Grazing in a changing Nordic region

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Livestock production and grazing have had a significant effect on ecosystems in the Nordic countries. Such impacts span from shaping valuable cultural landscapes to irreversible plant and soil losses. Changes primarily in agriculture, but also societal changes reflected in land use have resulted in a dramatic decline in grazing during the past decades in certain regions of the Nordic countries, while other regions face severe land degradation due to unsustainable grazing practices. This decrease is particularly pronounced in the utilisation of traditional biotopes, such as heathlands, meadows, rangelands and woodlands, which are mainly managed by grazing and cutting. The need to improve the cost-effectiveness of the livestock production has created a transition from extensive to intensive production systems. This has increased the area needed for cereal feed production, and diminished the use of traditionally managed biotopes.

In contrast to the above described trends, there currently is a renewed focus on the potential and need for sustainable utilisation of areas suitable for grazing. This growing interest is a result of the realization that agriculture has to take into account aspects others than production volume and efficiency, e.g. mitigation of and adaptation to climate change, protection of endangered and restoration of damaged ecosystems, maintenance of biotopes high in biodiversity, and enhancement of food security. Moreover, farmed landscapes have an inherent cultural and historical value. All these are key elements requiring attention according to the Nordic Strategy for Sustainable Development. To meet these challenges, we propose to gather experts and policy-makers for a multi-disciplinary conference on grazing in a changing Nordic region and its contribution to climate change adaptation, food security, biodiversity and environmental issues, regional livelihoods, and other ecosystem services.

Climate change is expected to limit feed availability and increase prices of feed. Currently livestock production in the Nordic region increasingly relies on imported feed from regions that are predicted to be adversely affected by climate change. One strategy to increase self-sufficiency in feed production in the Nordic countries is to promote more extensive production systems, thus increasing grazing in general, and in particular on marginal land, which otherwise would not be used for food production. At a national level the Norwegian Farmers Association, for example, calls for the evaluation of self-sufficiency in an attempt to adapt to climate change (Guldal 2014). Regionally, a recent report from the Nordic Council of Ministers points at grazing as an important part of adaptation to and potentially also mitigation of climate change while simultaneously increasing food production for a growing regional and global population (NCM 2014). A recent Nature paper by Eisler et al. (2014) points to ruminants being globally essential for future food production due to their ability, e.g. through grazing, to convert plant material not suitable for human consumption to high quality food. None the less, current intensive ruminant production systems, in particular those for beef, largely depend on high quality fodder that is produced on farmland suitable for human food production. Grazing on marginal land could use areas not suitable for cultivation of cereals into food production.

Generally, greenhouse gas emissions (GHG) from ruminant production have a negative impact on climate change. Extensive production results in larger GHG emissions than intensive systems per unit production. On the other hand, emissions arising from e.g. production and application of chemical fertilizers and pesticides, loss of soil organic matter and use of fossil fuels in transport of animal feed (FAO 2015) are likely to be lower in extensive than intensive production systems.

There is controversy whether grazing has unambiguously favourable effects e.g. on carbon sequestration and storage. While some authors have reported adverse effects of grazing on soil organic carbon (Daryanto et al. 2013, Fernandez et al. 2008), others have measured significantly higher soil carbon in grazed pastures compared to non-grazed exclosures (Reeder and Schuman 2002). Comparison of the rates of soil organic carbon sequestration vary

with soil texture and structure, climatic conditions such as rainfall and temperature, farming system and soil management (Follett and Reed 2010, Lal 2004).

Research on the impact of grazing on biodiversity of both flora and fauna has been ambiguous. It is recognized that conservation of European biodiversity is dependent on the continuation of low-intensity farming systems, which makes semi-natural pastures, meadows and orchards a cornerstone for European farmland biodiversity (Oppermann et al. 2012). Farming practices typical for cultural landscapes support biological diversity both on habitat and species level by maintaining the genetic variability of domesticated plants and animals, wild biodiversity, life support systems, as well as protecting cultural diversity (Dahlberg et al. 2013, Oppermann et al. 2012, Pykälä 2003). Lack of management of traditional rural biotopes results in endangerment and loss of these habitats, and the diversity within. For example, approximately 44 % of the endangered species on the Norwegian red list in 2010 are connected to cultural landscapes (http://www.miljostatus.no/Tema/Kulturminner/Kulturlandskap/). While unsustainable grazing results in ecosystem degradation and loss of biodiversity, appropriate grazing management can restore traditional biotopes, thus halting and even reversing biodiversity loss. Areas where soil and functioning of the ecosystem is severely degraded may have to be protected from grazing to restore native shrubs and trees that protect the sensitive land. Increasing the proportion of pasture area covered by shrubs or trees would increase the heterogeneity of the grasslands and have a positive effect on the species richness (Söderström et al. 2001, Pihlgren and Lennartsson 2008). Traditional biotopes together with buildings and other elements typical for this farming landscape (e.g. pollarded trees, stone fences, summer barns) have an intrinsic value, as they represent our cultural and historical heritage. Loss of these historical landscapes will result in less knowledge and understanding of the interaction between humans and nature (Dahlberg et al. 2013). Valuation of protection of biodiversity and other ecosystem services could be an important component of economically sustainable landscape management. It is important to create a biological knowledge basis to be able to assess the potential of revising national policies relative to e.g. re-distribution of subsidies to support both ecologically and financially sustainable food production operations.

Whether grazing is a suitable tool in nature management depends on the perspective (agricultural vs. pristine nature), type of habitat and grazing management, e.g. stocking density. For example, light to moderate stocking densities might have a favourable effect on biodiversity whereas high densities would decrease the plant diversity (reviewed by Reeder and Schuman 2002). Globally, overgrazing by livestock is a major factor in land degradation creating low production ecosystems and barren wastelands (Sundquist 2003).

Control of vegetation structure and composition of grazed landscapes may be controlled by the choice of the livestock species and breeds (Steinheim et al. 2005). Different species (cattle, sheep, horses, goats) have different grazing strategies relative to their diet and habitat use preferences. Within species, increased grazing, restoration of ecosystems or traditional biotopes and increased use of marginal land may enhance the competitiveness of the native breeds of grazing livestock. Native cattle breeds are more suitable for grazing in demanding terrain than commercial breeds, tend to cover longer distances while grazing and may provide better management of other vegetation types than grass-dominated pastures (Hessle et al. 2014). Cattle breeds have been suggested as a tool for obtaining specific grazing effects (Sæther et al. 2006, Hessle et al. 2014), although these differences can largely be explained by differences in body size and consequent relationships with feed intake, digestibility and selectivity in grazing behaviour (Rook et al. 2004). Steinheim et al. (2005) found significant differences in foraging characteristics in three Norwegian sheep breeds grazing on mountain pastures. Short-tailed Spæl and Norwegian Fur sheep grazed more on woody plants compared to Dala sheep (Steinheim et al. 2005), making them more suitable than Dala sheep in habitats rich in heather or tree and bush encroachment. Accordingly, guaranteeing food production in changing production systems may call for re-ranking of the importance of different breeds, or even species. An increase of extensive production systems may thus assist the conservation of native breeds, the launch of new niche products, and the enhancement of tourism in rural areas, as well as play a role in the education of the general public.

In addition to the above-mentioned controversies, the effects of grazing and its management on soil degradation, e.g. compaction, reduced water infiltration, erosional processes due to trampling and removal of vegetation cover

and climate change have been reported in the scientific literature (e.g. Carter et al 2014), but needs more investigation in the Nordic region. Some of these effects are undeniably global, such as GHG emissions, whereas some effects might be less relevant in the Nordic production systems. Nevertheless, it is imperative to identify the most important knowledge gaps through discussions and knowledge exchange between the different scientific disciplines studying these themes.

The objective of the conference is to provide an integrated assessment of grazing, its potential for contributing to food security, factors of sustainability including environmental impact, role relative to climate change adaptation and mitigation, biodiversity, socio-economic effects and contribution to eco-system services.

Topics of the conference will cover 1) Nordic ecosystems and their responses to grazing under climate change 2) historical and cultural values of traditional landscapes (conservation and restoration, biodiversity) 3) grazing management in Nordic conditions 4) environmental impact of grazing on biodiversity and ecosystem services 5) sustainable use and conservation of animal genetic resources in grazing and 6) socio-economic effects of grazing in rural areas (tourism, rural livelihoods) and linking goals of sustainability with support policies for grazing based agriculture.

There is a need for a Nordic-Baltic conference on ”Grazing in a changing Nordic region”.

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