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BOTANICAL ANALYSIS OF FALLOW GRASSLANDS EXISTING IN MOUNTAIN CONDITIONS

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Summary

The investigations were carried out in the years 2000 2004 on permanent grassland in Czarny Potok (Beskidy Mts. 650 a. s. l.). Botanical census was conducted by using Klapp's method on 26 plots (18 random selected plots and 8 controls). The whole floristic material was subjected to numerical classification. As a result, three main types of plots with the dominating species of: *Juncus effusus* (1), *Cirsium arvense* (2) and *Deschampsia caespitosa* (3), were distinguished. *Poa trivialis* was the dominating species of the control plots.

Results of the floristic and habitat analysis confirmed that the main factors determining the formation of meadow and pasture communities are as follows: the method of use, water relations and soil nutrient availability. It was found that idle glades are characterised by degraded sward of the average (the sward patches with the domination of *Deschampsia caespitosa*) or low use value (the swards patches with the domination of *Cirsium arvense* and *Juncus effusus*). The deterioration of the feeding value of the fallow plots is an effect of their high weed infestation, which in turn results, in this case, from habitat changes as a consequence of the cessation of use and earlier errors made in cultivation measures. Both high and low soil moisture, with improper meadow management, accelerated the weed infestation of the sward, what in turn lowers its use value. Cutting and fertilisation positively affect the use value of plant habitats, what was confirmed by the botanical and habitat analysis of the control plots with the domination of *Poa trivialis,* which is known to be of good use value.

Key words**:** fallow areas, botanical composition, habitat, degradation of mountain pastures

INTRODUCTION

Over the recent time period, due to the worsening economic situation in agriculture, a large number of fields and grasslands have been left as fallows (Ostromęcki and Piechota, 1996). It has resulted in far-reaching changes in the botanical composition of idle grassland areas (Kornaś, 1990). In mountains, this type of transformations is often accompanied by changes in water relations of the soil, what has an enormous impact on the use value of plant communities forming in new environmental conditions.

The aim of this study is the botanical and habitat characteristics of mountain meadows and pastures after the cessation of their use, under varying soil moisture conditions.

BRIEF CHARACTERISTICS OF THE STUDY AREA

The investigations were carried out on permanent grassland in Czarny Potok near Krynica (650 m a.s.l.), which is one of many fallow mountain pastures in this region. This land belongs to the Department of Grassland Science of the Agricultural University in Kraków.

Brown soil occurs there, formed from Magura sandstone with the granulometric composition of light loam. The parent rock is Carpathian flysch belonging to the Magura Nappe (Alexandrowicz, 1999; Słownik geograficzno-krajoznawczy Polski/ Dictionary of geography and nature sightseeing of Poland, 2000). In the upper parts of the valleys, a local weathering-resistant variety of Magura sandstone is found, the so-called Krynica sandstone. It is characterised by coarse-grained clay binder and grey or rust colour.

The whole area is dissected by a quite dense network of low-yielding fissure springs, formed in the flysch, as well as tubular springs occurring in mantle rock, mostly fed by rainwater (Dynowska and Pociask-Karteczka, 1999). Soil and hydrological conditions favour the occurrence of erosion processes (Adamczyk and Gerlach, 1983).

This area belongs to the Carpathian agricultural and climatic province, described as cool. There are over 150 ground frost days here and the vegetation period lasts, on the average, 173 days – from the 3rd decade of April until the 1st decade of October. Average monthly air temperatures range between –2.6°C in December and +16°C in July, whereas average monthly total rainfall is from 39 mm in February up to 116 mm in June (Hess, 1965).

METHOD OF STUDY

In the years 2000-2004, in communities representative for the object, on 18 random selected experimental plots with an area of 25 m^2, the floristic composition of the sward was determined using Klapp's method, with an accuracy of up to 1%. The species occurring with a smaller share than 1% received the sign +. For the purpose of comparison, an assessment was also made of the botanical composition of the vegetation occurring on the control object, without fertilisation, cut twice a year (plots no.: 7, 6, 10, 22) and in the patches with mineral fertilisation $P_{18}K_{66}N_{120}$ (plots no.: 11, 12, 19, 21). A total of 26 plots was examined.

In order to identify homogenous groups, the numerical classification was applied to these plots, based on the percentage shares of particular species. The MULVA-5 software package was used for the classification. Similarities were calculated by using the formula of van der Maarel:

$$r(x,y) = \frac{\Sigma xy}{\Sigma x^2 + \Sigma y^2 - \Sigma xy}$$

In the grouping of the plots, the "Minimum Variance Clustering" method was used (Wildi and Orlóci, 1996). The value of 0.5 was conventionally adopted in the classification for the species occurring on the plots with the share estimated at "+".

Then, for the identified groups of plots, based on the system of classification of grazing value of the sward according to Filipek (1973), the average use value index was calculated and it was compared with each other.

Soil samples were also taken from the surface level for chemical analysis. In the soil samples, chemical properties were determined using the methods applied for mineral soils: pH by the potentiometric method, the total nitrogen content by the Kjeldahl method and the phosphorus and potassium content by the Egner--Riechm method. The presentation of results of the investigations was limited to average values from a period of 4 years for three representative groups of the plots and for the control sample.

The characteristic of moisture conditions of the habitat was made based on indicator values according to Ellenberg (Ellenberg et al., 1992). For all the plots, the average weighted moisture indicator values – F – were calculated, in relation to the percentage shares, and then arithmetic means of the indicators for the whole groups.

The nomenclature of vascular plants follows Mirek et al. (2002).

RESULTS

The numerical classification allowed the identification of 3 main groups of plots with a different botanical composition and the control group (Fig. 1, Tab. 1). In group 1, a part of the patches has a slightly poorer species composition, but due to the same dominants they were not identified as a separate group. The other groups are well distinguished and they have a clearly differing botanical composition.

Characteristics of the distinguished groups of plots

a. Group 1 with the domination of *Juncus effusus*

At a higher groundwater level, the following species dominate in the vegetative cover: *Juncus articulatus* and *J. effuses* and to a smaller degree *J. conglomeratus* and *J. bufonius* (Tab. 1). Their joint share in the botanical composition ranges 78–83%. Among other species, the presence of *Scirpus silvaticus* (1-8%) and *Deschampsia caespitosa* (6-9%) is noticeable here. The other components of the sward are found in small (*Cirsium palustre, Equisetum palustre, Mentha longifolia* 1 – 2% in the patch) or very small quantities (*Campanula patula, Galium palustre, Lychnis flos-cuculi, Potentilla anserina* and other – less than 1%). Papilionaceous plants are not found in this type of patches. A large share of rushes and an almost complete lack of good grazing grasses significantly lower the use value which in this case is small (Tab. 2). Generally, these patches represent the poor and economically neglected pasture of *Epilobio-Juncetum effusi*.

b. Group 2 with the domination of *Cirsium arvense*

A primary component of the sward in these plots is field thistle which is mainly accompanied by grasses such as: *Briza media, Agrostis capillaris*, *Festuca ovina, Cynosurus cristatus, Deschampsia caespitosa.* The share of papilionaceous plants is insignificant here – maximum 1–2% in the patches. Among other species, the presence of nitrophiles is noticeable here, e.g. the dominant *Cirsium arvense* and a small quantity of *Urtica dioica.* Generally, the botanical composition of this group evidences relatively low soil moisture, what is indicated by the share of plants such as: *Briza media, Agrostis capillaris, Festuca ovina* or *Euphorbia cyparissias*. The grazing value of the patches with the domination of *Cirsium arvense* is small (Tab. 2).

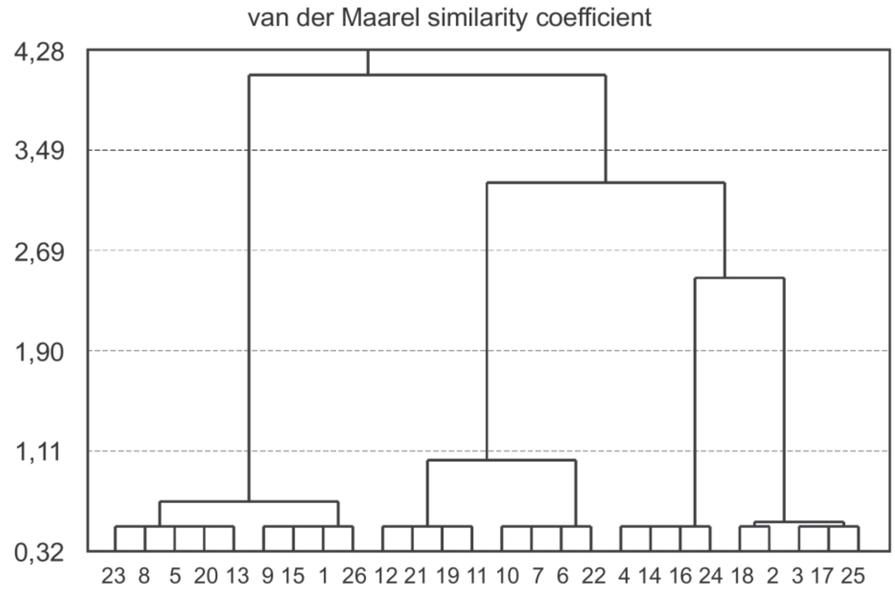

Fig. 1. Classification of 26 plots based on species percentage shares in the botanical composition.
23 26 plots with dominant *Juncus effusus,* 12 11 control sample with dominant *Poa trivialis* fertilisation, 10 22 control sample with dominant *Poa trivialis,* cut without fertilisation, 4 24 plots with dominant *Cirsium arvense,* 18 25 plots with dominant *Deschampsia caespitosa.*

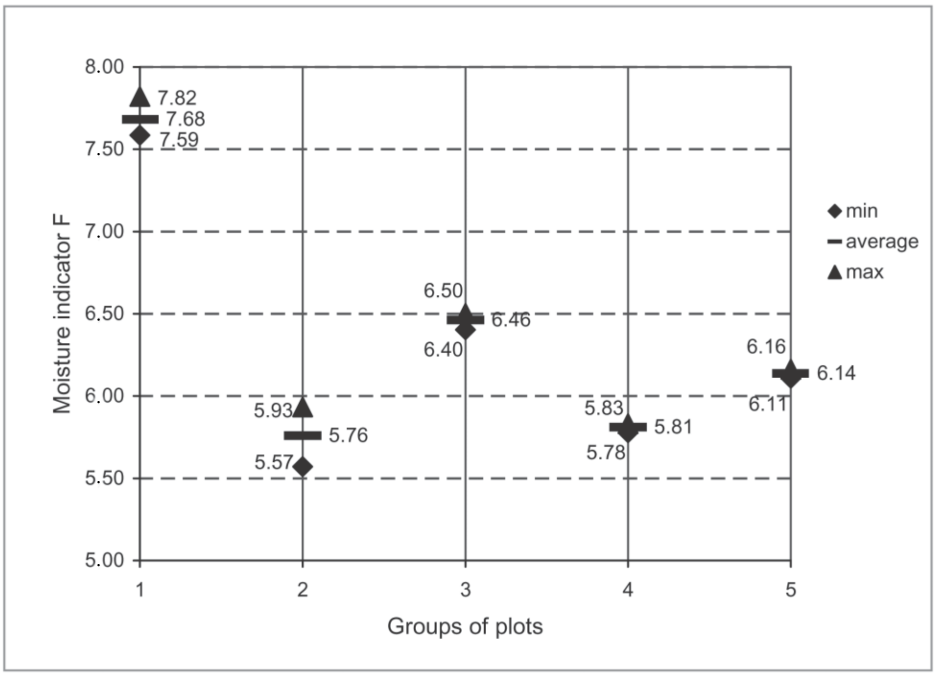

Fig. 2. Comparison of average Ellenberg's moisture indicator values (F) calculated for groups of study plots.
1 plots with dominant *Juncus effusus,* 2 plots with dominant *Cirsium arvense,* 3 plots with dominant *Deschampsia caespitosa*, 4 control plots with dominant *Poa trivialis*, fertilisation, 5 control plots with dominant *Poa trivialis,* cut without fertilisation.

Table 1
Botanical composition analysis of distinguished groups of plots.

Plots No/Group No	**23**	**8**	**5**	**20**	**13**	**9**	**15**	**1**	**26**	**12**	**21**	**19**	**11**	**10**	**7**	**6**	**22**	**4**	**14**	**16**	**24**	**18**	**2**	**3**	**17**	**25**
	Group 1									**Control sample**								**Group 2**				**Group 3**				
Grasses										Fertilisation $P_{18}K_{66}N_{120}$				Cutting												
Briza media L.																		3	3	2	5					
Agrostis capillaris L.																		3	2	4	2					
Festuca ovina L.										+	+	+	+	2	1	2	1	2	2	3	2					
Cynosurus cristatus L.	+	+	+	+	+													2	2	3	3	**18**	**18**	**14**	**15**	**12**
Deschampsia caespitosa (L.) P. Beauv.	8	7	7	6	9	8	7	6	8	2	1	1	2	4	6	5	3	7	6	5	4	**39**	**42**	**40**	**41**	**43**
Holcus lanatus L.										+	+	+	+	1	1	2	1					8	5	9	11	7
Festuca pratensis Huds.										**21**	**22**	**20**	**19**	**10**	**11**	**10**	**14**					4	2	5	1	2
Festuca rubra L.										**6**	**7**	**5**	**8**	**17**	**17**	**15**	**15**					11	10	14	11	12
Dactylis glomerata L.										**15**	**14**	**14**	**13**	**3**	**3**	**4**	**5**					2	5	2	3	5
Poa trivialis L.										**24**	**22**	**26**	**24**	**34**	**33**	**32**	**32**									
Poa pratensis L.										**20**	**20**	**19**	**20**	**9**	**8**	**10**	**7**									
Elymus repens (L.) Gould										2	3	3	3	4	3	3	2									
Anthoxanthum odoratum L.										+	+	+	+	1	2	2	2									
Holcus mollis L.										+	+	+	+	+	+	+	+									
Phleum pratense L.																										+
Papilionaceous																										
Trifolium repens L.										+	+	2	2	4	4	4	4	+	+	+	+					1
Trifolium pratense L.																		1	1	2	2					
Trifolium dubium Sibth.																										1
Rush																										
Juncus articulatus L. emend. K. Richt.	**27**	**28**	**30**	**31**	**29**	**32**	**31**	**32**	**30**													7	8	8	9	10
Juncus effusus L.	**35**	**34**	**35**	**36**	**38**	**24**	**25**	**22**	**23**																	
Juncus conglomeratus L. emend. Leers	**13**	**16**	**12**	**11**	**10**	**14**	**13**	**15**	**12**																	
Juncus bufonius L.	**7**	**5**	**5**	**7**	**6**	**10**	**10**	**9**	**14**																	
Other																										
Cirsium arvense (L.) Scop.	+	+	+	+	+													**79**	**80**	**78**	**79**	9	8	6	7	5
Alchemilla monticola Opiz	+	+	+	+	+					4	5	2	3	2	2	1	3	+	+	+	+	+	+	+	+	+
Achillea millefolium L.										2	2	3	2	3	3	4	2	+	+	+	+	+	+	+	+	+
Ranunculus acris L.	+	+	+	+	+					+	+	+	+	2	2	1	3	+	+	+	+					

Cirsium rivulare (Jacq.) All.										+	+	+	+	+	+	+	+									
Veronica chamaedrys L.										+	+	+	+		+											
Urtica dioica L.										+	+	+	+		+			1	2	1	1					
Glechoma hederacea L.																		+	+	+	+					
Plantago lanceolata L.																		+	+	+	+					
Stellaria graminea L.																		+	+	+	+					
Euphorbia cyparissias L.																		+	+	+	+					
Galium mollugo L.																		+	+	+	+					
Myosotis palustris (L.) L. emend. Rchb.	+	+	+	+	+	+	+	+	+									+	+	+	+					
Caltha palustris L.						1	+	1	+																	
Ajuga reptans L.	+	+	+	+	+																					
Equisetum arvense L.	1	2	2	2	2																					
Cerastium holosteoides Fr. emend. Hyl.	+	+	+	+	+																	+	+	+	+	+
Acinos arvensis (Lam.) Dandy																						+	+	+	+	+
Ranunculus repens L.	+	+	+	+	+					1	1	2	1	1	2	2	3									+
Rumex acetosa L.										+	+	+	+	+	+	+	+									
Taraxacum officinale F. H. Wigg.										1	1	1	1	1	1	1	1									
Galium verum L.										+	+	+	+	+	+	+	+									
Rumex acetosella L.																										+
Potentilla anserina L.	+	+	+	+	+	+	+	+	+																	+
Scirpus silvaticus L.	2	1	2	1	1	5	8	7	8																	
Lychnis flos-cuculi L.	+	+	+	+	+	1	+	+	+																	
Galium palustre L.	+	+	+	+	+	+	+	+	+																	
Campanula patula L.	+	+	+	+	+	+	+	+	+																	
Cirsium palustre (L.) Scop.	1	2	1	2	1	2	2	2	1																	
Equisetum palustre L.	2	1	2	1	1	1	2	3	2																	
Mentha longifolia (L.) L.	2	2	2	1	1	+	+	1	+																	
Veronica scutellata L.								+																		

c. Group 3 with the domination of *Deschampsia caespitosa*

These plots represent patches of an economically neglected mountain pasture. In their sward, the domination of hair grass is noticeable, but at the same time one of the best grazing species of grass also occurs here –*Cynosurus cristatus*. Its share is from 12 up to 18% in the patches. Among other grasses, *Festuca rubra* (10-14%) and *Holcus lanatus* (5-11%) are found. Moreover, a small admixture of *Juncus articulatus* (7-10%) and *Cirsium arvense* (5-9%) appears here. Other dicotyledonous species account for less 1% in the sward. The use value of these patches is at an average level (Tab. 2).

d. Control group with the domination of *Poa trivialis*

In the cut control plots, unfertilised, two grass species dominate which account for 50% of the yield: *Poa trivialis* 32-33% and *Festuca rubra* 15-17%. In smaller quantities, *Festuca pratensis* 10-14% and *Poa pratensis* 8-10% are found in the yield. Papilionaceous plants are represented only by *Trifolium repens* and they account for a bare 4% of the yield. Among other dicotyledonous plants, the following occur here: *Achillea millefolium*, *Alchemilla monticola*, *Taraxacum officinale*, which account for from 1 up to 4 % of the yield.

In turn, on the fertilised plots, three grass species co-dominate: *Festuca pratensis*, *Poa trivialis* and *P. pratensis.* In total, they account for about 65% of the yield. Compared to the unfertilised plots, a larger share of the good grazing species, notably *Dactylis glomerata* 13-15%, deserves attention. But the share of papilionaceous plants is also insignificant here. Among dicotyledonous plants, the presence of a remarkable nitrophile, *Urtica dioica*, is noticeable in the patches, which proves the increased level of soil nitrogen. Other plant species occur here in smaller quantities, likewise on the unfertilised patches. The grazing value of all the patches with the domination of *Poa trivialis* is good (Tab. 2).

Table 2
Assessment of feeding value of study plots based on the use value index (UVI) scale by J. Filipek (1973).

Feeding value of plants	UVI	Group 1	Group 2	Group 3	Control sample		
					fertilisation	cutting	total
very good	10 9						
good	8 7						
medium	6 4				8.20		7.32
small	3 1	0.55	0.94	3.94		6.90	
none	0						
poisonous plants	(1) (3)						

Table 3
Results of chemical analysis of soils.

Groups of plots with dominant	pH in 1 mol KCl dm ^{3}	Content [g. kg ^{1} soil]		Available [mg. kg ^{1} soil]		
		Matter org.	Total N	P	K	Mg
Cirsium arvense	4.6	45.3	2.88	13.0	203.8	256.5
Deschampsia caespitosa	4.3	**35.2**	**2.31**	**4.1**	120.1	**178.4**
Juncus effusus	**5.7**	**85.3**	**4.12**	6.0	76.9	**343.1**
Poa trivialis ($P_{18}K_{66}N_{120}$ control fertilisation)	4.2	50.4	2.93	**23.8**	**204.0**	247.3
Poa trivialis (control, cutting)	**3.8**	49.1	2.74	9.5	**64.8**	194.1

Results of habitat studies

The soils studied were classified as brown acid soils with the grain-size distribution of medium silty loam (the patches with the domination of *Cirsium arvense* and *Deschampsia caespitosa*) or light silty loam (the control patches with z *Poa trivialis*, fertilised and cut without fertilisation). In turn, on the patches with the domination of *Juncus effusus*, the soil is groundwater gley soil.

Most of the examined soils have a very acid pH. However, the soil occurring in the patches with the domination of *Cirsium arvense* is acid (pH 4.6), and in the patches with *Juncus effusus* is slightly acid (pH 5.7). In this latter case, a higher value of soil pH may result from its enrichment with alkaline components dissolved in ground waters (Tab. 3).

The content of organic matter in most of the soils studied ranges between 35.2 and 50.4 g. kg^{-1} of the soil. An exception is the soil occurring in the patches with *Juncus effusus* where this content is almost two times higher (85.3 g. kg^{-1} of the soil). In this case, the content of total nitrogen is also the highest (N=4.12 g. kg^{-1} of the soil) – (Tab. 3).

With the exception of the fertilised plots with *Poa trivialis* (23.8 mg. kg^{-1} of the soil), the content of phosphorus in the studied soils is very low (from 4.1 up to 13.0 mg. kg^{-1} of the soil). On the other hand, the content of potassium in the soil on the fertilised plots with *Poa trivialis* and on the plots with the domination of *Cirsium arvense* is in the range of high values (203.8 – 204.0 mg. kg^{-1} of the soil). In the other cases, the content of available potassium is low (from 64.8 to 120.1 mg. kg^{-1} of the soil). In all the examined soils, there is a very high content of available magnesium (from 178.4 up to 343.1 mg. kg^{-1} of the soil) – (Tab. 3).

The moisture analysis of the habitat, conducted based on the indicator indices of Ellenberg (F), showed that the plots with the domination of *Juncus effusus* were the most moist – F=7.68, whereas the plots with the domination of *Cirsium arvense* were relatively the driest – F=5.76 (Fig. 2). In terms of moisture, most of the examined patches are found on fresh soils, medium moist. The abovementioned patches with the domination of *Juncus effusus*, found on wet, non-drying soil, are a departure from this rule (Ellenberg et al., 1992).

DISCUSSION

The analysis of the botanical composition of the plots studied unequivocally confirmed the thesis that the most important factors determining the formation of meadow and pasture communities are as follows: the method of use of the sward, water relations and soil nutrient availability (Dobromilski and Kwarta, 1993; Dzwonko and Loster, 1990; Okruszko, 2000; Zastawny, 1992).

The cessation of grazing and the discontinuation of treatment measures result in a significant deterioration of the feeding value of the plant patches. It is confirmed by a comparison of the use value indices according to Filipek (1973), made for the studied plots (Tab. 2). The use value index value is good only for the control plots with the domination of *Poa trivialis*. But on the idle patches with the domination of *Deschampsia caespitosa*, this value is average, and on the patches with the domination of *Cirsium arvense* and with the domination of *Juncus effuses*, it is small.

Compared to the control patches, the remaining groups of plots are characterised by smaller shares of grazing grasses, such as: *Festuca pratensis, Dactylis glomerata, Poa trivialis, P. pratensis*. Generally, all the patches, even the control ones, are marked by an insignificant share or a complete lack of valuable, in terms of grazing, papilionaceous plants, what certainly lowers their use value (Tab. 1).

The deterioration of feeding values on the idle plots is an effect of their weed infestation. Among undesired species, the following can be mentioned: *Cirsium arvense, Deschampsia caespitosa, Juncus effusus, J. conglomeratus, J. articulatus, Ranunculus acris, R. repens* and other. It is worth noting that some of these species are the dominants on the patches studied.

The causes of weed infestation of the sward can be attributable to, among others, a change in soil properties after the cessation of cutting and grazing. The cessation of use results in an increase in the activity of dehydrogenases which accompanies a rapid change of physical and trophic factors of a habitat. In the successive years of lying fallow, the activity of dehydrogenases drops, what, coupled with a fall in the population of aerobes carrying out the soil mineralization processes, entails a change in the balance of organic matter decomposition. In such a case, a higher level of soil humus content is set (Malicki and Podstawka-Chmielewska, 1998). The availability of humus positively affects the physical properties of meadow soils – they are more permeable to air. However, too large amounts of nitrogen contained in organic matter favour the encroachment of weeds, what is clearly noticeable in the study area (Tab. 1, 3).

An additional factor which enables an increase in weed infestation is the improper meadow management which once occurred on the Beskidy Mountains glades. A high frequency of certain species supports this statement. Intensive grazing leads to defoliation and trampling of desired grazing species, thereby the spread of plants reluctantly eaten by herbivores, resistant to mechanical damage (Noy-Meir et al. 1989). They include, *inter alia*, *Deschampsia caespitosa* and various species from the genus *Juncus* which remain for a long time in the sward after the complete cessation of tending measures (Tab. 1). The expansion of their tufts, and in the case of rushes also underground rhizomes, outdistances other species in the competition for the inhabitation of such types of places.

Weed infestation is also favoured by a high level of soil moisture. On an improperly used pasture, the soil structure is often disturbed by grazing animals, what by high moisture leads to bogginess (Nowiński, 1967). It is just due to high moisture that the share of species from the family *Ranunculaceae*, which are poisonous, increases rapidly. After some time, a pasture managed in this way is completely infested with buttercups, rushes and other weeds which prevent its further use (Barabasz-Krasny, 2002). The patches with the domination of *Juncus effusus* are a good example illustrating this type of phenomenon. They are characterised by moist, non-drying soil whose structure easily suffers mechanical damage and by a substantial share of economically useless weeds, because of which their use value is small (Tab. 1, 2; Fig. 2). Pastures damaged in this way are most frequently left without taking any action, what leads to the activation of the succession leading to forest and thicket communities.

In overdried places, especially on slopes, bare soil areas exposed due to trampling are quickly inhabited by anemochoric weeds, as it takes place on fallow fields (Barabasz-Krasny and Puła, 2004). The plots with the domination of *Cirsium arvense* can serve as an example here. A large share of thistle could indicate the post-cultivation genesis of these patches, but the presence of species such as: *Cynosurus cristatus*, *Trifolium repens, Alchemilla monticola*, suggests that these are currently economically neglected areas of a devastated pasture (Tab. 1; Fig. 2).

In grassland management practice, the possibility to regulate the floristic composition of meadows and pastures by applying properly chosen fertilisation is of enormous significance (Kornaś, 1990). On the object studied, it is confirmed by the botanical analysis of the control plots with the domination of *Poa trivialis* (Tab. 1, 2). However, nation-wide, there often are cases of weed infestation of meadow and pasture communities resulting from improper fertilisation. In such a case, the excessive growth of certain dynamic species, making use of, for example, one-sided fertilisation with nitrogen and potassium, leads to the formation of undesired facies. In connection with that, properly chosen fertilisation is a factor necessary to achieve a better yield.

In acidified soils, such as are found in the study area, the process of leaching of mineral elements from the upper layers may quickly lead to their depletion. However, on the idle grassland in question, only a deficiency of phosphorus in the soil is clearly noticeable. There is little potassium in the patches with the domination of *Deschampsia caespitosa* and with the domination of *Juncus effusus*. But magnesium still occurs in large quantities in the soil on all the fallow plots (Tab. 3).

It should be generally stated that with the current floristic composition of the Beskidy Mountains glades one cannot speak of rational grazing management. These are areas which show features of floristic degradation resulting from both earlier neglect in tending measures and the present fallow lying.

CONCLUSIONS

1. The above investigations confirmed that the main factors determining the formation of meadow and pasture communities are as follows: the method of use, water relations and soil nutrient availability.

2. Idle glades have degraded sward of the average (the patches with the domination of *Deschampsia caespitosa*) or low use value (the patches with the domination of *Cirsium arvense* and the patches with the domination of *Juncus effusus*).

3. The deterioration of feeding values on the idle plots is an effect of their weed infestation.

4. Both high and low soil moisture, with improper meadow management, accelerated the weed infestation of the sward, lowering its use value.

5. Cutting and fertilisation positively affect the use value of plant communities. On the control object, the patches with the domination of *Poa trivialis* were considered as good in terms of the use value.

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Analiza botaniczna odłogowanych użytków zielonych powstałych w warunkach górskich

Streszczenie

Badania prowadzono w latach 2000-2004, na trwałym użytku zielonym w Czarnym Potoku (Beskidy Mts. – 650 m n.p.m.). Na 26 poletkach (18 wybranych losowo i 8 w doświadczeniu kontrolnym) przeprowadzono spisy roślin metodą Klappa. Całość materiału florystycznego poddano klasyfikacji numerycznej, w efekcie której wyróżniono 3 główne grupy poletek z gatunkami dominującymi: *Juncus effusus* (1), *Cirsium arvense* (2) oraz *Deschampsia caespitosa* (3). Osobną grupę stanowiły poletka kontrolne z dominującą *Poa trivialis*.

Rezultaty analizy florystycznej i siedliskowej potwierdziły tezę, iż najważniejszymi czynnikami decydującymi o kształtowaniu zbiorowisk łąkowo-pastwiskowych są: sposób użytkowania, stosunki wodne oraz zasobność gleby. Stwierdzono, że nieużytkowane polany mają ruń zdegradowaną, o średniej (płaty z dominacją *Deschampsia caespitosa*) lub małej wartości użytkowej (płaty z dominacją *Cirsium arvense* oraz płaty z dominacją *Juncus effusus*). Pogorszenie walorów paszowych na poletkach odłogowanych jest efektem ich dużego zachwaszczenia. Z kolei wzrost zachwaszczenia wynika w tym wypadku ze zmian siedliskowych, będących następstwem całkowitego zaprzestania użytkowania oraz wcześniejszych błędów w zabiegach użytkowych. Zarówno wysoka jak i niska wilgotność gleby przy nieprawidłowej gospodarce łąkarskiej przyspiesza zachwaszczenie runi, obniżając jej wartość użytkową. Koszenie oraz nawożenie wpływa korzystnie na wartość użytkową zbiorowisk roślinnych, co potwierdziła analiza botaniczna i siedliskowa poletek kontrolnych.