

## IMPACT OF THE GRASSLAND MANAGEMENT PLANNING APPLICATION ON SOME FEATURES OF THE GRASSLAND VEGETATION FROM WESTERN ROMANIA – CASE STUDY

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### Abstract

*Permanent grasslands in Romania represent an important resource for animal breeders because they represent a very high rate from the total agricultural land. The problems characteristic for many grassland surfaces from lowland area are mainly degradation determined by overgrazing, improper management or the lack of the management works. The aspects related with the management of permanent grasslands from Romania are regulated by a national law (34/2013 with the latest updates) that imposes to the permanent grassland owners (private and public) to elaborate a Grassland Management Planning that is based on the preliminary evaluation of the grassland's vegetation and the problems found there. The planning sets the proper measures for permanent grassland use and maintenance of the vegetation cover. This work is a case study that takes in consideration six permanent grasslands from lowland area of western Romania that are in public ownership and rented by private animal breeders. The purpose of the work was to determinate the application of the Grassland Management Planning that is reflected in the grassland vegetation quality and biodiversity. The results obtained show that the forager value of the analysed grasslands is low according with the pastoral value obtained. Thus, biodiversity expressed as Shannon index is relatively high, but this fact is due to a great number of annual weed species that colonizes the grasslands, their origin being the surrounding access ways and the arable land from the vicinity.*

**Key words:** permanent grassland, pastoral value, biodiversity, grassland management planning

### INTRODUCTION

Worldwide during the last decades, the agricultural systems and landscape evolution have changed significantly as a consequence of interaction among multiple factors, such as global population increase, people movement through the areas with more resources, cities development, technical and genetically progress, consumption diversification, improved cropping technologies, machinery revolution, faster access to the information, climate variability and climate changes, grasslands diversity and multifunctionality [1][2][3][4][5][6][8][9][20][21][22][27][28]

and [29]. Permanent grasslands' importance, diversity and multifunctionality are aspect already illustrated in the researches from this scientific field, being from far one of the most used agricultural land from Europe [23].

In Romania, from the all about 5 million hectares of permanent grasslands most of them are affected by an intense degradation process. This degradation implies the aspects as agricultural – forager value, biodiversity and landscape.

Diversity expressed as species richness has kept especially the attention of the researchers from the field of botany, ecology and grassland science bringing important contributions to the knowledge regarding the

dynamics of the sward of the permanent grasslands [19].

Species diversity is a key factor that allows grasslands to evolve in the context of some continuous changes, processes that are accelerating nowadays due to the climate changes that are more obvious at global level [18]. The management practices, changes of the rainfall and temperatures regime and the anthropic intervention are the main factors that are influencing the vegetation of the pastures and hayfields and their distribution [11].

Looking at large scale and comparing with the situation of the permanent grasslands from the past their surface decreased considerably (49%) comparative with the forests surface (29%)[15]. Nowadays, the surfaces occupied with agricultural land are representing 11% from the total land surface and those occupied with grasslands represents 29% from the total land surface [15].

Thus, regarding the pastoral patrimony from Romania there are affected plant communities, and most are favoured certain species that are invasive [14].

The structure of the vegetation cover of the permanent grasslands is determining the quality of the forage obtained and production potential of these ecosystems. Grasslands are the cheapest forage sources for the grazing animals [12].

In Banat region (western Romania) an important surface of land is covered with permanent grasslands. Their distribution shows that they are covering about 69,000 hectares in the plain area, over 250,000 hectares in hill area and about 26,500 hectares in mountain area [11].

Along the time the grassland surfaces from Romania were diminished, especially those from the plain area followed by those from hill area. These have become forested grasslands or are parts of the extended infrastructure from the nearby area (as secondary roads, widened trenches etc). A considerable part of them is affected by abandonment, occasionally use, and extensive grazing because the surfaces aren't delimited by adequate fitments (e.g., electric fences etc.)

## MATERIALS AND METHODS

Plains occupies about a half from the Banat region surface and represents the lowest morphologic level with altitudes comprised between 75-200 metres a.s.l. The slope is very smooth and the land is usually flat with very few undulations and valleys with low depth [16]. The permanent grasslands analysed in this work are placed in Banat region (western Romania), Timiș County following the transect where are positioned the localities Dudeștii Noi (DdN), Becicherecu Mic (Bm), Biled (Bd), Șandra (Sn), Tomantic (Tmn) and Cenad (Cd). Grassland from Dudeștii Noi (DdN) was considered as control.

The altitude of the analysed grasslands is comprised between 78-90 m a.s.l. as it follows: Dudeștii Noi (DdN) 90 m, Becicherecu Mic (Bm), Biled (Bd) 78 m, Șandra (Sn) 86 m, Tomantic (Tmn) 83 m and Cenad (Cd) 87 m.

The main feature of the analysed area is represented by the high amount of clay in the soil, excessive in some points [16].

The observations and data were collected in the year 2019 in the second decade of April, first decade of July and last decade of September.

The present work is a case study and its purpose is to highlight the state of the vegetation, the forager value and biodiversity at a certain moment.

The investigations related with the management of these surfaces considered for research were realised on the background of personal observation and verbal communication of the grassland users that are managing these land surfaces.

Synthesizing the general pieces of information regarding the analysed grasslands they can be characterised as follows:

-grassland Dudeștii Noi (DdN) is grazed with cattle there being respected in general the regulations regarding the time of keeping the animals on pasture; the electric fences are present delimiting the pasture surface.

-grassland Becicherecu Mic (Bm) is overgrazed with sheep, the maintenance works aren't applied consequently; it isn't delimited with electric fence, only by some

trenches and ditches that can be easily crossed by the grazing animals.

-grassland Biled (Bd) is exploited with sheep and is delimited by electric fences.

-grassland Şandra (Sn) is occasionally grazed by sheep; there were applied works for shrubs' clearing.

-grassland Tomantic (Tmn) is under-grazed, there usually are grazing sheep and sometimes cattle.

-grassland Cenad (Cd) is under-grazed; it is mainly grazed by sheep; isn't delimited by electric fence.

The grassland swards were investigated using the linear point quadrat analysis method [10]. This method had helped to the calculation of the pastoral value (VP) this index being important for the assessment of the agro-forager value of a permanent grassland. Its calculation implies several steps as follows:

(1) multiplication of the specific volume (VS) for every species with the specific quality index (IS);

(2) Summing of the obtained values and division of their sum with 5.

Using the same method there was calculated specific frequency (FS%) for every species from the vegetation sward of the analysed grasslands.

For the calculation were used the vegetation surveys they being used also for the calculation of the biodiversity index Shannon.

## RESULTS AND DISCUSSIONS

The floristic composition and typological characterisation of the permanent grassland represents a necessary background in the setting of the proper management measures for the use and conservation of the permanent grassland [30].

Thus, after the determining of the participating species in the vegetation cover in the six analysed sites they were grouped in the functional groups, respectively grasses, legumes and plants from other botanical families (forbs) as is shown in Figure 1.

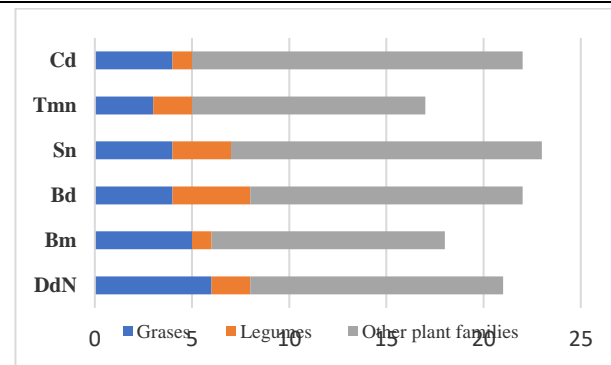


Fig. 1. Number of species on main functional groups (grasses, legumes and species from other plant families) measured in studied grasslands.

Source: Own experiment.

Compared with the control (DdN) the less numerous grasses species were determined in the grassland (Tmn), species as *Alopecurus pratensis* L., *Lolium perenne* L., *Cynodon dactylon* L., *Festuca pratensis* L.

A particular aspect on this grassland is determined by the presence of the species *Vulpia myuros* L., a therophyte species (Th), xero-mesophytic, moderate thermophilic, without forager value, and a quite great participation rate in the sward. This species was identified also on grasslands from northern Oltenia region (Romania) where it occupies open habitats and is accompanied with a variable number of species depending by the soil and climate conditions [25].

This aspect is due to the fact that the animals are consuming this species sporadically and the cuts for the cleaning by mowing of the remained plants after grazing are applied only randomly.

Other grass species that had kept the attention by its presence in variable rates on all analysed grassland is *Cynodon dactylon* L.

On the base of some correlations resulted from anterior researches regarding the dynamics of this species had resulted that it has a great capacity to explore the existent resources and is able to adapt to the existent climatic conditions (low rainfall amount during the vegetation season, high temperatures, deficient management [11].

The higher and higher presence and coverage rate of these grasses in grasslands from a year to other suggests a certain trajectory of transformation of these grasslands from mesophytic to xero-mesophytic.

An important specific frequency (FS%) in the vegetation cover of the analysed grasslands have the leguminous species.

In all the analysed sites species *Trifolium repens* L. was present in different rates.

Many researches had in view observations on the spread, morphology and dynamics of species *Trifolium repens* L. These have shown that the species has a greater intensity of leaves and flowers growth in vicinity of the species *Poa pratensis* L. and *Dactylis glomerata* L. [33].

On the grassland from Biled (Bd) the specific frequency of the species *Trifolium repens* L. was 6%, on the grassland from Şandra (Sn) 4% and 1% on the grassland from Cenad (Cn). In the case of the grassland from Cenad (Cn) is noticeable that the specific frequency (FS%) approximatively equal with the species *Lotus corniculatus* L. (3.6%) has the species *Ononis spinosa* L., this species having no forager value and being avoided by herbivores (domestic and wild).

There is known that the performances of the species in a vegetation community are supported by a sum of conditions: growing rate, possibility to exploit soil resources, water, temperature and reproductive capacity. All these aspects are supporting the constant existence of a species in a certain place for a considerable period of time [24].

The presence of the forbs is sward is also important. There were found species as: *Capsella bursa pastoris* L., *Mentha arvensis* L., *Cirsium aevense* (L). Scop., *Chenopodium album* L., *Cerastium arvense* L., *Cichorium intybus* L., *Senecio vulgaris* L., *Stellaria media* L. The forbs were found in the greatest rate on the grassland Cenad (Cd) and Şandra (Sn) in comparison with the grassland from Dudeştii Noi (Dn) and Biled (Bd) where the maintenance works are satisfactory applied according with the Grassland Management Planning recommendations.

The contact with the agricultural land and the uncontrolled movement of the animals and the soil seed bank are only some of the reasons that determinate the presence in a high rate of the forbs mainly ruderal species that are advancing from the edge of the plots to the interior.

Ruderal species as is shown by some researchers are well adapted to the environmental stress situations. This is due mainly to their short life cycle and high prolificity [34].

Along the time the researches regarding the grassland species from the permanent grasslands and on the cultivated temporary grasslands have facilitated the getting of new pieces of information that have allowed the ecological and agronomical characterization of the main grassland species (e.g., nutritional value, palatability, digestibility etc.).

The relative character of the pastoral value was analysed by many researchers, they considering that it is influenced by the grassland use mode (cutting, grazing, type of grazing herbivores and their feeding preferences) [17].

Specific frequency (FS%) of the species in the vegetation cover and their dynamics give important pieces of information regarding the agronomic and forager value of the analysed grasslands.

Thus, on the base of the vegetation surveys there was calculated the pastoral value (VP) (0-100 scale), the obtained VP for the control Dudeştii Noi (Dn) was VP = 39 and the lowest VP obtained was determined on the grassland Sandra (Sn) VP = 23, followed close by Cenad (Cn) VP = 24. Most of the analysed grasslands have low forager value (Cenad (Cn), Becicherucu Mic (Bm), Tomnatic (Tmn) except the control grassland Dudeştii Noi (Dn) that can be considered medium – to good forager from the point of view of the forager value.

All these can be explained by the fact that under-exploitation determinate a high seed multiplication of the grasses that are growing in bunches [18], mainly the non-valuable ones. In our case study the situation is confirmed by *Vulpia myuros* L from the grassland Tomnatic (Tmn) respectively *Bromus hordeaceus* L. from the grassland Becicherecul Mic (Bm), Cenad (Cn) and Şandra (Sn).

It is possible that these grass species have excluded other species less competitive for light and in this way to determinate bare soil

patches in the sward that favours new species more competitive [32].

Most of the researches are concluding that a decrease of the grazing pressure favours the increase of biodiversity in the vegetation community by the appearance of new species [32].

A similar situation was found on the grassland from Cenad (Cn) where Shannon index for biodiversity ( $H'$ ) had the highest value ( $H'=4.03$ ) being similar with the value of the control and the other analysed sites. Even it is the grassland with the highest biodiversity it hasn't valuable species from forager point of view.

This situation is explained by the fact that there can be found numerous annual species resulting from the contact with the arable fields from the surrounding area.

Correlation of the pastoral value with Shannon biodiversity index (Figure 2) of the analysed grassland sites show a positive correlation coefficient  $r_{calc} = 0.52$ , but the value obtained is slightly below the signification level  $p \geq 0.05$  ( $r_{value} = 0.669$ ). Thus, the determination coefficient ( $R^2 = 0.278$ ) show that the hypothesis is true for 27.8% from the analysed situations. The positive trend of the correlations and the linear regression suggests the need to apply these statistics on a greater number of sites to have more clear conclusions regarding the relationship between Shannon biodiversity index and pastoral value of the grasslands from the target area.

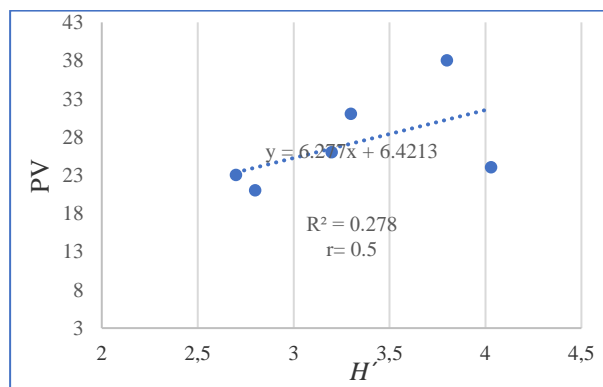


Fig. 2. Pearson's correlation between Shannon index ( $H'$ ) and Pastoral Value (VP) (one tailed test;  $df = 5$ ;  $p \geq 0.05$ )

Source: Own results.

On the other grassland surfaces analysed there the biodiversity index show a low to medium value, this aspect being influenced by the wrong management, lack of the application of the works for the improvement of the floristic composition.

Regarding the works for the improvement of the floristic composition and restoration and maintenance of the biodiversity of the grasslands the most popular ones are based on the seed transfer using hay harvested at the seed maturation stage of the main species from other grasslands from surrounding area with a higher biodiversity [31].

Research results show that this improvement method can be applied successfully on degraded grasslands [31].

To understand better the analysed vegetation features are necessary more researches to have a more complex view on the grassland vegetation features. The knowledges in this way are very useful and represent some of the most important details for proper grassland management and conservation [7], [35], [13].

## CONCLUSIONS

Analysis of the floristic composition and its trajectories isn't always enough to do a proper characterisation of the changes from functional point of view, respectively the species coverage rates in a certain site.

The adaptation strategies of the species in stress conditions (changes in the rainfall amounts, oscillating temperatures etc.) or in proper environments are aspects necessary to be investigated.

Regarding the present case study there can be concluded that most of the analysed grasslands are framing in the category of the low to mediocre quality; and where were applied maintenance works consequently can be noticed an improving trend.

Grassland surfaces analysed here are recently influenced by the measures set by the grassland management planning regulated by the grassland law 34/2013 [22] with latest updates. The recommendations from these regulations are a start point for the achievement of a satisfactory balance among

the floristic composition, applied management and conservation when is the case.

In the past land owners weren't considering that is necessary to apply rational grazing or to find a way economically efficient for the improvement of the agronomical and economical value of these communal pastures and to maintain the biodiversity.

In present the new applied policies at national level are pushing the responsibility to the grassland owners or concessionaires or other types of grassland users to apply a right management mostly when they are applying for agro-environment subsidies.

The time interval for the permanent grassland from private and public ownership restoration or at least maintenance in a relatively good condition depends by the application of the proper maintenance works.

Monitoring of these grassland surfaces has become a priority at least after the year 2000 for most of the grassland scientists and financing entities in our country, the main goal being sustainability and preservation of biodiversity, production and maintenance of the open landscape in relationship with its' proper exploitation.

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