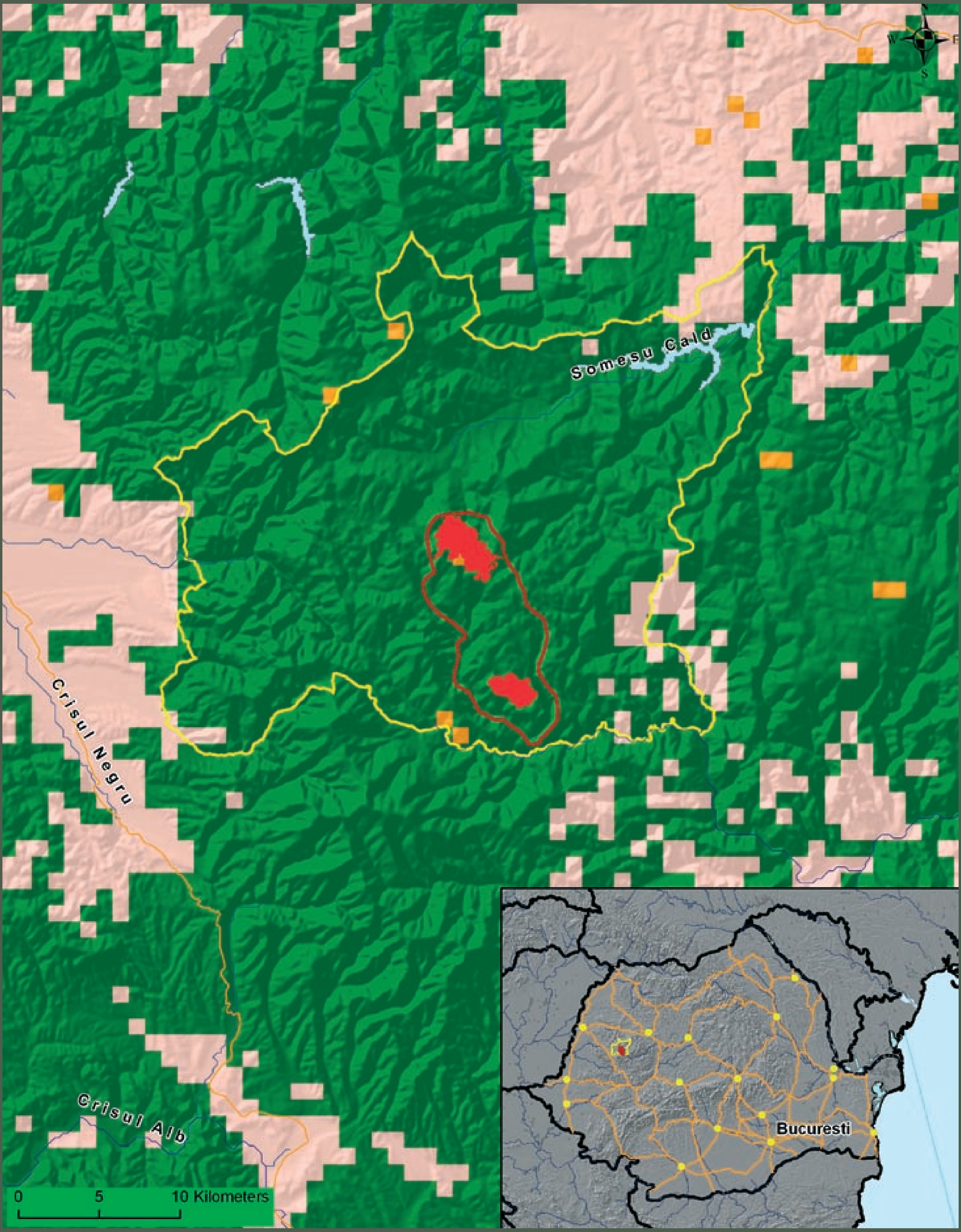
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The grasslands of the Apuseni Mountains, Romania

Katja Brinkmann, Florin Păcurar, Ioan Rotar, Evelyn Rușdea, Eckhard Auch, Albert Reif

Vegetationskunde, Waldbau-Institut, Fakultät für Forst- und Umweltwissenschaften, Tennenbacher Str. 4, D-79085 Freiburg, Germany,
@ albert.reif@waldbau.uni-freiburg.de

Introduction

The Apuseni Mountains possess a wide range of mountain grassland types that have a high natural and aesthetic value, and consequently they attract many tourists. In this traditional cultural landscape, small-scale farming structure and a traditional system of land use still exist. This has resulted in a large variety of landscape structures and plant communities. However, landscapes are not static; they change with the prevailing socio-economic and social framework conditions. An inter- and trans-disciplinary, participatory project, known as 'Proiect Apuseni' studied the land use system, vegetation, landscape patterns and their actual changes within the process of societal transformation, and predicted the future outlook for the Apuseni Mountains (Rușdea et al., 2005; Reif et al., 2008). The project identified and evaluated development strategies, and made recommendations for sustainable regional development in participation with the local people and Romanian politicians.

Location, climate and geology of the Apuseni Mountains (figure 1)

The Apuseni Mountains are located in north-western Romania and cover an area of ca. 11,000 km² (Bleahu and Bordea, 1981). They consist of several ranges forming the western border of the Transylvanian basin. The highest peaks reach ca. 1,880 m above sea level. The potential natural vegetation is formed by zonal mixed beech (*Fagus sylvatica*)-fir (*Abies alba*)-spruce (*Picea abies*) forests in the montane belt, and spruce (*Picea abies*) forest in montane frost hollows, e.g. dolines and the subalpine belt (Serbănescu et al., 1975).
The area of the present case study is situated in the central part of the Apuseni Mountains in the so called 'Moți country', ranging along a transect from the community centre in the Arieș Valley, near Gârda des Sus, to the mountain village of Ghețari (1,100 m), and the 'Poiana Călineasa' high pasture to the north. Within this transect, the local village Ghețari was chosen for a detailed landscape analy-

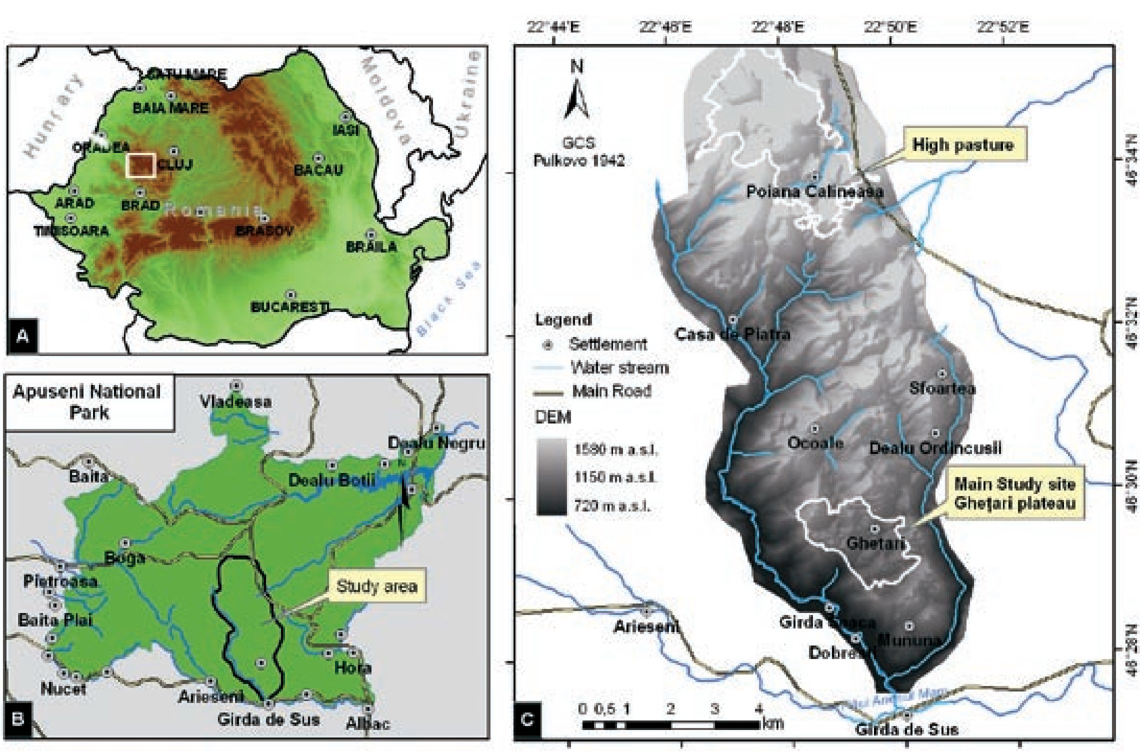


Figure 1 Location of the Apuseni Nature Park (A) in Romania, and the study area (B, C), ranging along a transect from the community centre in the Arieș Valley, near Gârda des Sus, to the mountain village of Ghețari, and the 'Poiana Călineasa' high pasture to the north.

sis, including geology, soils, climate, hydrology, vegetation, history, ethnography, land uses, household and regional economy (Rușdea et al., 2005). This village comprises an area of 308 hectares and hosts 28 households. It is situated between 46°29'51.63" and 46°29'1.25" northern latitude, and 22°48'44.30" and 22°49'37.03" eastern longitude. It belongs to the special conservation area of the Apuseni Nature Park, whose boundaries were fixed in 2003. The first call for the protection of the Apuseni Mountains were already made in the 1920s by two prominent Cluj academics (Abrud and Turnrock, 1998), but the administration of the nature park with a total surface of 75,784 ha was not formed until 2004 (http://www.parcapuseni.ro).

The geology of the Apuseni Mountains is extremely variable (Bleahu and Bordea, 1981). In the study area that comprises the village of Ghețari, its surroundings ('Ghețari plateau') and the 'Poiana Călineasa' high pasture, limestone and mudstone predominate (Bleahu et al., 1980; Dumitrescu et al., 1977). The soils are rendzinas, rendsinic lithosols, slightly acidic, deep brown earths, and 'Terra Rossa', a tropical relic soil (Parichi and Stănilă, 2005).

The climate of Ghețari is montane (mean annual temperature of ca. 5 °C, mean annual precipitation of 1200 mm), and in the 'Poiana Călineasa' high pasture boreal (mean annual temperature of ca. 3.5 °C, mean annual precipitation of 1400 mm). The winters are long and cold, with snow covering the landscape between October and April (Bogdan and Iliescu, 1962).

The Apuseni Mountains are inhabited by the 'Moți', a people of Roman origin. Colonisation of the mountains began from the valleys. Until the 19th century, the mountains were inhabited only during the summer months when the land was used as mountain pasture. The people lived in small, one roomed 'mutăturas' surrounded by stables. An increasing population led to the foundation of permanent settlements around 1880. The houses were enlarged to two and three roomed buildings, and some were even bigger (Goia, 2005).

Subsistence production and traditional grassland use
(figure 2)

The basic needs of the people are provided for by subsistence production and animal husbandry. It is for this reason that hay production plays an important role, as forage is vital for livestock sustenance during the long winter period.

The work carried out consists of many different activities, revolving around gardening, agriculture, forest use, craftwork and trade (Auch, 2006). The specific performance of each activity shapes the species composition and structure of the habitats, and the landscape as a whole. The human activities and the landscape are functionally connected to the adjacent areas, ranging from administrative centres of the community in the valley to high summer pastures in the mountains. Each household owns approximately three hectares of farmland.

Landscape near Ocoale

Meadows with Picea abies near Gheþari

Fertilizing meadows with manure at Ordancusa gorge

Transport of haycocks to the barn at Gheþari

This consists mostly of meadows, together with a small garden and small fields where the people cultivate potatoes and occasionally cereals, such as rye, barley and oats. The households have a few (1 to 3) cattle, originating from a mixture of different races. At night, and during very cold periods, the animals are kept in almost dark stables, often together with one or two horses. A small number (3 to 5) of sheep and pigs are kept separately in other stables. Hay is stored in separate compartments in the stables, in barns or outdoors as haystacks.

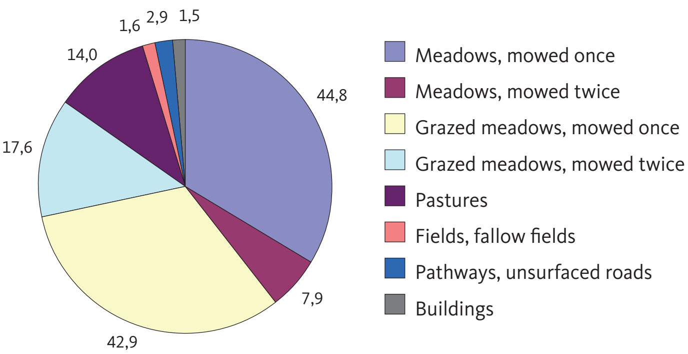
From May to July, most of the cattle, horses and sheep are brought to the high mountain pastures, e.g. the common 'Poiana Călineasa' high pasture (ca. 9,000 hectare; 1,450 m), consisting of grassland and forest. Poiana Călineasa is owned by several communities and is used in an unregulated manner. The area is unfertilised and heavily grazed at a density of 0.64 livestock units/ha (including the forests), and 1.05 livestock units/ha on the grassland. The women guard the animals, and manage the cheese production. The men harvest timber from the forest. In mid-July, the herders and their animals return to the village because all of the townspeople are needed for hay making. Hay is still mown and baled by hand using scythes and wooden rakes.

During either the winter or spring the meadows are fertilised with farmyard manure, which is transported by horse drawn carts, deposited in heaps, and spread manually. Approximately 90 t ha^{-1} fermented manure is spread on the meadows which were cut twice, and ca. 20 t ha^{-1} on the meadows cut once.

After mowing in July and again in September, nearly all of the meadows are grazed. To the present day, the animals graze also in open and wooded pastures whenever possible, and even browse in relatively closed forest areas. These traditional silvopastoral forest uses and the more recent furtive removal of trees have led to a continuous transition between open land, edge vegetation with a mosaic of herbs, grasses and shrubs, and the forest itself. The latter is, in places, quite open, lacks large diameter trees, and is grazed.

Gardens and fields cover only a small area, but remain an essential component of subsistence agriculture, producing mainly potatoes, cereals, vegetables and salad. Most of them are fenced off to keep grazing animals out.

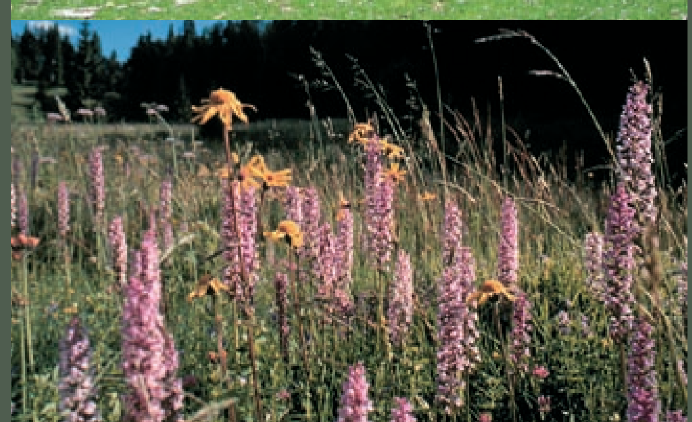
Figure 2 Division of management of grassland



Centaurea pseudophrygia, species of montane grassland

On the way to high mountain pasture

Removal of poisonous leaves of *Veratrum album ssp. lobelianum* at Ocoale



Oligotrophic grassland with *Gymnadenia conopsea and Arnica montana* at Gheþari

Recent changes of the land use system

In earlier times, subsistence production was of greater importance than it is today. Up until ca. 1950, several activities were practised to a major extent in the Apuseni Mountains:

- Fields were much more extensive than today. Step baulks, terraces and stone piles were characteristic of the areas surrounding settlements. Today, most of the fields are abandoned because cereals and maize are increasingly bought from the lowlands, in exchange for wood products.
- Flax was cultivated for the local production of textiles. Today, only a few retteries near springs provide a reminder of these times.
- Weaving was formerly of much greater importance, e.g. all sheets were produced locally. Today, weaving is practised by several women only during the winter.

Since ca. 1995, rapid land use changes have occurred. The driving forces of these changes were the availability of new technology (e.g., electricity, chainsaw), new economic pressures and changes, corruption and less control over private activities. Differences in family structures, equipment and capital resulted in an increase in economic and social differences. In particular, the elderly remain bound to their traditional ways of life and find themselves in increasing poverty. The population is declining in the face of limited employment opportunities and poor services (Abrud and Turnrock, 1998; Surd and Turnrock, 2000).

Families with access to chainsaws and horses facilitating timber extraction, and circular saws for processing, were able to better utilise the timber resources, and were suddenly confronted with relatively high monetary incomes. Illegal cutting is a problem in the Apuseni Mountains and this leads to considerable environmental damage (Abrud and Turnrock, 1998). Over the last eight years, the quantity of timber removed from the forest has increased threefold. Both legal and unregulated forest use have led to a reduction in the volume of merchantable timber.

Grassland vegetation

Different floristic elements form a vegetational mosaic on the open land. The vegetation in the area around Ghețari, including the mountain pasture "Poiana Călineasa", has been classified and mapped (Reif et al, 2005). The nomenclature of plant communities is based upon Sanda et al., (1980), Oberdorfer (1977, 1978, 1983, 1992) and Coldea (1991) and the species names follow Ciocârlan (2000). Floristic elements adapted to increased disturbance caused by different management practises and site properties formed ten ruderal plant communities, five grassland communities and seven transitional shrub and fringe communities along the forest edges. The average numbers of vascular species (per 25 m²) of the ruderal vegetation ranged between 13 and 26, and was 29 in the successional stages

Cattle grazing at the high pasture of Calineasa.

Sharpening the scythe by hammering at Gheþari.

Recently constructed building for drying medicinal plants in Gheþari (WWF-Project)

Grassland in winter, fertilized with manure in Ocoale.

between fallow field and meadow. The grassland and forest edge communities were particularly species-rich with between 28 and 48 vascular species on average.
The species composition of the grasslands of Ghețari reflects the montane climate. Lowland species are absent, or restricted to a few special sites, e.g. *Arrhenatherum elatius* to road margins. The widespread grassland species were clovers (*Trifolium pratense* and *T. repens*), the grasses *Festuca rubra*, *Agrostis capillaris*, *Anthoxanthum odoratum*, *Poa pratensis,* and the herbs *Leontodon hispidus*, *Alchemilla vulgaris*, *Veronica chamaedrys*, *Rhinanthus minor*, *Chrysanthemum ircutsianum*, *Hypericum maculatum*, *Lotus corniculatus*, *Prunella vulgaris*, *Achillea millefolium*, *Ranunculus acris*, *Plantago lanceolatum* ssp. *sphaerocephalum*, *Cerastium holosteoides* and *Tragopogon pratensis*.

Meadows of the *Molinio-Arrhenatheretea*

Based upon the water supply, which reflects differential species groups, meadows were subdivided into communities on wet, moist and moderately moist sites (Reif et al., 2005).
Meadows on wet sites, around springs, water courses and in valley bottoms are frequent in montane landscapes, but rare in the limestone area of Ghețari. Differential species are *Filipendula ulmaria*, *Geum rivale*, *Lathyrus pratensis* and *Caltha palustris* (Calthion).
Meadows on deep, moderately moist soils are found on bottom slopes, terraces and near temporary streams of the karsts. During June and July, the differential species *Astrantia major* and *Trollius europaeus* characterise the landscape, with *Chaerophyllum hirsutum* locally (*Astrantio-Trisetetum* Knapp 1952; Oberdorfer, 1983; Dierschke, 1997).
On moderately moist sites, productive meadows with a high grass component occur (*Centaurea pseudophrygia-Polygono-Trisetion*-community). Differential species are *Centaurea pseudophrygia, Colchicum autumnale*, *Stellaria graminea*, *Pimpinella major*, *Rumex acetosa*, *Trisetum flavescens*, *Cynosurus cristatus* and *Vicia cracca*. These meadows provide most of the hay for the winter. They can be subdivided into a more fertile 'typical' type, and a less productive transitional *Thymus pulegioides*-type.
Meadows of the *Festuca rubra-Agrostis capillaris*-community are associated with acidic clay-rich soils under extensive use with very low fertiliser inputs. This type is transitional to the acidic grasslands with the occurrence of *Nardus stricta*, *Potentilla erecta*, *Viola declinata*, *Potentilla aurea* and *Luzula multiflora,* together with some species of the *Centaurea pseudophrygia-Polygono-Trisetion*-community.

Pastures on shallow unfertilised soils on limestone (*Festuco-Brometea*)

Intensive grazing represents the major land use on shallow limestone soils. This habitat has often a skeleton-rich soil, found on steep upper slopes with a southerly aspect. Drought tolerant species make

Veronica chamaedrys

Grassland and fences in Ocoale

Coming back from the high mountain pasture in July in Ocoale (Gheþari Project).

Coming back from the high mountain pasture in July in Ocoale (Gheþari Project).

up the grassland. The water supply is limited during the summer, and productivity is low. In many places, stones and boulders are removed from the surface and piled up along the forest edges and around the remaining trees.

Diagnostic species are *Linum catharticum*, *Ranunculus bulbosus*, *Anthyllis vulneraria*, *Scabiosa columbaria*, *Euphrasia stricta*, *Plantago media*, *Sanguisorba minor*, *Polygala comosa*, *Silene nutans* and *Erigeron acris*. Frequent companions include species such as *Thymus serpyllum* agg., *Carlina acaulis*, *Hieracium pilosella*, *Gentiana austriaca*, *Gymnadenia conopsea*, *Antennaria dioica*, *Briza media* and *Achillea distans*, which also occur in moderately acidic, unfertilised grasslands. Similar vegetation has been described as *Anthyllido-Festucetum rubrae* Soó, 1971. In the montane climate there is a lower drought risk than in the lowlands. Thus, mesic species of the *Molinio-Arrhenatheretea*-grassland overlap with the stress tolerant species of unfertilised grasslands.

Grassland on acidic unfertilised soil *(Nardo-Callunetea)*

In meadows and also in pastures, acidic grassland species (*Nardo-Callunetea*) overlap gradually with species of limestone grasslands *(Festuco-Brometea)* and fertilised meadows *(Molinio-Arrhenatheretea)*, depending on the soil acid–base status and fertilisation regime. Diagnostic species of the acidic grasslands are *Nardus stricta*, *Potentilla erecta*, *Viola declinata*, *Potentilla aurea*, *Luzula multiflora*, *Carex pilulifera* and *Hieracium lactucella*. Similar vegetation has been described and named *Violo declinatae-Nardetum* Simon1966. The intensity of the grazing and the levels of fertilizer applied makes the difference between species-rich and species-poor acidic grassland. Species-rich acidic grasslands with low fertilization occur near the village of Ghețari and are used as meadow and for aftermath grazing. The diagnostic species are *Euphrasia rostkoviana*, *Polygala vulgaris*, *Arnica montana*, *Euphorbia carniolica*, *Hieracium aurantiacum*, *Traunsteinera globosa*, *Danthonia decumbens*, *Botrychium lunaria*, *Scorzonera rosea*, and in rare cases, the orchid *Leucorchis albida*. Similar grasslands with stands of *Orchis sambucina* and *Dactylorrhiza saccifera* occur in nearby villages. At the end of April, and with increasing altitude, the spring geophyte *Crocus vernus* dominates the landscape.

Species-poor acidic grassland occurs on the mountain pasture 'Poiana Calineasa', situated outside of the Ghețari area, at a higher elevation (1,450 m). The permanent intensive grazing results in a very low sward entirely dominated by mat grass (*Nardus stricta*).

Habitats, diversity and productivity of grasslands

The mosaic of floristically different grassland types is the product of slope gradients and associated characteristics, mainly water storage capacity, that in turn are related to soil depth, and management factors, including grazing intensity, hay yield and fertilisation. The relationships between the most important environmental factors and

Grazing cow in Ocoale

On the way to the high pasture

Storing the hay in form of a large haycock in Gheþari.

Transport of haycock

the grassland communities were analysed by a canonical correspondence analysis with 108 samples, for which a full set of environmental data was available. The statistical analysis was carried out using Canoco (ter Braak and Šmilauer, 2002) with a square root transformation of species data and by down weighting rare species (figure 3). Hay meadows of the class *Molinio-Arrhenatheretea* are mainly found on periodically wet to moderately moist, fertilised sites. The class *Festuco-Brometea* show preference for moderately dry, unfertilised soils on limestone and are mostly grazed. Meadows and pastures of the class *Nardo-Callunetea* are connected to moderately acidic, unfertilised soils.

Meadows of the *Polygono-Trisetion* association (mountain meadows) cover 72 % of the open land in the study area with a yield potential of between 25 and 45 dt DM ha^{-1} and an energy concentration of 4,3 up to 4,9 MJ NEL kg^{-1} DM. Altogether 26% of the open land is characterised by lower productivity meadows (9 - 12 dt DM ha^{-1}) of the *Anthyllido-Festucetum rubrae* community on shallow unfertilised soils (limestone) and the *Violo declinatae-Nardetum* community on acidic unfertilised

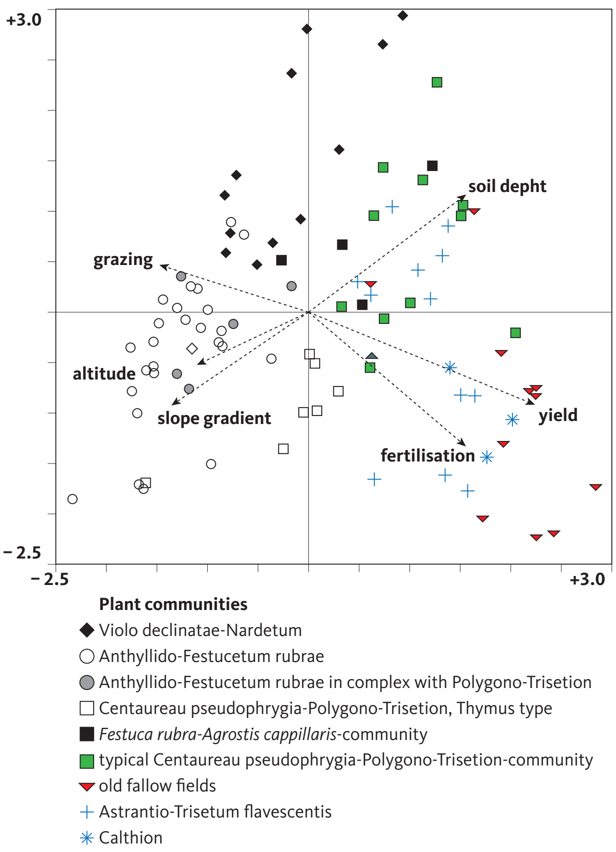


Figure 3 Canonical correspondence analysis of the grassland communities and site factors. The eigenvalues are 0.438 for the first canonical axis, and 0.182 for the second. The cumulative variance of the species-environment relationship is 71.4%.

Carlina acaulis

Grasland with fences and terraces in Gheþari

Leaves of *Fagus sylvatica* covering the grasses.

Women raking leaves from a meadow.

soils. Both are important Natura 2000 habitats (Doniţă et al., 2005). The calcareous grasslands are remarkably rich in species with up to 65 species per 25 m² and they provide a habitat for rare species such as *Gentiana lutescens, Gentiana cruciata* and *Orchis ustulata* (Brinkman, 2006). Altogether 66% of the open land in the study area was classified as "beta-euhemerob" (not natural = intensive agricultural use) and 28% as "mesohemerob"(semi natural = extensive agricultural use) (table 1).

Table 1 Characteristics of the grassland types within the area of Gheţari (308 ha)

Grassland type	Area (%)	Number of species (25 m²)		Naturalness [1]	EU Code [2]	dt DM ha^{-1} (MJ NEL kg^{-1} DM)[3]
		Mean	SD			
Calthion	0,4	30	5,5	5	-	46 (4,0)
Astrantio-Trisetetum	4,6	33	6,9	3	6520	44 (4,6)
Centaurea pseudophrygia-Polygono-Trisetion-community (typical)	33,1	30	5,1	4	6520	36 (5,0)
Centaurea pseudophrygia-Polygono-Trisetion-community with *Trollius europaeus*	1,9	32	5,0	3	6520	36 (4,7)
Centaurea pseudophrygia Polygono-Trisetion-community Thymus-type	47,2	39	5,0	3	6520	25 (4,0)
Festuca rubra-Agrostis capillaris-community	0,8	35	5,0	3	6520	20 (4,2)
Violo declinatae-Nardetum	4,6	35	11,0	2	6230	11 (3,7)
Anthyllido-Festucetum rubrae	26,3	38	9,3	2	6210	9 (3,6)

Mean = arithmetic average; SD = standard deviation

1 Classification of Naturalness and hemeroby (Grabherr et al., 1998; Blume and Sukopp,1976): 2 = qualified nature-related (β-mesohemerob), 3 = semi-natural (α-mesohemerob) 4 = relatively far from natural (β- euhemerob), 5 = far from natural (α-euhemerob).

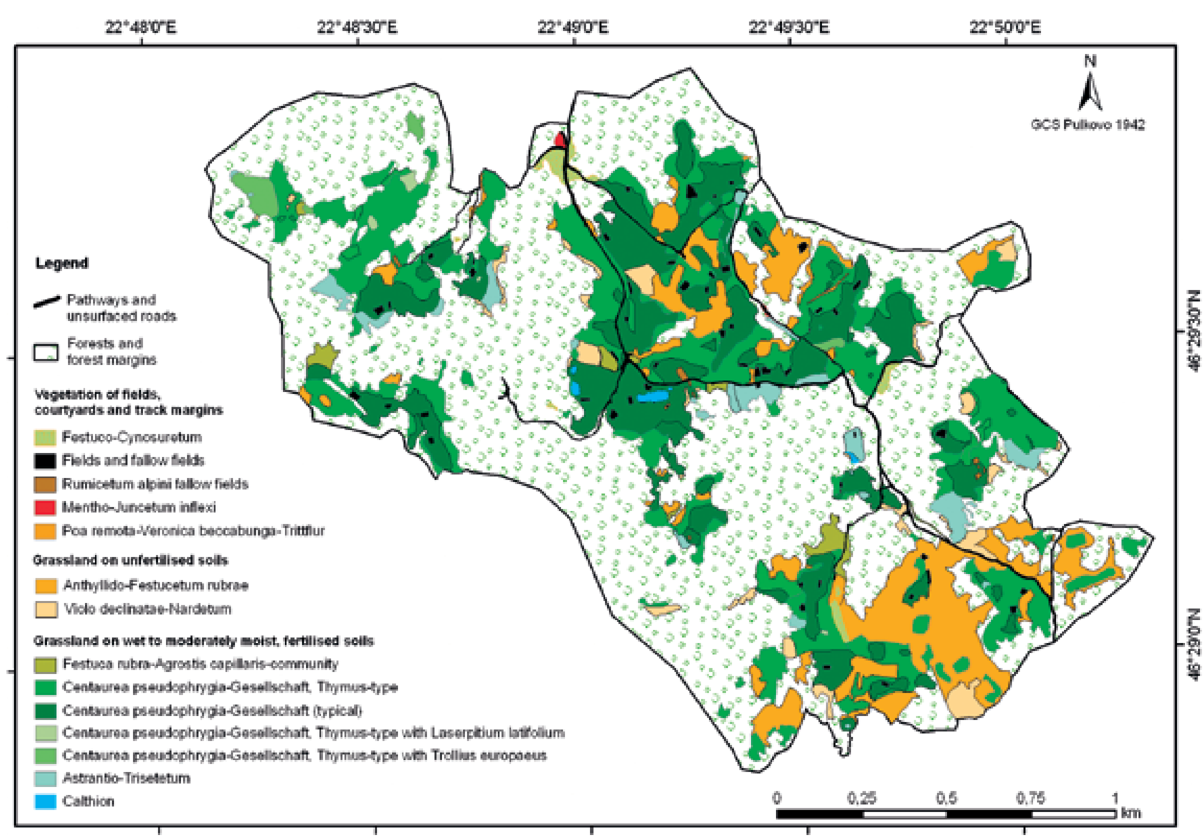
2 NATURA 2000 habitat: 6230 = Species-rich Nardus grasslands, on siliceous substrates in mountain areas, 6520 = Mountain hay meadows, 6210 = Semi-natural dry grasslands on calcareous substrates *(Festuco-Brometalia)*

3 dt DM/ha = average dry matter production, MJ NEL/kg DM = Net energy lactation in megajoule per kg dry matter

Grassland management and effects of fertilization

The actual state of species and landscape diversity is remarkable high in the whole area of the Apuseni Mountains and results from traditional and extensive management practices. Altogether 9 Natura 2000 grassland habitats occur in the Apuseni Nature Park (Doniţă et al., 2005, figure 4). Under these circumstances, it will be necessary to develop efficient grassland management techniques in this region to maintain the grassland use and vegetation types of high natural value. Likewise measures improving the forage quality are necessary to secure farmer's income. Brinkmann (2006) and Păcurar (2005) analysed the effects of different fertilisation intensities on

Figure 4 Plant communities of the open landscapes of the area of the village of Gheţari. (Abbreviations: CPT = Centaurea pseudophrygia-Polygono-Trisetion community; CPTT = Centaurea pseudophrygia-Polygono-Trisetion community, Thymus type) (source: Ruşdea et al., 2005)



yields and the floristic composition of three different low productivity mountain grassland types in the study area over a period of four years. A relatively low fertiliser input (10 t ha^{-1} manure, 50 kg ha^{-1} NPK) combined with "10 t ha^{-1} manure + 50 kg ha^{-1} NPK" and "10 t ha^{-1} manure + 100 kg ha^{-1} NPK" barely changed the initial plant community composition. Higher fertilisation regimes caused a successional process with a shift in species composition and the establishment of different plant communities. The *Violo declinatae-Nardetum* community was replaced by a *Festuca- rubra –Agrostis capillaris* meadow after four years of fertilisation. Fertilisation levels higher than 100 kg ha^{-1} NPK changed the *Festuca rubra –Agrostis capillaris* meadow to a *Polygono-Trisetion* type and fertilisation of productive meadows generated a community poorer in species.
Altogether, thirty species reacted to fertilisation with a significant negative correlation, including species, which are listed in the plant red data list of Romania (Oltean et al., 1994; Anca et al., 2004) such as *Arnica montana*, *Orchis ustulata*, *Gentianella lutescens* and *Parnassia palustris*. The experimental results indicated that the grasslands are extremely sensitive to intensive land use practices and respond to increases in production through nutrient inputs rather quickly.

Future development trends and land use scenarios

Within the Proiect Apuseni, (Rușdea et al., 2005) land use scenarios, the future alternatives for grassland management and the opportunities and risks in the context of nature conservation and agriculture were identified and evaluated.
Three 'action strategies' were defined, representing three different political strategies. The first involved a trend scenario with uncontrolled development of traditional land uses and without EU accession. The two alternative scenarios assumed that Romania is a member of the European Union. The first of these envisaged sustainable land use strategies with a moderate investment of own capital. The second depicted large-scale investments by an external investor with a decline in agricultural land use.
The modelling of the scenarios was based on a landscape model with the calculation of spatial and non-spatial variables (Lehmann and Brinkmann, 2005). For the evaluation of the different scenario results, a set of ten economic and bio-physical indicators were depicted as an amoeba diagram, which is a multi-dimensional graph representing the interactions between people and the environment (Wefering et al., 2000) (figure 5). Each scenario was evaluated in

Women raking leaves from a meadow in the Ordancusa valley.

Haycocks near Ocoale

Cows coming back from the pasture in Mununa.

Euphorbia carniolica, an eastern European species of acidic grassland in Gheþari

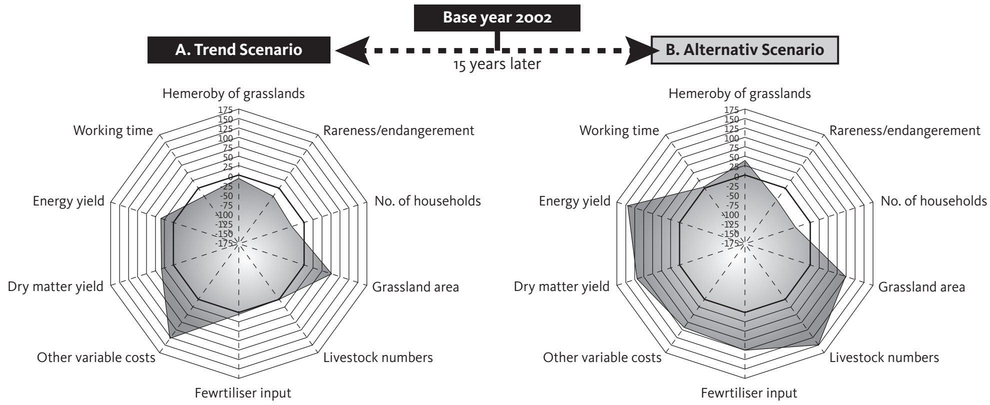


Figure 5 Example of the indicator results of two scenario types depicted as an amoeba diagram. (source: Wefering et al., 2001)

terms of sustainability, i.e., maintenance of productivity and income, and of nature conservation values.

The scenario results illustrated potential conflicts between nature conservation and socio-economic demands. It is predicted that in the villages of the Apuseni Mountains the valuable timber resources will all have been harvested within ca. 20 years, and the monetary incomes drastically reduced (Rușdea et al., 2005).

The economic pressures upon the rural households in montane areas will increase. This will lead to increasing farm size, specialisation and mechanisation and intensification of the more fertile soils. The agricultural use of marginal soils will decrease, or be abandoned completely and the land afforested. All unfertilised grassland plant communities and their related fauna will lose their characteristic species. Such a loss of biodiversity and landscape patterns has taken place in the mountain areas of central and Western Europe over the last decades. (Vos and Stortelder, 1992; Groth and Bressi, 1997; Klijn and Vos, 2000). Nevertheless, for some inhabitants limited rural subsistence production will remain the way of life over the coming next years, and should be accepted by governmental institutions.

Conclusions and recommendations

Romania has a high level of diversity of species and ecosystems, especially in the Carpathian Mountains, where seventy-five percent of the endemic and sub-endemic species are found (Ioras, 2003).The biodiversity hot spots within the Nature Park of the Apuseni Mountains are protected as special conservation areas. However, several problems complicate the national protection strategy, e.g. financial mechanisms, monitoring, enforcement, and the dissemination capacity of local environment protection agencies. There is also a need for environmental education (Abrud and Turnrock, 1998; Ioras, 2003).

The existing diversity of grassland in mountain areas will not be maintained automatically. Its continued management depends mainly on measures that improve the livelihood of the farmers. From the agriculture perspective, better management techniques with an efficient use of natural resources (e.g. earlier harvest dates, better composting of livestock manure) are essential. Grassland management techniques should be adopted that based on knowledge of site classification, manure fermentation and mowing dates. Inputs of small quantities of farmyard manure should be included in management strategies, depending on the natural soil conditions, the habitat type and the intensity of land use (mowing, grazing). Progress in animal husbandry depends on better hay quality, systematic animal breeding and the construction of modern stables.

In terms of nature conservation, the grassland types with a high natural value, especially the Natura 2000 habitats, should be preserved, particularly in the Apuseni Nature Park. If they lose their function for grazing, their maintenance will become costly. Under these circumstances, the management of these habitats have to be based on practices that mimic the traditional management.

Grassland utilisation should also, in future, remain a component of farming systems, combined with new approaches to generate income and improve the livelihood of the people. The development of organic farming represents an important way to support sustainable agriculture. The current situation shows that significant financial resources and special assistance for farmers to become more market-oriented are needed to develop such a production system. Several sources of finance are available, including EU structural funds, multilateral assistance and direct foreign investment. This process has just begun in Romania (Anca et al., 2004). The collection of medicinal plants, including *Arnica montana*, on marginal sites and the marketing of other eco-products is one prospect for the future. Direct marketing would increase people's incomes (Kathe, 2006).

Rural tourism will be a major concern in the future (Abrud and Turnrock, 1998; Surd and Turnrock, 2000), but it provides both opportunities and risks. Investigations into new tourism facilities are expensive, and not all villages have the potential to attract enough tourists. Regional planning should analyse carefully the present and future potential, and target attractive locations.

Cooperative forms of tourism, farming and marketing of products will be essential in the future. Governmental institutions should promote development programs, for example, through adequate education and transparent participation. Credits should also be given to medium-sized households in mountain regions. The present practice favours the larger households, and increases social differences. A 'micro-credit' programme should be developed and tested. The 'Proiect Apuseni' recommended a combination of ecotourism, cattle farming and forestry to ensure the sustainable development of the region (Ruşdea et al., 2005).

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