

Effect of topography and land use in the past on mountain grassland vegetation



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Mountain grasslands are among the most abundant in species plant communities in Europe. This is due to the large variation of abiotic conditions and different ways of management. The aim of this study was to evaluate the importance of topographic factors (altitude, slope, exposition) and land use in the past (grassland, arable land) on current plant species composition of grassland.

Materials and methods

The study was conducted in the catchment area of the Lomniczanka river in Beskid Sadecki (Polish Carpathians). Altogether 73 releve were done in altitude gradient from 660 to 1060 m a.s.l. Land use of each plot area in the past was determined according to archival maps. Vegetation classification was made using TWINSPLAN and DCA analysis with CANOCO program. The Ellenberg ecological indicator values were also calculated.



Results

In the highest altitude most common were communities with black berry (*Vaccinium myrtillus*), beneath the mat-grass communities (*Hieracio-Nardetum*) and in the lowest altitudes bent-grass meadows (*Agrostietum*) (tab. 1.).

Along with increasing altitude a reduction in the number of species per plot and the Shannon-Wiener diversity index was observed. The values of Ellenberg indicator of fertility (N), reaction (R) and temperature (T) also decreased. There was only slight increase in moisture indicator value (F) Fig.1.

Table 1. Plant species associated with vegetation types of grasslands (phi* fidelity factor for the species - Tichy 2002). Only species with frequency > 50 % were displayed.

	Vaccinium myrtillus	Hieracio-Nardetum	Agrostietum
<i>Deschampsia flexuosa</i>	80	---	---
<i>Vaccinium myrtillus</i>	62	---	---
<i>Hieracium vulgatum</i>	48	---	---
<i>Carex pilulifera</i>	31	9	---
<i>Nardus stricta</i>	21	13	---
<i>Luzula luzuloides</i>	20	23	---
<i>Holcus mollis</i>	19	14	---
<i>Potentilla erecta</i>	14	31	---
<i>Veronica officinalis</i>	1	29	---
<i>Rumex acetosa</i>	---	46	---
<i>Dianthus deltoides</i>	---	35	18
<i>Stellaria graminea</i>	---	32	21
<i>Cruciata glabra</i>	---	31	31
<i>Carex pallescens</i>	---	26	14
<i>Campanula patula</i>	---	23	26
<i>Veronica chamaedrys</i>	---	51	40
<i>Thymus pulegioides</i>	---	20	24
<i>Anthoxanthum odoratum</i>	---	16	23
<i>Hypericum maculatum</i>	---	13	2
<i>Festuca rubra</i>	---	11	15
<i>Agrostis capilaris</i>	---	5	18
<i>Luzula multiflora</i>	---	5	13
<i>Briza media</i>	---	13	35
<i>Achillea millefolium</i>	---	39	42
<i>Plantago lanceolata</i>	---	22	55
<i>Pimpinella saxifraga</i>	---	15	56
<i>Ranunculus acris</i>	---	5	59
<i>Alchemilla monticola</i>	---	3	56
<i>Cerastium holosteoides</i>	---	---	50
<i>Leucantemum vulgare</i>	---	---	50
<i>Polygala vulgaris</i>	---	---	53
<i>Phleum pratense</i>	---	---	56
<i>Euphrasia rostkoviana</i>	---	---	59
<i>Lotus corniculatus</i>	---	---	59
<i>Leontodon hispidus</i>	---	---	60
<i>Prunella vulgaris</i>	---	---	62
<i>Dactylis glomerata</i>	---	---	63
<i>Trifolium pratense</i>	---	---	68
<i>Trifolium repens</i>	---	---	68
<i>Cynosurus cristatus</i>	---	---	87

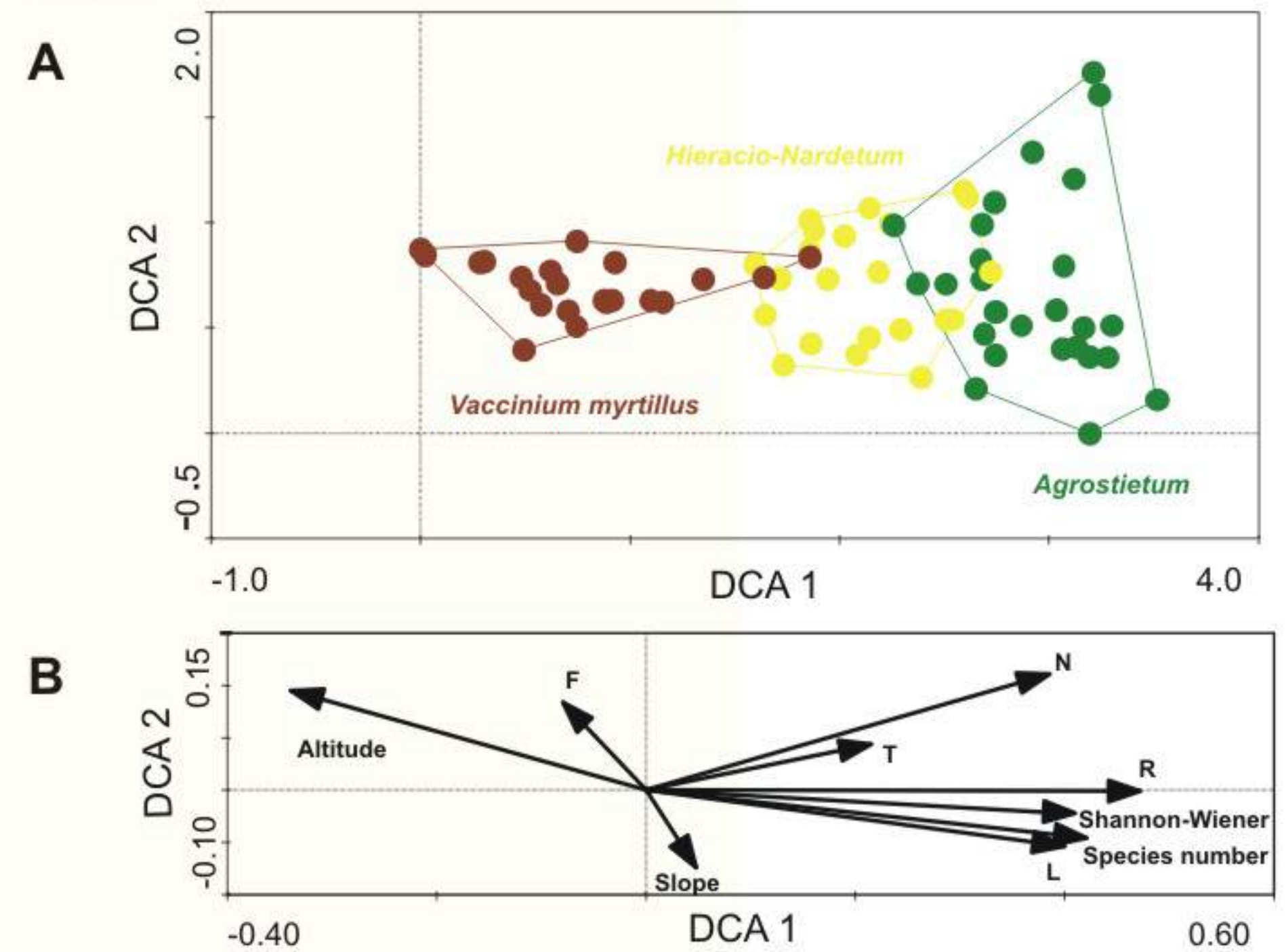


Fig. 1. DCA classification of plots (A), influence of topographic factors and Ellenberg indicator values (B)

Contrary to the expectations and the results of other studies no effect of land use (pasture versus arable land) in the past on the current state of the meadows vegetation was found. All of identified plant communities were found on former meadows, pastures and arable land (tab. 2).

Table 2. The share of phytosociological relevés classified into particular communities at present according to the land-use pattern in the past [%].

Plant community	mid-19th century		1980s	
	Arable land	Grassland	Arable land	Grassland
<i>Vaccinium myrtillus</i>	64	36	0	100
<i>Hieracio-Nardetum</i>	48	52	4	96
<i>Agrostietum</i>	71	29	4	96

The main reason is probably that a long period of time elapsed since the conversion of arable land into grassland (almost all plots were located on sites being grassland in the 80s. of XX) and an influence of habitat factors related to the altitude was overwhelming.



Vaccinium myrtillus



Hieracio-Nardetum



Agrostietum

Conclusion

The results show the crucial importance of altitude on the formation of species composition of mountain grasslands.