Changes of sward characteristics in cut meadow after introduction of intensive sheep grazing

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Abstract

The type of management and its intensity is the main driver of sward structure and plant community characteristics in temperate grasslands. The aim of the study was to find changes in plant community characteristics after introducing intensive sheep grazing on previously cut meadow. Therefore, a grazing experiment was established in 2019 on a meadow, previously cut once or twice per year. The meadow was intensively grazed by sheep through the whole year except during periods with snow cover, and sward height was maintained at 2–3 cm. The percentage cover of all vascular plant species was visually estimated in each plot in the years 2019–2023. Mean vegetation cover increased during the first three years of the experiment until it reached 100%. Mean cover of *Lolium perenne* and the prostrate legume *Trifolium repens* increased, whereas mean cover of forbs *Galium album, Hypericum maculatum* and *Veronica chamaedrys* decreased. The changes in plant species composition were found already in the second year of the study; however, species richness was not affected. After five years of intensive sheep grazing there was a rapid increase in cover of some grazing-tolerant species; however, typical pasture sward with dominance of species adapted to frequent defoliation has not yet been created.

Keywords: intensity, management, plan species composition, species richness

Introduction

The type of management is one of the key drivers affecting grassland communities. Hay-making and grazing, are two basic defoliation options which can also be used in combination (Van Diggelen and Marrs, 2003). On meadows during hay-making the above-ground biomass is non-selectively cut and removed at the same time, while factors affecting vegetation under grazing management on pastures include stocking rate, selective grazing, trampling and nutrient enrichment (WallisDeVries, 1998). This results in different plant communities with different plant species composition on meadows (*Arrhenaterion*) and pastures (*Cynosurion*) (Chytrý *et al*., 2010). However, little is known about how long it can take for changes from meadow to pasture, and *vice versa*, to occur. Therefore, this study addressed the related research question: What are the changes in plant community characteristics after introducing intensive sheep grazing on a previously cut meadow?

Materials and methods

The experiment was established in 2019 on a previously long-term meadow cut once or twice per year, in Oldřichov v Hájích, Czechia (50°51′6″ N, 15°5′18″ E; 425 m a.s.l.). The area of the experiment has a 30-year mean annual rainfall of approximately 805 mm and a mean annual temperature of 7.2°C. The bedrock is granite and the soil is cambisol. The experimental site was a meadow which was cut once or twice per year for at least 20 years until 2018. The experiment is arranged in three randomized blocks with four replications (12 plots, each plot is 1 m^2). Intensive grazing with sheep (Suffolk breed) was introduced on this traditionally managed meadow in May 2019. Continuous grazing was applied for the whole year with the exception of periods with snow cover, and the sward height was maintained at about 2–3 cm in the years 2019–2023. The percentage cover of all vascular plant species was visually estimated in each plot in the years 2019–2023. Nomenclature of vascular plant species follows the regional flora

(Kaplan *et al*., 2019). ANOVA was used to analyse univariate data and redundancy analysis (RDA) in the CANOCO 5.0 program (RDA; ter Braak and Šmilauer, 2012).

Results and discussion

Mean total (%) vegetation cover of all presented plant species increased during the first three years of the experiment until it reached 100% (Figure 1a). This increase is connected with the higher sward density after intensive grazing, which supports tillering of grasses and increase of stolon growing points of white clover; that is why pastures commonly have denser swards than meadows (Pavlů *et al.*, 2006). Based on RDA analysis there was a significant effect of year on plant species composition, which explained 20.3% of the variability (F=3.4, P=0.002) on all constrained axes (Figure 2). However, there were no significant changes in species richness in the years 2019–2023 (Figure 1b). After five years of intensive sheep grazing the presence of recorded species remained similar, but their proportions had changed considerably. For example, the mean cover of grazing-tolerant species such as *Lolium perenne* and *Trifolium repens* increased whereas the mean cover of forbs *Galium album*, *Hypericum maculatum* and *Veronica chamaedrys* decreased. Some typical prostrate pasture species such as *Hypochoeris radicata* and *Leontodon autumnalis* started to occur during the five years of the study. Further, there was no observed reduction in the number of forbs even though their total cover decreased over the same time. This means that the majority of forb species were still able to survive under grazing pressure by decreasing their height. However, it is not clear for how long these forb species can be resilient to the long-term selective grazing of sheep, because long-term continuous sheep grazing usually results in a reduction of forbs (Pavlů *et al*., 2021). Besides *L. perenne* and *T. repens*, other typical plant species belonging to mesophile pastures (Chytrý *et al*., 2010) have not yet been recorded.

Conclusion

Although changes in plant species composition were already found in the second year of intensive whole-year grazing, the presence data of recorded species remained similar. After five years of this management there was found to have been a rapid increase in cover of some grazing-tolerant species, which started processes to change the meadow community to a pasture community. However, this process will take more years as the presence of other typical pasture species has not yet been recorded.

Acknowledgements

The data collection was supported by the Technical University of Liberec and paper writing and finalisation by DiGraSO project No.100693117.

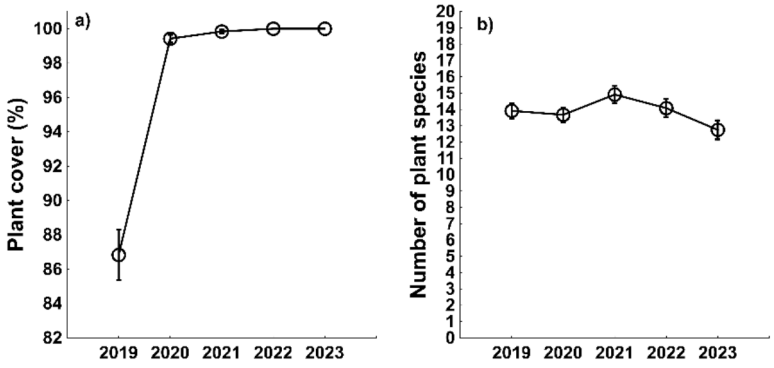

Figure 1. (a) The mean plant cover (%) and (b) the mean number of plant species in the years 2019–2023.

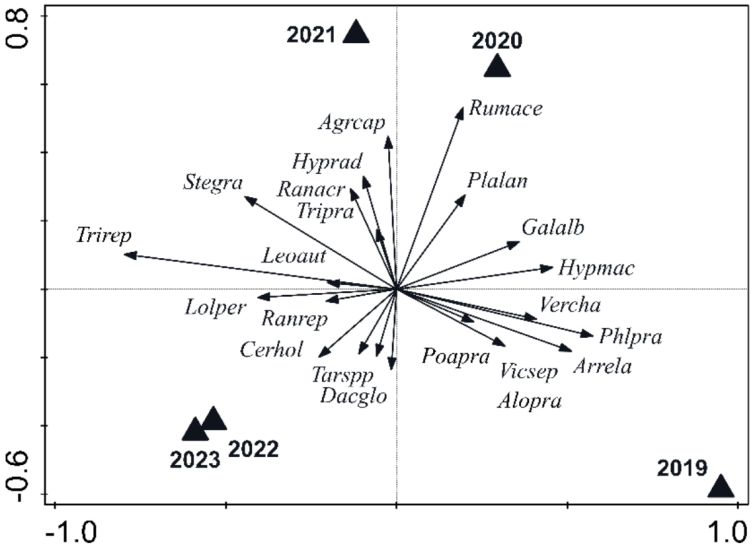

Figure 2. Redundancy analysis (RDA) ordination diagram. Results of RDA of plant species composition data collected in the years 2019–2023. Species abbreviations are based on the first three letters of the genus name and the first three letters of the species name: *Agrcap=Agrostis capillaris*, *Alopra=Alopecurus pratensis*, *Arrela=Arrhenatherum elatius*, *Cerhol=Cerastium holosteoides*, *Dacglo=Dactylis glomerata*, *Galalb=Galium album*, *Hypmac=Hypericum maculatum*, *Hyprad=Hypochaeris radicata*, *Leoaut=Leontodon autumnalis*, *Lolper=Lolium perenne*, *Phlpra=Phleum pratense*, *Plalan=Plantago lanceolata*, *Poapra=Poa pratensis*, *Ranacr=Ranunculus acris*, *Ranrep=Ranunculus repens*, *Rumace=Rumex acetosa*, *Stelgra=Stelaria graminea*, *Tarspp=Taraxacum spp.*, *Trifpra=Trifolium pratense*, *Trirep=Trifolium repens*, *Vercha=Veronica chamaedrys*, *Vicsep=Vicia sepium*.

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