

## Secondary dry grassland management by frequent mowing in the Western-Cserhát, Hungary

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### Abstract

The effect of long-term mowing on the composition of secondary dry grasslands was studied in the Western Cserhát hills in Hungary. Our main aim was to develop an effective method which can facilitate the regeneration of grasslands. Here we report the results of a long-term mowing experiment designed to suppress the spread of *Calamagrostis epigeios*. In May 2001 we established permanent plots in the study area to understand if the dominant grass species of abandoned grassland fields can be suppressed by mowing. It was found that mowing was a useful management technique for modifying the botanical composition of the grassland to a composition that was better suited for agricultural use, in particular for grazing which could replace the costly and time-consuming hand-cutting. Mowing twice a year significantly affected the palatability of the herbage. Plant species richness and diversity increased continuously during the eight-year-long study.

Keywords: floristic composition, mowing, *Calamagrostis epigeios*, Shannon-diversity

### Introduction

Pastures were the traditional use for grasslands in the study area, as in other areas of in Hungary. The population of grazing livestock has dramatically reduced in the last twenty years, resulting in an increased shrub layer and grass species such as *Calamagrostis epigeios* spreading aggressively. This species is a tall growing, unpalatable grass which is not grazed by livestock. Grasslands infested by this grass are therefore not suitable for management as pastures. Creating and maintaining diverse grasslands remain a complex issue influenced by various abiotic and biotic factors. Frequent mowing was suggested as a potential management measure for improving and maintaining grassland biodiversity (Kramberger and Kaligarić, 2008). Other possibilities include grazing and burning (Ónodi *et al.*, 2008). Based on examples of studies in other countries, we have tried to introduce regular mowing to change the sward composition gradually and make it suitable for future grazing. Our main questions were as follows: Can the unpalatable *Calamagrostis epigeios* be suppressed by mowing? Are there possibilities to increase the diversity of sward by this?

### Materials and methods

The field experiment was conducted from 2001 to 2009 in a secondary dry grassland of the *Polygalo-Brachypodietum* plant community, near Vác in Northern Hungary (47° 47' 45" N, 19° 14' 13" E; 190 m a.s.l.). The study area is a vineyard that had been abandoned 30 to 35 years ago and used as a pasture thereafter. Due to the socio-economic changes between 1980 and 1990, grazing was terminated. The area represents a typical semi-natural, extensively managed hilly landscape. The area is 7.1 hectares with a north-eastern aspect and it is covered

by a mosaic of shrubby areas and open grasslands. We established an experiment with eight 3 m x 3 m plots, positioned randomly. The range of conditions of the observed environment was well represented by the eight plots. Vegetation data were monitored in 2 m x 2 m permanent quadrats, placed in the middle of each 3 m x 3 m plot. The treatment was mowing twice a year, in June and September of all years. As a control, eight unmanaged plots were established. Five and eight years after 2001 we sampled the plots in June, estimating the cover (as percent) of all plant species. Diversity changes were analysed using the Shannon-diversity (Pilou, 1975). The effects of mowing were tested using repeated-measure analyses of variance (ANOVA). For *post-hoc* test the TukeyHSD was used. Data were analysed by the R-statistical program (R Development Core Team, 2009).

## Results and discussion

At the start of the experiment (in May 2001) *Calamagrostis epigeios* was the dominant component of the forage with a cover of 64%, and the amount of legumes was 21%. The palatability index of the grassland was 1.6, according to evaluation method of Balázs (Balázs, 1960). After five years, i.e. by the spring of 2006, there was a considerable shift as *Calamagrostis epigeios* decreased to 17%; however, the cover of important legumes had not increased. By May 2009, the previously dominant *Calamagrostis epigeios* declined to 3% cover, which was at place seven in the dominance rank of the species. The most abundant species were legumes, e.g. *Dorycnium herbaceum* with 24%. The total cover of legumes was 37% in year 2009, which was significantly different from the value of 2001 ( $P < 0.001$ ). The palatability index of the grassland increased to 3.0. The average number of species was quite low compared to other grasslands in a good condition, which is 40-60 species per 4 m<sup>2</sup> (Bartha, 2007). At the beginning of the experiment the average number was 11.6 species per 4 m<sup>2</sup>. Species richness had increased with regular mowing to 25 species per 4 m<sup>2</sup> by June 2009. This change corresponds to findings in other studies (e.g. Kramberger and Kaligarić, 2008). The results of the repeated-measure analyses of variance (ANOVA) demonstrate that the mowing treatment was successful, with a significant ( $P < 0.001$ ) change of diversity. The TukeyHSD test (multiple comparison of means with 95% family-wise confidence) showed that only the 2001-2009 comparison was significant,  $P = 0.001$ . The *post-hoc* test showed a consistent trend of increase over time (Fig. 1).

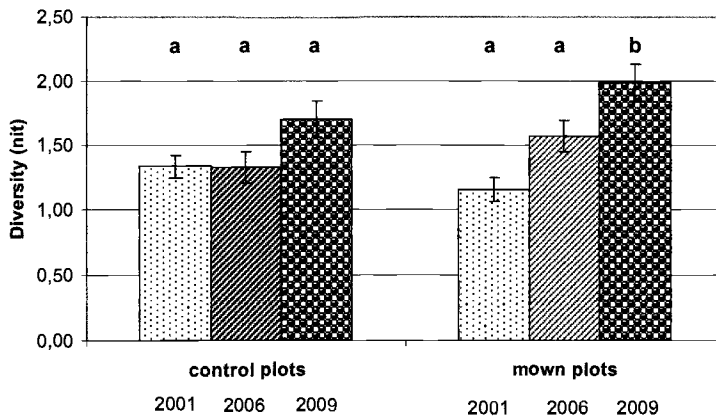


Figure 1. Shannon-diversity changes in the treated and control plots as a comparison of different years.

## Conclusions

We conclude that the five-year study was not long enough, as a significant difference was detected only over an eight-year time-scale. Mowing has significantly increased the palatability, the species richness and the diversity in the course of secondary succession. Therefore, mowing twice a year proved to be a successful management measure for controlling *Calamagrostis epigeios*. It also resulted in a sward composition that can provide herbage that is suitable for mowing as well as for grazing. The latter is particularly attractive as it could replace the costly and time-consuming hand-cutting.

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