

Long-term mowing on biomass composition in Pannonian dry grasslands in the Western-Cserhát

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This study is focusing on the vegetation of seminatural dry grasslands. Those loess grasslands are valuable with large biodiversity; however their long-term preservation requires regular conservation management (Deák et al., 2016, 2021a, b; Valkó et al., 2018, 2022; Csontos et al., 2022; Szentes et al., 2012a, b, 2022). The report demonstrates the results of mowing experiment, designed to suppress the spread of unpalatable grass species, *Calamagrostis epigeios*. The study site is located in mid-successional loss grasslands, in the Western-Cserhát, near Rád, northern Hungary.

The extent of the loess bedrock and its vegetation were often coupled with additional effects such as agricultural activities (Zólyomi, 1936, 1958; Bíró et al., 2018; Penksza et al., 1994, 1996, 2011; Barczy et al., 2004a, b, 2012; Deák et al., 2016, 2021a; Valkó et al., 2018). Ecological behavior and dynamics of species of habitats can also help to sustain the habitats because existence of ecologically variable species can form habitats, and to maintain their functional diversity (Török et al., 2016, 2018; Penksza et al., 2021), but degradation of habitat is possible too (Penksza et al., 2007, 2020; Szabó et al., 2010, 2011).

Regular, but low-intensity grazing and mowing can support the maintenance of grassland (Poschlod et al., 2002; Lindborg, 2006; Dostatny et al., 2021; Valkó et al., 2018; Szentes et al., 2007, 2009a, b; Pruchniewicz and Żolnierz, 2019). Suitable management can prevent dominance of invasive plant species, regardless of native or non-native species (Fülöp et al., 2021; Bajor et al., 2016). Appropriate grazing pressure can provide constant low level of disturbance, which is necessary to prevent tree growth and preserve high species diversity (Házi et al., 2013, 2022; Valkó et al., 2018, 2022; Herczeg, 2005; Herczeg et al., 2005; Valkó and Deák, 2021).

Calamagrostis epigeios is able to settle spontaneously on waste and remediated areas and to grow and develop on sand with high pH and high Ca contents and stabilize extremely poor habitats (Király, 2009; Penksza, 2009a, b, c). Those species are parts of Northern Europe, included *Calamagrostis epigeios* as crop wild relatives as a crop wild relatives (CWR) (Dostatny et al., 2021). The population of livestock has dramatically decreased in the Carpathian Basin in the last few decades (Török et al., 2018) resulting in an increased shrub layer, and an aggressive spread of grass species such as *Calamagrostis epigeios* (Házi et al., 2011, 2012).

Recent changes involve land-use intensification and abandonment, and these processes are often

accompanied by diversity loss in semi-natural habitats (Ryser et al., 1995; Fiala et al., 2003; Bartha, 2007). Grassland biodiversity is threatened by the collapse of extensive animal husbandry. Decreasing biodiversity due to the aggressive expansion of grasses into grasslands has been reported from various parts of Europe (Rebele, 1996; Rebele and Lehmann, 2001; Sedláková and Fiala, 2001; Catorci et al., 2013, 2017).

Calamagrostis epigeios (L.) Roth is a tall perennial clonal grass (Rebele, 1996) and a decent example of a species that spreads successfully to man-made areas. *Calamagrostis epigeios* has a broad distribution range in Europe. It occurs in natural grasslands (Catorci et al., 2013; Somodi et al., 2008) in forests (Csontos, 2010; Zhukovskaya and Ulanova, 2006), in river floodplains (Penksza et al., 2012, 2021; Járdi et al., 2021), and ruderal assemblages (Házi et al., 2009; Prach, 1987). *Calamagrostis epigeios* potentially forms monodominant patches and able to reduce species richness considerably (Somodi et al., 2008). Frequent mowing was suggested as a potential management measure for repressing tall herbs or clonal grasses and for maintaining or improving grassland biodiversity (Prach and Pyšek, 1994, 2001; Huhta et al., 2001; Deák and Tóthmérész, 2007; Kramberger and Kaligarić, 2008). Successful control of *Calamagrostis epigeios* by mowing was reported from the first five years of vegetation succession on a species-poor ruderal landfill site from Germany by Rebele and Lehmann (2001). However, there is no data available from other habitats, especially from secondary grasslands. Regular biomass removal was suggested as a potential management method for improving and maintaining grassland biodiversity (Kramberger and Kaligarić, 2008). Other possibilities include grazing and burning (Ónodi et al., 2008; Valkó and Deák, 2021). This study's aim was to examine the effect of multi-annual mowing on recovery of coenological composition of a *Calamagrostis epigeios* invaded grassland, and to introduce regular mowing to change the sward composition gradually and make it suitable for future grazing (Tesitel et al., 2017, 2018; Házi et al., 2022; T-Járdi et al., 2022).

The study aims to the investigate the followings: Can the unpalatable *Calamagrostis epigeios* be suppressed by mowing? Are there possibilities to increase the diversity of sward by this? The study aims, to measure potential value-increasing effect of mowing, and to determine the carrying capacity in the aspect of grassland management.

The experimental design consisted of 8 permanent plots, where mowing was applied twice a year.

The vegetation was sampled annually (from 2001) in a 2×2 meters quadrats before. Species names are given according to the nomenclature of Király (2009) and Engloner et al. (2001). The field experiment was conducted from 2001 to 2021 on a secondary dry grassland of the *Salvio-Festucetum rupicolae* plant community. The area was originally covered by the forest component of the Pannonian forest-steppe zone. For centuries, this hilly landscape was a mosaic of small vineyards, orchards, and croplands, with scattered patches of woods and steppes. Land use has often changed due to wars and changing economic conditions. Therefore, abandoned fields and the related secondary succession is well known in this area and the species adapted to challenging successional stages are also part of the regional species pool. The forage values of various lawns were calculated by the Balázs (1960) and Brimle et al. (2005).

In 2001, *Camagrostis epigeios* was the species with the highest coverage rate according to the both treatment types, with an average cover value of 63%. However, as a result of mowing, a significant difference was detected in the amount of litter and legumes species as well. The number of species showed a slight increase in both types of treatment, from 15 to 37 in the mowed plots, but also from

18 to 27 in the control plots. We concluded that mowing twice a year was beneficial to modify botanical composition of a grassland. In a way it was suited well for agricultural usage, in particular grazing which can replace the expensive and time-consuming scythe. It is also a suitable management measure for controlling the native invader species as a *Calamagrostis epigeios*, and can significantly increase the proportion of species with higher forage values.

Mowing has significantly increased the density of *Calamagrostis epigeios*, 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*, and for obtaining a sward composition. The treatment was effective in restoring grassland composition, although the achievement and maintenance of favorable conservation status for the grassland habitat require long-term management planning and regular treatment. According to the objectives, mowing not only promotes the control of the invasive species, but also the economic utilization of the area.

Keywords: productivity of the grassland; unpalatable grass; long-term data; permanent plots

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