FLORISTIC SURVEY ON THE PASTURE GRAZED BY DOMESTIC WATER BUFFALOES (*BUBALUS BUBALIS*) IN THE MÁTRA MOUNTAIN (SZURDOKPÜSPÖKI)

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GABRIELLA FINTHA, PHD STUDENT

Abstract

In nature conservation, it is long been understood that the adequate grazing is a proper management method on different habitats. The literature reviewed describes that grazing by different animals can affect on grasslands positively, so the importance of extensive grazing is increasing. However, impacts of grazing by buffalo on dry grasslands are a less researched. Based on this, the following research question has been formed: How does grazing by water buffalo affect on the species composition of grassland in terms of ecological values and nature conservation? The innovation of the investigation is that we examined not only the vascular but also the bryophyte flora. In this research article, we have found that the weeds (W) are steadily decreasing but the natural disturbance helps the restoration of the semi-natural grassland. In the present study, bryophytes have been a well indication of the disturbance of the areas. In order to define impacts of the long-term consequent of grazing by buffalo, we should carry on the research. We expect that this method can reveal effective solution for extensive farmers.

Keywords: coenological research, conservation, cryptogam flora, biodiversity, relative ecological values

1. Introduction

In recent decades, the conservation of the biodiversity of the remaining natural habitats and the reconstruction of degraded habitats have become increasingly urgent (Jones et al. 2018). By 2020, the European Union aimed to restore 15% of degraded ecosystems, so the science of restoration ecology has begun its serious development (Palmer et al. 2015).

Grasslands are significant in many ways in conserving and sustaining species diversity and landscape diversity. Natural and semi-natural grassland preservation in the ecological sense is extremely important for the survival of nationally protected plant and animal species. Besides, grasslands are crucial and essential for wildlife because they play a significant role in biodiversity conservation and agriculture. In addition, the area of grasslands and species richness in grasslands have decreased across Europe in recent decades. Therefore, the spread of intensive agricultural technology has transformed natural disturbance systems (Valkó 2019). This unbeneficial trend is also visible in Hungary, which is due to the expansion of intensive agricultural cultivation, the incorporation, breaking up and fragmentation of grasslands and changes in the land management (Penksza et al. 2010; Horváth et al. 2017). Several grasslands have become degraded, weedy and shrubbed without nature conservation management, human interventions, so the elimination of nature conservation treatments often threatens the biological diversity of

habitats, in addition, the cover growth of some cosmopolitan species may lead to a decrease in diversity (Pápay et al. 2017).

According to McNaughton (1979), moderate grazing can double the production of grassland, although intensive grazing already has strong selection effects on the species composition of vegetation. Small disturbances of this type are necessary in many cases in the grassland because they have beneficial effects on species diversity. However, if it is not implemented, a shrubbery grassland will be formed (Morris 2000; Penksza et al. 2009). Regular biomass removal is essential for the maintenance of lawns, which can be carried out by mowing or grazing, resulting in increased species richness and establishment of new species. Moreover, the settlement of weeds can be control by grazing and mowing and by their alternating use (Kovács et al. 2019). Plant and animal species missing from the area may reappear because of regular grazing (Török et al. 2018). Grazing is used in several regions with different animals such as sheep, goat, cattle or buffalo (Penksza et al. 2010). Different animals have different effects on the lawn as they graze in different ways and the species composition of vegetation is also affected by the intensity of grazing. Low or medium intensity grazing can preserve important plant species. In addition to the general effects of grazing, the particularities of the grazing of individual animal species are important for nature conservation because these can show significant differences in their effects on vegetation and soil (Tóth et al. 2018).

Nowadays, grazing by domestic water buffaloes (*Bubalus bubalis*) has been spreading for habitat management and economic reasons because they have shown positive effects on grassland management and nature

conservation (Valente et al. 2022). The main advantageous characteristic of the water buffalo is its special ability to subsist in coarse feed, straw and crop residues, and they adapt well to the area. On the other hand, they feed less selectively during grazing so they can be adequate for management in various habitat types (Antkowiak et al. 2015).

In our research, we were looking for the answer to the following questions:

(1) Is domestic water buffalo able to conserve the grassland after clearing of shrubs?

(2) How does grazing by water buffalo affect the species composition of grassland in terms of ecological values and nature conservation?

2. Literature Review

Recently, grazing has become expanded which is forecast significantly reduced the productivity of grasslands and may result in changes in the composition of sward plant communities (Török et al. 2013). Therefore, the preservation of flora biodiversity should be a priority. Grasslands under ’Natura 2000’ can be used for mowing and grazing, in these areas only cattle, buffalo, sheep, goats, donkeys, horses can graze, but overgrazing is prohibited, according to the management plan of the nature reserve, herbages and meadow can be grazed, but strictly according to the animal holding capacity of the

area. Grazing is important because they have a positive effect on species diversity, suppressing competitor species and promoting the spread of propagules, and ensuring the continuous maintenance of ecosystem services (Morris 2000). Mowed meadows and wooded pastures are the plant associations that are rich in species in Central Europe, therefore when grazing stops in the area shrubs and forests will spread (Saláta 2011). However, from a nature conservation point of view, mowing or grazing in these areas should be conducted later (Penksza et al. 2010). Different animals have different effects on the lawn because they graze differently. The species composition of the vegetation is also influenced by the intensity of depasture (Tóth et al. 2018). Low or medium intensity grazing can preserve important plant genera. The effects of grazing depend on grassland type. This is because cattle graze higher and can graze more easily the top-grass vegetation. From a nature conservation aspect, in addition to the general effects of grazing, it is particularly important what the peculiarities of the grazing of individual animal species or breeds are, because they can show significant differences in their effects on both vegetation and the soil (Tóth et al. 2018).

The choice of breed must be taken into account the animal's grazing skills, customs, body weight. From a nature protection viewpoint, these factors are very important because they determine how much trampling damage should be expected. The grazing habits of extensive and intensive varieties vary. The traditional breeds pick less when grazing, are active and adapt well to the area.

The main aspect of extensive animal husbandry while preserving the quality of lease in the long run is the most economical utilization of

pasture and animals. At the same time, the conservation of grasslands and the conservation of arable land into swards is also important from a significant soil protection point of view, it can also reduce the degree of erosion vulnerability. Preservation of grasslands, transforming arable land into grass from a significant soil protection point of view because it can reduce the extent (Gournellos et al. 2004). The presence of animals in the pasture has three types of effects on the lawn 1. grassland vegetation is selectively consumed by the animal, 2. dung to the lawn, 3. and it tramples it with his hooves (Béri et al. 2004).

It is also important to focus on the selective consumption of livestock, it has a particular role in the change of vegetation. It instinctively avoids stinging, poisonous and bad-tasting plants and does not graze in close proximity to them. The physiological reserves of favored and willingly grazed plants are more easily depleted due to the high animal load and may therefore be slowly pushed out of the lawn. The generative development of non-grazing species is not hindered by browse, so their ratio can increase in the lawn. Without intervention, plants proliferate progressively in the grassland, the pasture will be become weedy over time degrading the value of the vegetation (Béri et al. 2004). In contrast, Vinczeffy (2006) claims that plants dominate the terrain that endure grazing and taste to animals. However, according to Kátai (1993), grazing causes favorable changes in the physical, chemical and microbiological properties of soils, including the wildlife of the turf. The impact of trampling on vegetation also depends on type of soil, grazing animal species-, and plant composition (Vinczeffy 2006).

In Hungary, under grazing the livestock reduced heavily. Higher grasses, shrubs and other woody plants are growing during the under grazing of grasslands. In these areas, the constant species which grow lower will disappear completely by abandoning grazing.

As the under grazing, the overgrazing is not benefit for our grasslands, neither. During overgrazing, the animals are grazing constantly the spacious gramine and papilionaceous plants that may lead to be inhibited by assimilation because the photosynthetic surface is constantly chewed (Kozák 2012).

3. Material and Methods

3.1. Data collection

Coenological surveys on the sample areas were carried out in 2 x 2 m quadrats. These works were made 6 surveys in the sample areas of Szurdokpüspöki in 2022. Szurdokpüspöki belongs to Mátra Mountain but this place is situated at only 140 to 180 m above sea level.

Works were made according to the method of Braun-Blanquet (1964), but coverage was given in percentage. Species names were given according to the nomenclature of Király (2009) for vascular plants, Lüth (2021) for mosses. In addition, we analysed the distribution of species using the nature conservation value categories (TVK), according to Simon (2000). We assessed the data according to life-form of Raunkiær (1934) and Pignatti (2005). The data were evaluated

in terms of the social behaviour types (SBT) and relative ecological indicator values. These works were made according to the method of Borhidi (1995). This method is similar to the method of Ellenberg (1950) but this method is not applied the Hungarian botanists. The evaluation of life strategies of bryophytes is according to Dierßen (2001).

Nature conservation value categories (Simon 2000):

I. group: natural condition indicative taxa
   U-unique species, KV-specially protected species, V-protected species, E-constant species, K-accompanying species, TP-pioneers.

II. group: degradation indicator taxa
   TZ-natural disturbance tolerant, A-adventive species, G-economic crops, GY-weeds.

For Pignatti's categories, the following categories were used (Pignatti 2005):

Perennial species

H scap scapose hemicryptophytes

H caesp caespitose hemicryptophytes

H ros rosulate hemicryptophytes

H rept reptanthe micryptophytes

H bienn biennal hemicryptophytes

G rhiz rhizome-geophytes

Annual species

T scap scapose therophytes

Dwarf shrubs

Ch rept reptant chamaephytes

Suffrutex

Ch suffr sufruticose chamaephytes

Arboreal

P caesp Caespitose phanerophytes

3.2. Study area

The samples were collected in Szurdokpüspök in the Mátra Mountain in Zagyva-Völgy. The small region is an average asymmetric river valley with a height of 180 m altitude between the Cserhát and the Mátra. The climate of the micro-region is moderately cool-moderately dry but temperately warm in the south.

In the 3 examined areas, shrub cutting was carried out, then grazing with buffaloes.

1. sample area grazed for 2 years.
2. sample area grazed for 4 years.
3. sample area grazed for 6 years.

4. Results and discussion

4.1. Social Behaviour Types of species on sample areas (SBT)

In all areas under investigation, the proportion of competitors (C), natural disturbance tolerants (DT) and generalists (G) is the highest. As a result of continuous grazing, the vegetation in the areas is subject to constant disturbance. The results clearly show that the weeds (W) are steadily decreasing, so the natural disturbance helps the restoration of the semi-natural lawn (Figure 1.).

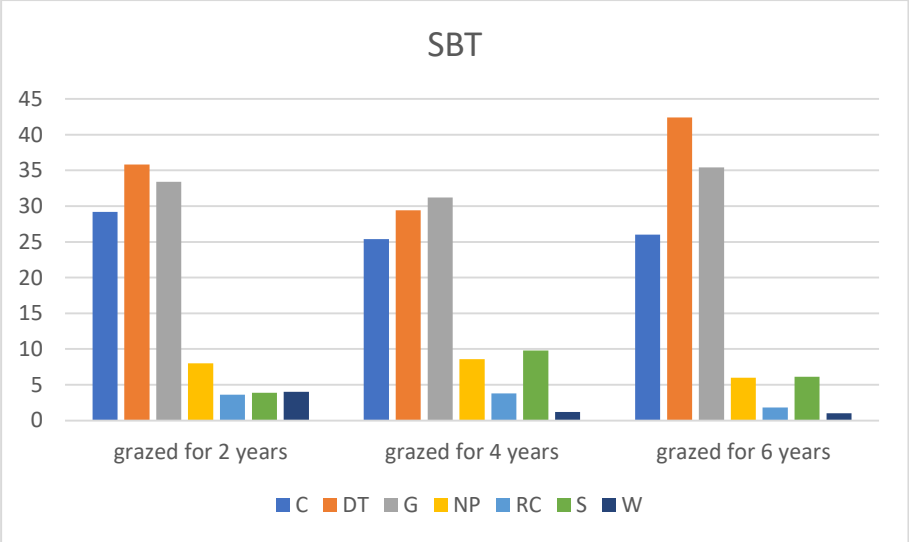

Figure 1. Distribution of Social Behaviour Types of species on sample areas

4.2. Nature Conservation Values of species on sample areas (TVK)

The number of protected species (V) and natural pioneers (TP) shows the increase in the categories of species in proportion to the time of grazing the area.

Natural pioneer species made the first lawn cover, so their presence suggests that there was recently disturbance in the area (grazing and shrubbery eradication).

Subsequently, competitors, constant species appeared that occupied permanently their place in the semi-natural habitat which is characterized by a potentially formed association.

Based on the results, the grasslands of the studied areas moved towards the formation of semi-natural condition (Figure 2.).

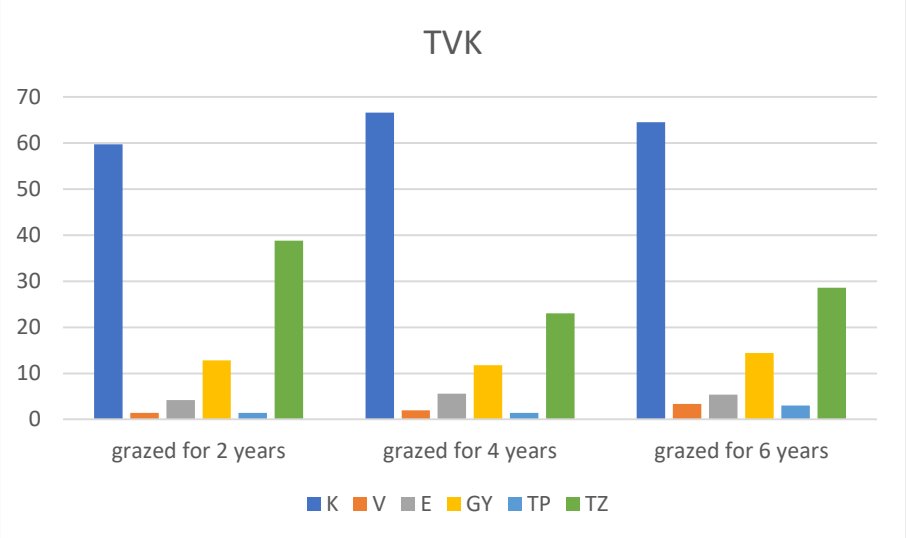

Figure 2. Distribution of nature Conservation Values of species on sample areas

4.3. Lifeforms of species on sample areas

The stabilising effect of nature conservation treatments can be clearly seen in the distribution of species cover by value of **Pignatti-lifeforms categories**. The proportion of arboreal (P caesp) in the area grazed for 6 years shows a significant decrease compared to the area grazed for 2 years.

On the bare soil surfaces formed by grazing, the amount of annual species (T scap) increased (Figure 3.).

The results of species rating by **Raunkiaer-lifeforms categories** are similar to the results of the Pignatti-lifeforms categories. The number of perennial species (H; Ch; TH) decreased while annual species were spread (Figure 4.).

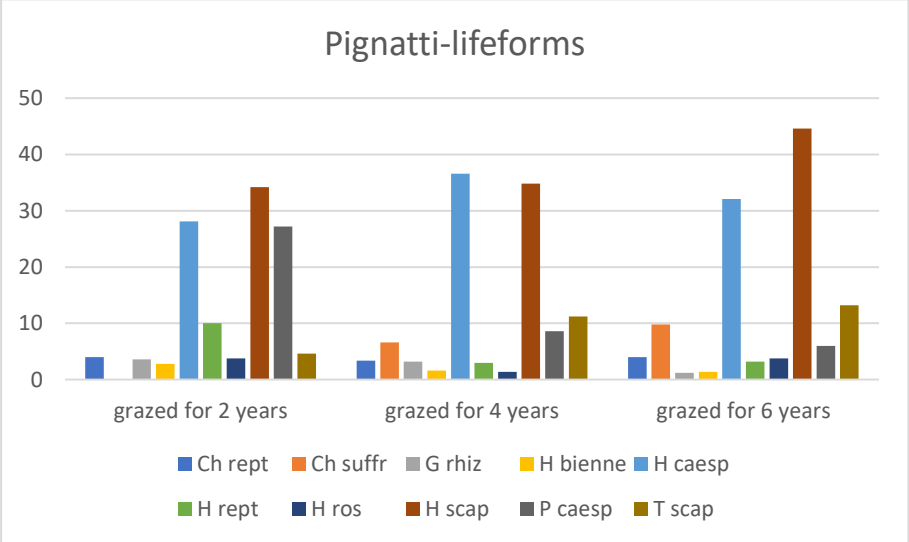

Figure 3. Distribution of Pignatti-lifeforms of species on sample areas

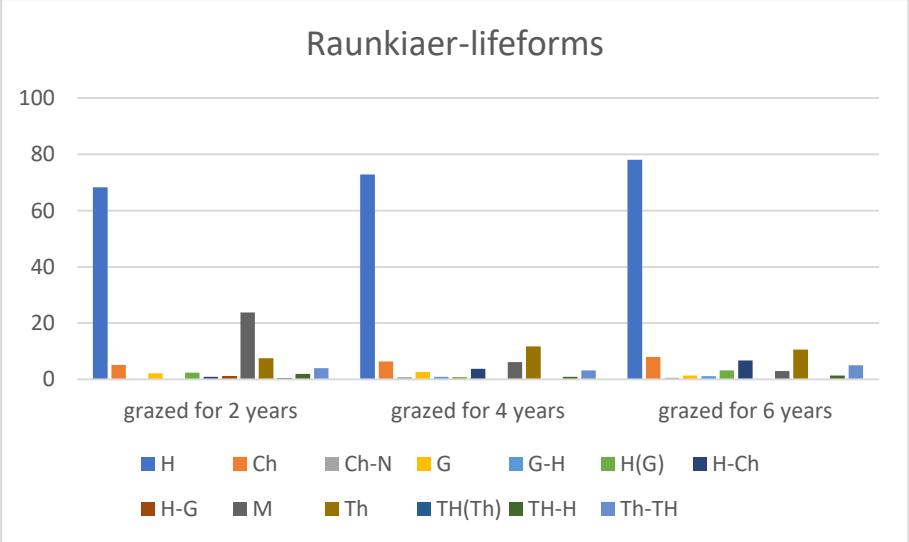

Figure 4. Distribution of Raunkiaer-lifeforms of species on sample areas

4.4. Life strategies of bryophytes on sample areas

There was a remarkable difference between the three sample areas concerning the percentage of species in each of the life strategy categories. The I. sample area was more abundant in perennials and stress tolerant perennials and there was no present in this area colonist and annual shuttle species. However, the III. sample area there were not found in the perennial species, but colonists representing in the large number of species. None of the bryophytes in the II. sample area belonged to the annual shuttle category. A possible explanation for this rate is the existence of that the 6th year of grazing was formed for colonist species optimal open bare soil surface (Figure 5.). In the 3 area the species composition was significantly different from each other. In the I. sample area identified by 3 perennials species

(*Thuidium abietinum, Homalothecium lutescens, Brachythecium albicans*), 3 competitive perennials (*Brachyhecium rutabulum, Oxyrrinchium hians, Calliergonella cuspidate*), one annual category (*Pottia truncata*) and one stress-tolerant perennial category (*Hypnum cupressiforme*). Species found in grazing area for 4 years constituted a transition in term is life strategy. It was identified three new species in the II. sample area, there was 2 colonists species *Didymodon rigidulus, Tortula ruralis*. The species composition of the area grazed for 6 years was significantly different from the bryophyte species found in the other examined areas. The III. sample in the examined area, the largest proportion of colonist species lived (*Ceratodon purpureus, Tortula muralis, T. ruralis, Barbula unguiculata, Bryum argenteum*), and to a lesser extent annuals (*Pottia truncate, P. lanceolata*).

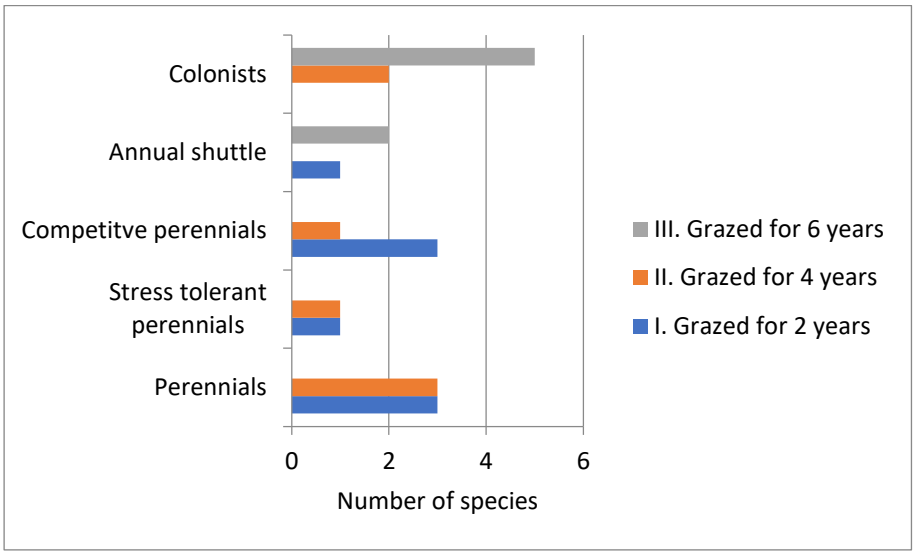

Figure 5. Life strategies of detected bryophyte species on sample areas

5. Conclusion

87 species were identified during the coenological examinations performed on pastures. Overall, the distribution of life-forms in the examined areas reflects the reduction of weeds, woody species and increase in species diversity in areas, that have been grazed for a long time. In particular, the number of natural stress-tolerant species increased in proportion to the intensity of grazing. Trends justify the effectiveness of nature conservation grasslands treatments. The detailed species composition of the bryophytes living there, has not yet been investigated by the research of grasslands previously. In the present study, bryophytes were a well indication of the disturbance of the areas. Consequently, we can conclude that probably grazing by domestic buffalo might be effective for conservation and maintenance of grassland. In addition, this animal species is suitable against shrubs growing.

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