Notes on the dynamics of grassy vegetation in the Lovech district

Nikolay Velev

Institute of Botany, Bulgarian Academy of Sciences, Acad. G. Bonchev St., bl. 23, 1113 Sofia, Bulgaria, e-mail: nvelev@bio.bas.bg

Received: March 18, 2005 ▷ Accepted: May 05, 2005

Abstract. The shrinking livestock breeding in Bulgaria in the last 15 years has led to the abandonment of a number of grassy communities that were traditionally subjected to grazing and mowing. Attention in this article is directed at the weakening anthropogenic impact on vegetation and the subsequent demutation processes. The observed changes have been mainly related to the invasion of shrubs, forest and bracken. The study has extended to the grassy phytocoenoses situated up to the upper timberline of the forest.

Key words: demutation succession, herbaceous phytocoenoses, meadows, pastures

Introduction

On the territory of Bulgaria, especially in the lowlands and foremountains, grassy vegetation prevails under the impact of human activities, namely forest cutting, grazing, mowing, etc. (Stojanov 1926; Velchev 1962; Ganchev & al. 1964; Bondev 1973, 1991).

Stojanov & al. (1951) characterised the widest-spread meadow and pasture phytocoenoses in the country. Their study covered 800 sites in Bulgaria and the authors had pointed out the wide distribution of the phytocoenoses of *Chrysopogon gryllus* (L.) Trin. that emerged secondarily in replacement of forest vegetation. The widely distributed coenoses of this species in Bulgaria and the trend towards their extension under the impact of the anthropogenic factor were also reported by Stojanov (1941).

The secondary origin of grassy vegetation in some localities in the Lovech district (the northern slopes of the Troyan and Teteven mountains) was noted down by Velchev (1958) and Valchev & Nikolov (1997). Ganchev (1962) provided data on the major types of grassy phytocoenoses that settled in the vacated territories in the xerothermic oak belt. According to other authors (Jordanov 1936), there were primary steppe communities in Bulgaria, although modified by the climatic changes and human activities.

The above-mentioned works revealed data not only on the origin of the grassy coenoses in Bulgaria, but also on their composition, status and running dynamic processes under the impact of various factors.

Kochev & Cerovska (1987) mentioned some major trends in the dynamics of vegetation in the oak and beech belts of the Central Balkan Range. They offered schemes of the degradation processes that took place after cutting out of the forests: from the primary communities of *Fagus sylvatica* L. and *Quercus cerris* L. to the derivative formations of *Agrostis capillaris* L., or *Pteridium aquilinum* (L.) Kuhn. and *Festuca valesiaca* Schleich. ex Gaudin respectively, passing through a variety of intermediate phases. Practically, this is an almost standard scheme of the direction of ongoing changes after clear cuttings, which typically manifests itself in a variety of concrete situations.

Today, owing to the slackening anthropogenic impact, this process is seldom observed, while the direction of successions in many cases switches from degradation to demutation (return to the initial status)

(Meshinev & al. 2000; Apostolova & Meshinev 2001; Meshinev 2001; Yordanova 2001, etc.). The authors report active regeneration processes in the grassy communities, which are not under pasture or mowing regime anymore.

Material and methods

The study of meadows and pastures in the Lovech district was part of the *National Grassland Inventory Project Bulgaria*, PINMATRA 2001/20, implemented in the period 2000–2004. The Project was funded by the Ministry of Agriculture, Nature Management and Fisheries of the Netherlands.

The present study extended to over 80 localities in the Lovech district and was carried out in the period June-August 2004. The studied sites were selected in line with the Project's requirements:

- maximum coverage of the diversity of grassy communities within the boundaries of the investigated administrative district;
- attention focus on the larger-area polygons;
- inventory only of the grassy communities under the upper timberline of the forest.

The following phytocoenoses have not been object of study: artificially sown grass mixes, weed and ruderal grassy communities, as well as the hydrophytic communities of *Phragmites* Adans. and *Typha* L. type. The smallest areas subject to inventory were of 0.25 ha (50/50 m). Seventy phytocoenological descriptions were made (one for each locality) in a homogeneous stretch of the grassy communities (on an area of about 100 sq. m), and the data were entered into a standard field research form.

Results and discussion

The analysed grassy communities belonged to 14 plant formations. For two phytocoenoses developing on abandoned arable lands no formation could be reported because of their early succession stage. All communities were of secondary origin and lay under the upper timberline of the forest, mainly in the belts of the xeromesophilous oak and hornbeam forests and partially in the beech belt. Most of them were in close proximity to various settlements, which reflected on the mode of their utilization: pasture (in the vicinities of villages) and mowing. With the greatest number of localities were presented the formations of *Chrysopogon gryllus* (30), *Bromus arvensis* L. (10), *Dasypyrum villosum* (L.) Cand. and *Agrostis capillaris* (six each). The other formations of *Poa pratensis* L., *Brachypodium pinnatum* (L.) P. Beauv., *Festuca valesiaca*, *F. nigrescens* Lam. (at an altitude of 1000 m), *Vulpia myurus* (L.) C.C. Gmel., *Dactylis glomerata* L., *Elymus repens* (L.) Gould, *Arrhenatherum elatius* (L.) P. Beauv. ex J. et C. Presl., *Stipa capillata* L., and *Dichantium ischaemum* (L.) Roberty were represented by one or two localities. The investigated communities were situated within the range of 80 m to 1260 m a.s.l., the total projection cover of the grass stand was high, varying from 90 % to 100 %, which determined them as closed phytocoenoses. The soils were mainly averagely thick, noneroded and moderately moist, with lessive soils dominating as a type (in 87 % of the studied phytocoenoses), more seldom alluvial (7 %), planosols (4 %), and least frequently phaeozems (1 %) (Ninov 2002). The slopes of the studied terrains varied from flattened to such with gradient of 35°, including almost all possible expositions. The mode of utilization of these grassy communities was usually pasturing (pasturing alone on 41 % of the coenoses), less frequently mixed use (20 %) and mowing (19 %). A rather significant part of the meadows and pastures (20 %) were completely abandoned (Fig. 1), and in 45 % of the terrains used for pasture pasturing intensity was very low (Fig. 2). The abandoned phytocoenoses have characteristically a higher grass stand and a lower number of ruderal species.

The range of anthropogenic impact was concentrated chiefly in the lower parts around the settlements, owing to which the process of demutation was expressed stronger in the more distant localities. In some parts of the district the development of shrub vegetation was so advanced that the grassy communities have transformed into shrub communities.

The shrinking of human activities is very conspicuous across the Lovech district, where (besides the abandoned meadows and pastures) many other abandoned terrains are now observed, used in a variety of ways in the recent past: fields (with the greatest total acreage), vineyards, etc.

The regime of pasturing and mowing keeps the area under grassy phytocoenoses within certain durable boundaries. When pasture stops or is strongly limited, the adjacent tree and shrub vegetation begins to encroach towards its natural habitats and "encloses" the

secondary grassy coenoses. This is the main direction of the succession process: phytocoenoses consisting of larger life forms gradually replace the phytocoenoses consisting of smaller life forms: moss communities → grassy communities → shrub communities → tree communities (Tansley 1926).

The return to the initial status (demutation succession) is observed in the higher parts of the mountains (Yordanova 2001), as well as in the treeless zone (Meshinev & al. 2000; Apostolova & Meshinev 2001). Most (59 %) of the studied grassy communities are threatened by extinction, owing to the strong invasion of brackens (*Pteridium aquilinum*), shrubs and forest (Fig. 3). A comparison with the topographic maps of 1970 shows that for the Lovech district this process is most pronounced in the lower mountain belt (600–1000 m a.s.l.), where almost without exception invasion of brackens is observed, occupying up to 70 % of the former pasture area in some places (Balkanets village, Troyan mountain).

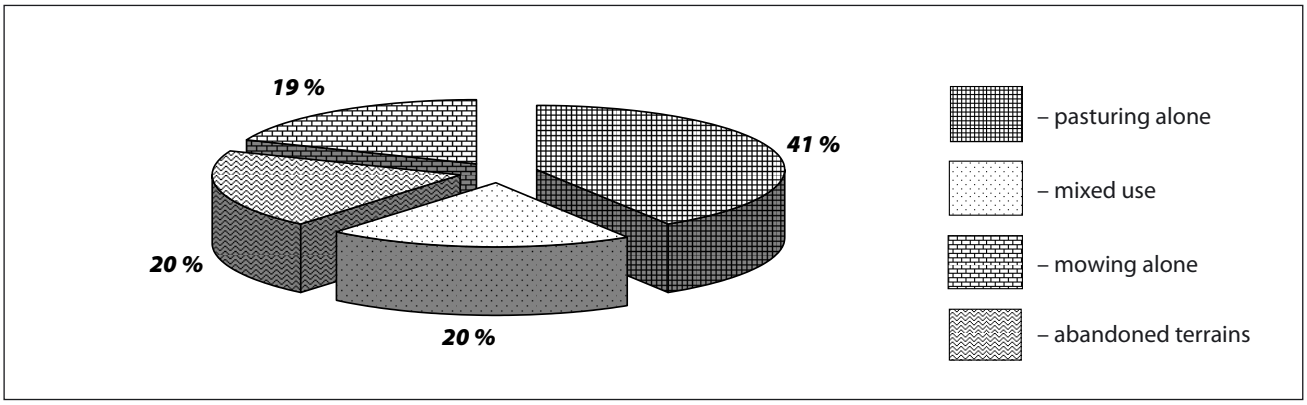

Fig. 1. The mode of utilization of the studied phytocoenoses

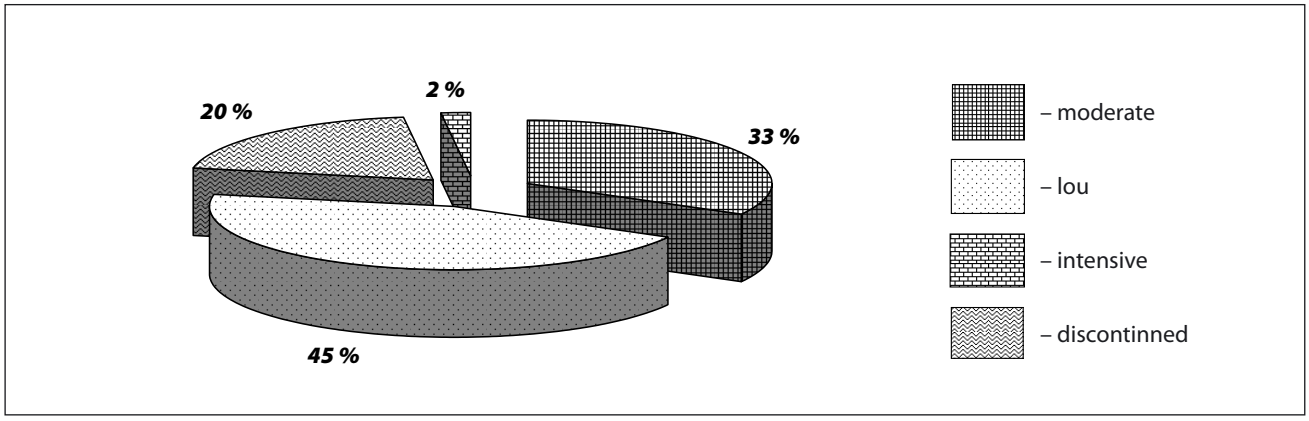

Fig. 2. Grazing intensity

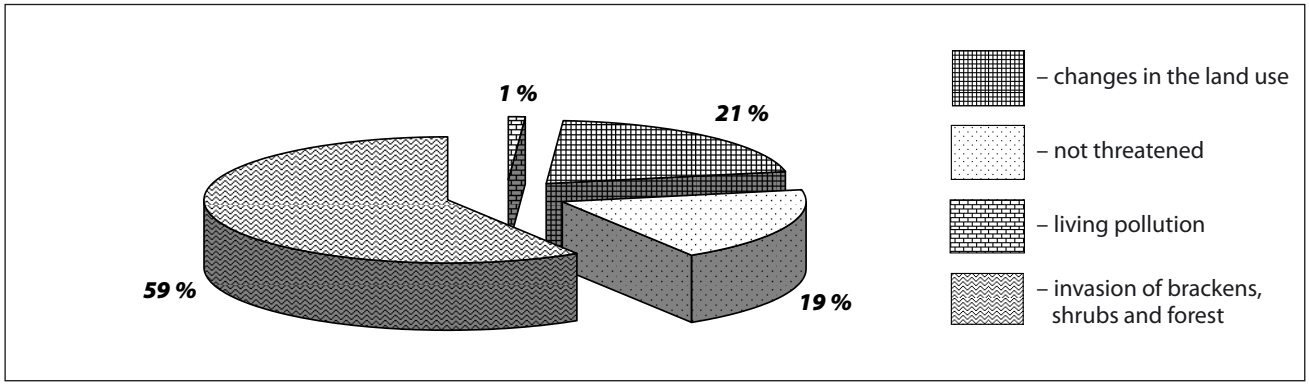

Fig. 3. Threatened phytocoenoses owing to:

Another indicator of the reduced anthropogenic impact in the hilly and foremountain regions is the invasion of *Rhinanthus rumelicus* Velen., which in some phytocoenoses with discontinued grazing (Teteven district) has maintained 30 % of the projection cover. It is well known that this species cannot stand intensive grazing and trampling and, along with this, leads to xerophytisation of the herbaceous vegetation, attacking, above all, the mesophytic gramineous plants (Ganchev 1973).

The dominant role and great abundance of *Chrysopogon gryllus* in most of the analysed grassy communities is another proof of the less intensive grazing. It is well known that this species cannot stand substrate overpacking and under intensive grazing yields to more trampling-resistant species: *Festuca valesiaca*, *Dichantium ischaemum*, *Cynodon dactylon* (L.) Pers., etc. (Ganchev & al. 1964).

About 20 % of the grassy coenoses are threatened by extinction, owing to changes in the land use and in particular to land ploughing, because they are seminatural communities that have developed on abandoned arable lands. They all are in different succession phases, depending on how long ago their formation has started. These communities are usually situated along the roads, on powerful, moderately humid soils and characteristically maintain relatively high species diversity. The early succession stage of many phytocoenoses is corroborated by the presence of some cultured species in their composition (*Triticum vulgare* Host., *Avena sativa* L., etc.). Other phytocoenoses formed on earlier abandoned arable lands have reached in their development the status of mesophilous meadows or pastures, depending on their location and mode of utilization. They could be regarded as stable grassy communities until an inset of changes in the land use.

In conclusion, the following general pattern could be outlined showing the status of the grassy communities in the area of study and the main trend in their development. Owing to the considerable shrinking of the number of grazing animals, grazing intensity has gone strongly down. This, in turn, leads to invasion of shrubs, forest and brackens into the grassy communities: a conspicuous process across the entire area. On the other hand this generally conditions a palpable shrinking of the area of grassy phytocoenoses, and eventually to their extinction. A number of grassy phytocoenoses in the area of study fall into this group: in their case the process has advanced to the stage of turning them into shrub communities. Among the major invasive species are: *Paliurus spina-christi* Mill., *Crataegus monogyna* Jacq., *Rosa canina* L., *Prunus spinosa* L., *Syringa vulgaris* L., *Clematis vitalba* L., *Rubus caesius* L., *Carpinus orientalis* Mill., *Quercus cerris* L., etc.

Unchanged is the area of those phytocoenoses, which lie in close proximity to the settlements, where the pasture and mowing regime is still maintained. These are mainly pastures of the village common type. They characteristically maintain low species diversity, a strongly packed substrate owing to intensive trampling, and considerable presence of ruderal species, such as: *Urtica dioica* L., *Sambucus ebulus* L., *Centaurea calcitrapa* L., *Carduus nutans* L., *Eryngium campestre* L., *Cynodon dactylon*, *Polygonum aviculare* L., *Dipsacus laciniatus* L., etc.

In order to preserve the seminatural grassy communities within their present boundaries, it is necessary to maintain moderate grazing so as to forestall the invasion of shrub and tree vegetation, as well as of brackens. By trampling and grazing, grazing animals decrease the survival of undergrowth. Along with this, a moderate grazing regime introduces heterogeneous environment, without causing pasture digression and strong packing of the substrate and thus helps increase the floristic richness of the phytocoenoses (Begon & al. 1986). Conversely, the presently observed process of relapse to the original status of the vegetation (demutation) will prevail until complete transformation of the grassy into shrub or tree phytocoenoses. Grazing would curb the overdevelopment of *Rhinanthus rumelicus*, which deteriorates the fodder quality of the grassy phytocoenoses (Ganchev 1973), and would also thin out the monodominant grass stands (for instance, of *Chrysopogon gryllus*) helping the introduction of some less competitive species and thus improving the biological diversity of the communities.

A future intensification of livestock breeding would require mechanical clearing out of the old pasture terrains by cutting the shrub vegetation and "knocking down" of the young bracken laves in spring. Brackens could be also successfully kept under control with the help of herbicides (Martin 1976).

Acknowledgements. The author is grateful to Dr. T. Meshinev for his help during writing out of this article.

References

Apostolova, I. & Meshinev, T. 2001. Vegetation map of the high-mountain treeless zone in Vitosha Nature Park. – In: **Temniskova, D.** (ed.), Proc. Sixth Natl. Conf. Bot., Sofia 2001. Pp. 241-252. Sofia Univ. St. Kliment Ohridski Press, Sofia (in Bulgarian).

Begon, M, Harper, J. & Townsend, C. 1986. Ecology. Individuals, Populations and Communities. Blackwell Scientific Publications, Oxford.

Bondev, I. 1973. Radical and derivative vegetation in Bulgaria and their mapping. – In: **Jordanov, D.** (ed.), Second Natl. Conf. Bot., Sofia 1969. Pp. 183-189. Publishing House Bulg. Acad. Sci., Sofia (in Bulgarian).

Bondev, I. 1991. The Vegetation of Bulgaria. Map 1: 600000 with explanatory text. St. Kliment Ohridski Univ. Press, Sofia, (in Bulgarian).

Ganchev, I. 1962. Formierung und eitwicklung der in Bulgarien verbreiteten wiesen-und wiedenzönosen. – Izv. Bot. Inst. (Sofia), **9**: 5-42 (in Bulgarian).

Ganchev, I. 1973. Influence of *Rhinanthus* L. on the composition and dynamics of meadow communities. – Izv. Bot. Inst. (Sofia), **23**: 77-89 (in Bulgarian).

Ganchev, I., Bondev, I. & Ganchev, S. (eds). 1964. Vegetation of the Meadows and Pastures in Bulgaria. Publishing House Bulg. Acad. Sci., Sofia (in Bulgarian).

Jordanov, D. 1936. Über die verbreitung der steppenvegetation in Bulgarien. – Sborn. Bălg. Akad. Nauk., Klon Prir.-Mat., **32**(15): 1-105 (in Bulgarian).

Kochev, H. & Cerovska, L. 1987. The plant coenoses in the river-bed of river Beli Ossam (Central Stara Planina Mountain). – In: **Kuzmanov, B.** (ed.), Proc. Fourth Natl. Conf. Bot., Sofia 1987. Vol. **3**, pp. 18-24, Sofia (in Bulgarian).

Martin, D. J. 1976. Control of bracken. – Bot. J. Linn. Soc., **73**: 241-246.

Meshinev, T. 2001. On some dynamic process in Bulgaria`s vegetation today.- In: **Temniskova, D.** (ed.), Proc. Sixth Natl. Conf. Bot., Sofia 2001. Pp. 235-240. Sofia Univ. St. Kliment Ohridski Press, Sofia (in Bulgarian).

Meshinev, T., Apostolova, I., Kachaunova, E., Velchev, V. & Bondev, I. 2000. Flora and plant communities.- In: **Popov, A. & Meshinev, T.** (eds), High Mountain Treeless Zone of the Central Balkan National Park. Biological Diversity and Problems of its Conservation. Pp. 1-337. BSBCP, Sofia.

Ninov, N. 2002. Soils. – In: **Kopralev, I.** (ed.), Geography of Bulgaria. Pp. 277-315. FarCom, Sofia (in Bulgarian).

Stojanov, N. 1926. On the origin of the xerothermic plant element in Bulgaria. – J. Ecol., **14**(1): 138-154.

Stojanov, N. 1941. Versuch einer phytozönologischen chatakteristik Bulgariens. – God. Sofiisk. Univ. Fiz.-Mat. Fak., **37**(3): 93-194 (in Bulgarian).

Stojanov, N., Kitanov, B. & Georgiev, B. 1951. Grundtypen der wiesen-und wiedenvegetation Bulgariens als basis zur futter-erzeugnis. – Izv. Bot. Inst. (Sofia), **2**: 15-48 (in Bulgarian).

Tansley, A. G. & Chipp, T. F. (eds). 1926. Aims and Methods in the Study of Vegetation. London.

Valchev, V. & Nikolov, V. 1997. Vegetation in the beech belt on the northern slopes of the Zlatitsa-Teteven Mountains. – Phytol. Balcan., **3**(2-3): 107-116.

Velchev, V. 1958. Geobotanische notizen über die wiesen-und wiedenvegetation im gebiet von Trojan und Teteven. – Izv. Bot. Inst. (Sofia), **6**: 49-77 (in Bulgarian).

Velchev, V. 1962. The Herbaceous Cover of Calcareous Terrains in the region Dragoman – Beledie Han, district of Sofia. Publishing House Bulg. Acad. Sci., Sofia (in Bulgarian).

Yordanova, M. 2001. Vegetation dynamics on the abandoned pastures in West Rhodopes.- In: **Temniskova, D.** (ed.), Proc. Sixth Natl. Conf. Bot., Sofia 2001. Pp. 339-344. Sofia Univ. St. Kliment Ohridski Press, Sofia (in Bulgarian).

Grasslands of Bulgaria. Final report of the National Grasslands Inventory Project – Bulgaria, 2001–2004 (PINMATRA/2001/20).