique character worthy of preservation. This results in unsolvable management problems. In the context of adopting a holistic approach to the handling of former military training areas respecting the complexity of these specific landscapes, the developments on the former military training area in Dauban are both innovative and exemplary. The possibility to amalgamate different concepts, to create smooth transitions and to test new ways of management exists. The newly constructed MAB - reserve centre in Wartha provides the opportunity to promote conservation education. The subject of the natural re-immigration of moose from Poland can be discussed and the notion of moose as indigenous game can be promoted.

Moreover, long term studies can be undertaken to observe and test the influence of large herbivores on the vegetation

under controlled conditions. Finally, the enclosure exemplifies an experiment involving the keeping of animals within their natural environment, a model also applicable for zoos.