Grasslands restoration opportunities in different habitats, with different grazing animals. Overview case studies I: wooded pastures, deforestation

Dénes Saláta[1] – Szilárd Szentes[2] – Andrea Kevi[3] – Dániel Balogh[3] – Ildikó Turcsányi-Járdi[3] – Tünde Szabó-Szöllösi[3] – Zsombor Wagenhoffer[2] – László Sipos[4, 5] – Eszter Saláta-Falusi[3] – Ferenc Stilling[3] – Péter Penksza[6] – Gabriella Fintha[3] – Péter Póti[7] – Attila Fűrész[7] – Ferenc Pajor[7] – Petra Balogh[3, 8] – Károly Penksza[3]

[1]Institute for Wildlife Management and Nature Conservation, Hungarian University of Agriculture and Life Sciences, Gödöllő
[2]Animal Breeding, Nutrition and Laboratory Animal Science Department, University of Veterinary Medicine, Budapest
[3]Institute of Agronomy, Hungarian University of Agriculture and Life Sciences, Department of Botany, Gödöllő
[4]Department of Postharvest, Commercial and Sensory Science, Institute of Food Science and Technology, Hungarian University of Agriculture and Life Sciences, Budapest
[5]Institute of Economics, Centre of Economic and Regional Studies, Budapest
[6]Anton Paar Hungary, Budapest
[7]Institute of Animal Husbandry, Hungarian University of Agriculture and Life Sciences, Department of Animal Husbandry and Animal Welfare, Gödöllő
[8]Hungarian Research Institute of Organic Agriculture, Budapest
penksza.karoly@uni-mate.hu

ABSTRACT

Since 1992, data on the vegetation of the various grasslands in the country have been collected continuously and in recent years the vegetation of these areas has been surveyed repeatedly to monitor changes. Our aim has been to identify the conservation values and grassland management values of grasslands grazed by different animals, grasslands and wooded pastures that have been planted or restored. In the Pannonian region, we have also carried out studies in lowland mid-range, hilly areas. Areas grazed by horses, Hungarian grey cattle, sheep, goats and domestic water buffalo. The results of grazing with different animals at several study sites have been monitored and have been continuously monitored since 1994. In this paper, a brief overview of the results of the conversion of wooded pastures and deforested areas to pasture is presented.

Results from three wooded pastures and one shrubland are summarised. Results from Hungarian grey cattle sheep and Hungarian domestic buffalo pasture are summarised. In all areas, grazing was successful in maintaining habitats. The maintenance of the scrub area and the preservation of its mosaicity were best ensured in the Hungarian grey cattle pasture. Sheep were responsible for maintaining the grassland vegetation. Water buffaloes ensured the maintenance of the pasture.

Keywords: *productivity of the grassland; Festuca species, forage value*

INTRODUCTION

In addition to pastures, forest pastures and wooded grasslands were also investigated. Forest pastures are one of Europe's oldest forms of land use, where livestock graze in mosaic habitats characterised by grasslands interspersed with different tree and shrub species. Over the centuries, wooded rangelands have been an important traditional element in the Carpathian Basin as one of the dominant farming types (Moreno et al., 2018; Burgess and Rosati, 2018). The importance of wooded rangelands habitats has increased significantly due to current global climate change concerns, as declining grassland areas have opened up the possibility of livestock grazing in areas that were not previously considered of high farming importance. Öllerer et al. (2019) provided a complex review of the effects of livestock grazing on temperate forest vegetation. They concluded that successful forest grazing conservation depends on the selection of grazing animal species and that the lack of grazing can negatively affect biodiversity and forest management. This needs to be taken into account when managing wooded rangelands as semi-natural habitats (Bernes et al., 2018; Burrascano et al., 2013).

Large herbivores play a fundamental role in the establishment of forests, shrublands and grasslands (Mitchell, 2005). Therefore, grazing livestock can contribute to the current forest-grassland mosaic (Varga et al., 2020).

Different native and introduced livestock such as cattle, sheep and horses can replace wildlife activities (Póti et al., 2007). The type of grazing influences the vegetation structure and yield of grasslands (Naveh and Whittaker, 1980; Török et al., 2018). Therefore, we have investigated and evaluated the vegetation of grasslands grazed by different animals.

The cenology surveys were carried out between 1994 and 2024, during the period of the dominant aspects of vegetation. The methods were based on the Braun-Blanquet (1964) method, but also on the % cover of species, and on Balázs (1960). In addition to the assessment of the natural state of the vegetation, diversity and grassland management analyses were also applied (Tóthmérész, 1995). The distribution of the life forms of the species forming the vegetation of the sites was also specifically addressed, based on Pignatti (2005). Species names were recorded according to the nomenclature of Király (2009). The cenological data were also analysed in the evaluation of different statistical analyses. As a rule, the non-parametric statistical method was used to analyse the cover values of species in different sample areas, as these variables were not normally distributed according to the Shapiro-Wilk test ($p < 0.05$). Accordingly, the non-parametric Kruskal-Wallis test (= 0.05) was used, and for multiple pairwise comparisons the non-parametric Dunn's test with Bonferroni correction (Addinsoft XSTAT, 2016) was used.

RESULTS (CASE STUDIES)

Wooded pastures

I. Cserépfalu-Erdőbénye (grazing animal: Hungarian grey cattle - racka sheep)

Hungarian grey cattle grazing was practised in Cserépfalu. Hungarian Racka sheep were grazing in Erdőbénye. We also distinguished between shrub-woody area and grassland vegetation types in both sample sites. For the grassland vegetation types, there were also lower grazing pressure and overgrazing in the sample areas. In the shrub-forested areas, it was also possible to distinguish between lightly grazed, grazed, overgrazed and abandoned areas (*Figure 1*).

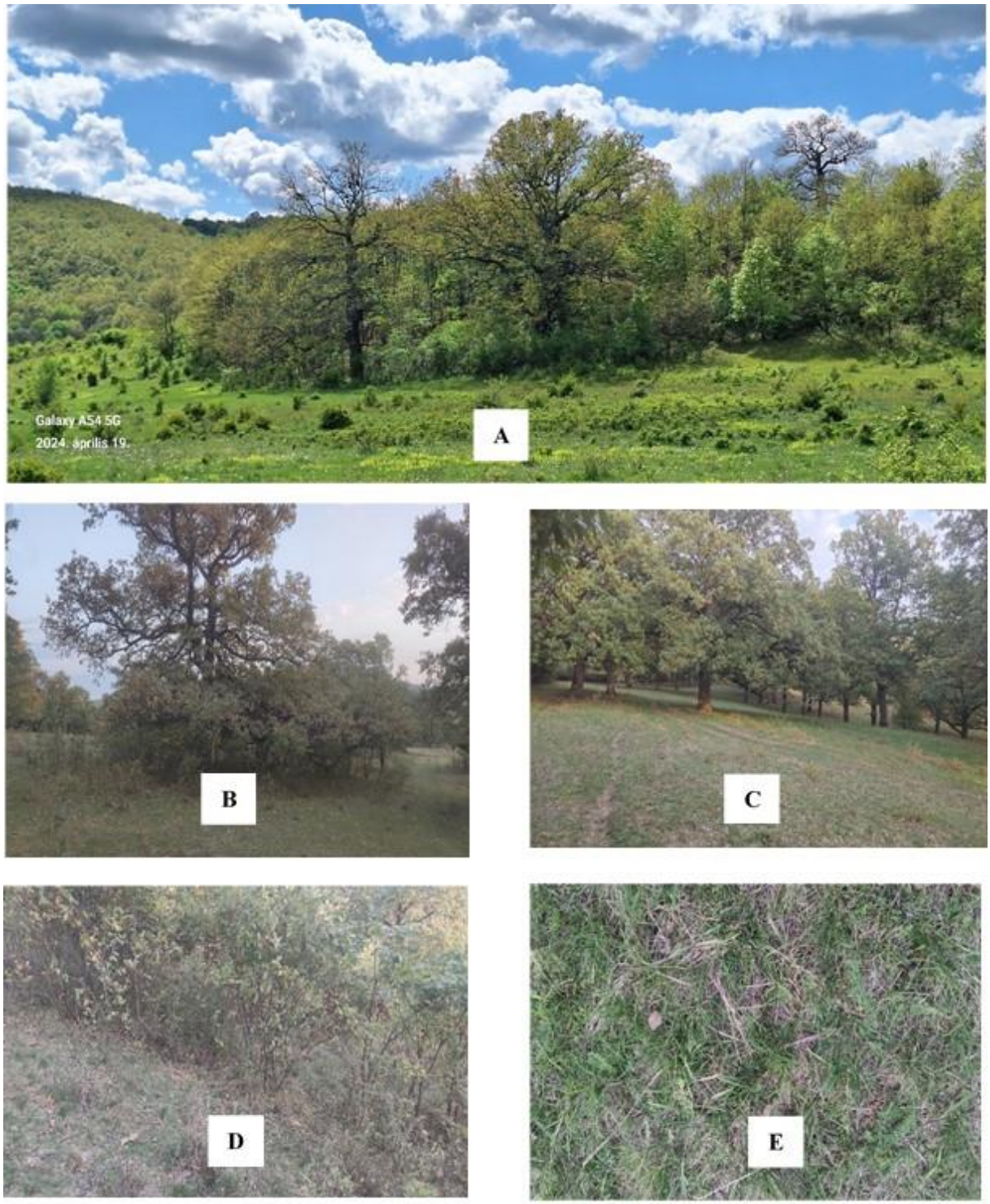
The species in the study areas included a number of weed and natural disturbance tolerant species as a result of permanent grazing. There were many species that are valuable plants for grassland management (Klapp et al., 1953; Briemle a et al., 2005). Some weed species were also thorny species such as *Eryngium campestre, Ononis spinosa* and *Carduus acanthoides*, which impeded grazing. There were several species of weeds such as *Conyza canadensis*, *Setaria viridis* which occurs in both sample areas, and *Poa humilis*, which has been found in other Pannonian grasslands in the overgrazed sample areas, was also present in both areas (Penksza and Böcker, 1999/2000).

The Pignatti lifeform (Pignatti, 2005; Chiarucci and Bonini, 2005)], in contrast to the Rankieaer lifeform (Raunkiær, 1935), were good indicators of grazing intensity. It has also been clearly shown that the proportion of rosette species is higher in sheep pastures due to the short period of time sheep chew their food (Fraser et al., 2001). The different grazing habits of different livestock populations will also result in different effects on grassland restoration. Livestock and selected grazing animals may have significantly different effects on grassland and grazed areas (Vera, 2000; Briemle et al., 2005). The number of shrubs in the two sample sites was inversely related.

The proportion of shrubs increased in Cserépfalu (*Figure 2*), where cattle grazed intensively, and decreased in Erdőbénye, where sheep grazed. Sheep consumed more shrubs and consequently influenced the downward trend (Bernes et al., 2018; Walker et al., 2015; Tasker and Bradstock, 2006). As grazing intensity increased, abundance of reptanthe micryptophyte and rosulate hemicryptophyte species (H rep, H ros) increased, indicating an increase in grazing pressure. Similar trends were also found in another study (Catorci et al., 2017). The abundance of saprophytic therophyte species was more significant in grazed shrub-woodland (WB) and grazed grassland areas, which was due to intensive grazing and trampling, resulting in the expansion of weed species.

Overall, the wooded pastures tested with the two grazing animals gave different results. There were differences in diversity, life history and pasture management values. The shrub-woodland and grassland mosaics were diverse at both sites. The Hungarian Grey Cattle played a significant role in the conservation and establishment of these patches by not consuming the shrubs, preserving the woody-shrub-grassland mosaic patches and habitat diversity. Therefore, Hungarian grey cattle are better suited to the conservation of wooded pastures than Hungarian racka sheep. However, sheep grazing has proven to be significant for grassland management with high values of grass and legume species important for grassland management. They also provided high yielding green biomass.

Figure 1: **Wood pasture in Cserépfalu**



A: overview image of the wooded pasture, **B**: mosaic of wooded, shrub and grassland patches, **C**: intensively grazed grassland in the foreground and intensively grazed woodland in the background, **D**: the re-shrubbed area, E: the grassland established and maintained by Hungarian grey partridge

1. ábra: Cserépfalu fáslegelő

A: a fáslegelő áttekintő képe, **B**: erdős, cserjés és gyepi foltok mozaikja, **C**: előtérben intenzíven legelt gyepterület és a háttérben intenzíven leget erdős terület, **D**: a visszacserjésedő terület, **E**: a magyar szürke szarvasmarhák által kialakított és fenntartott gyep

Figure 2: **Forest pasture in Erdőbénye. In the foreground, a grassland intensively grazed by racka sheep**

2. ábra: Erdőbényei fáslegelő. Előtérben a racka juhokkal intenzíven legeltetett gyep

II. Balatoncsicsó (grazing animal: merino sheep)

In the Balatoncsicsó wooded pasture, we have been conducting studies since 1994 (*Figure 3*). We treated the shrub-woody patches around the trees and the open grassland vegetation separately, and were even able to study the vegetation of an area excluded as a control. The results show that the sample areas under and around the trees contain few membered and nitrogen-signalling species (e.g. *Galium verum, Urtica dioica, Veronica hederifolia*) and the presence of woody species is significant (e.g. *Brachypodium sylvaticum*). We can monitor the results of continuous grazing in this woody pasture. The woody sample plots are statistically significantly different from the average cover values of grassland in all study years. The results for the wooded areas clearly show that there has been no significant change over 30 years. While the average cover value from the 2009 grassland plot was significantly different from the cover values of the control plot and the wooded sample plot. The control plot results also contained a more significant proportion of semi-natural area species and protected species. Protected species (*Pulsatilla nigriccans, Stipa eriocaulis*) were also present in the grassland, but disturbance-tolerant species were dominant, with Festuca pseudovina being the dominant grassland species in the association. Grazing by sheep also confirms the results from the bogs that it is useful for grassland management and is also present from a management point of view.

The average vegetation cover value in the control area was significantly different from the cover values in the control and the woody sample area. The control area results also contained a more significant proportion of species from semi-natural areas and protected species. Protected species (*Pulsatilla nigriccans, Stipa eriocaulis*) were also present in the grassland, but disturbance-tolerant species were dominant, with *Festuca pseudovina* being the dominant grassland species in the association The grazing of sheep also confirms the results from the Forest of Bénye (Penksza et al., 2024), which show that grazing is both economically important and beneficial for grassland management.

III. Szurdokpüspöki after the deforestation (grazing animal: merino sheep)

The releves was carried out in Mátra, in the area of the Mátra Buffalo Reserve near Szurdokpüspöki. The pasture has a similar structure to the vegetation type of the wooded pastures separated as grassland, which is why it is discussed together with the wooded pastures. The study was conducted in three sample plots. Two of these sample plots were subjected to shrub clearance and stubble crushing four and six years ago, respectively, and have since been grazed by Hungarian domestic water buffalo (*Figure 4*).

The question was whether buffalo grazing could be used to control shrubs without intervention? To what extent can buffalo maintain the grassland over time? What is the value of the pastures from a conservation and especially a grassland management point of view?

During the study, the quantity and number of species of grassland grasses of grassland management importance and their cover value increased. In addition, the number of butterfly species has increased.

A significant change has occurred in the direction of a decrease in the proportion of shrubs and an

increase in the proportion of grassland species. The dominant species have become *Festuca valesiaca* and *Festuca rupicola*. The distribution of species conservation category scores shows that the proportion of weeds and disturbance-tolerant species decreased and the proportion of natural vegetation species increased in areas abandoned between 2 and 4 and 6 years ago, in that order. In addition, protected species, such as Stipa pulcherrima, have also appeared in the areas. Klapp's values show an increase in the proportion of species with a higher grassland management value (6-8) in the four and six years of water buffalo management area

During the study period, we found that the domestic water buffalo is an effective habitat manager. It is able to maintain grassland habitat without interference (stalk crushing, shrub clearance). Its better adaptability to habitat formation and maintenance may also be due to its better nutrient utilisation compared to Hungarian grey cattle (Fűrész et al, 2023; Mihailou and Massaro, 2021; Escarcha et al., 2018; Warriach et al., 2015). In addition, buffalo grazing also creates mosaic, diverse habitats, diverse habitats and areas with good forage values from a grassland management perspective.

Figure 3: **Balatoncsicsó wood pasture. A. overview of the pasture**

3. ábra: Balatoncsicsó fáslegelő. ***A****. a fáslegelő áttekintő képe*

Figure 4: **Shrubland of Szurdokpüspöki**

A: 2 years and **B**: 6 years of shrubland. 2 and 6 years of grassland grazed by buffalo

4. ábra: A szurdokpüspöki cserjeirtott gyepterület

A: 2 éve és **B**: 6 éve cserjeirtott és bivalyokkal legeltetett gyepterület

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