Monitoring semi-natural grasslands in Gyimes, Romania
EFNCP report

Dániel BABAI[1] and Zsolt MOLNÁR[2]
[1]Research Centre for the Humanities Hungarian Academy of Sciences
[2]Centre for Ecology Institute of Ecology and Botany Hungarian Academy of Sciences

In the last 100 years, the extent of species-rich, extensively maintained semi-natural grasslands has decreased with up to 70-90 % in Western Europe. In the meanwhile, these are among the most biodiverse (in sense of species richness) areas across Europe (White Carpathians – Merunková et al. 2012) and, in certain cases, around the world (Wilson et al. 2012). A significant proportion of these species-rich, semi-natural grasslands is found in mountain regions, in economically and socially disadvantaged areas. In these areas, in the last half a century, and especially starting with the 1970s, important changes have occurred in the economy, and in the agricultural sector in particular. In the reality of a globalised economical climate, sensitive to market processes, upland farming, traditionally built on animal husbandry became increasingly disadvantaged against the more efficient lowland agricultural production. The profitability of the labour-intensive upland farming decreased gradually.

As a result, a significant amount of these semi-natural grasslands (pastures and hay meadows) that stood at the base of upland animal husbandry, ensuring both summer and winter fodder, has been abandoned (in areas inaccessible for machinery) or intensified (use of artificial fertilisers, more frequent mowing) in order to increase the incomes with the inputs. Both of these processes, abandonment and intensification, result in species loss (Csergő and Demeter 2012), and lead globally to the drastic decrease in the amount of species-rich semi-natural grasslands.

For the above-mentioned reasons, the large, extensive grasslands from Gyimes represent high nature and conservation value areas. Despite this, in the last years this area has also been affected by the increasing rate of abandonment (Demeter ined.). Intensification is not yet a threat here, although around three-quarters of the European mountain areas face the negative outcomes of both intensification and abandonment at the same time. For now, Gyimes is characteristically affected only by the decrease in the volume of farming, namely by the abandonment of pasture and meadow maintenance in the areas considered unprofitable. The rate of abandonment is still relatively low, but the amount of abandoned grasslands

dynamically increases from year to year, especially in the case of the most species-rich, distant hay meadows (see Table 1. for a detailed description).

Therefore, it is important to act in time in order to prevent further losses. There is a great need for the identification of sustainable solutions, since the biodiversity conservation interventions and practices applied in Western Europe are extremely costly and, in the lack of internal economical motivation cannot be sustained without external financial help. This makes the future maintenance of these extensive grasslands difficult, even impossible in the long run.

The aim of this project was to obtain data in a large area about the values of species-rich semi-natural grasslands, and, based on the spectral characteristics of the sample areas and using remote sensing technology, make estimations about the location of such grasslands in the entire Gyimes, identifying those areas where the maintenance of traditional practices is extremely important and desirable for the long-term maintenance of the best grasslands.

1. The study area

1.1. Delimitation of the study area

The studied area, Gyimes is located in the valley-system of the Tatros (Trotuş) River, which crosses the Eastern Carpathians (central coordinates of the study area: N-46°37’22.45”, E-25°57’24.06”), encompassing about 600 km^2. The narrower study area is represented by the valley-system of the Hidegség (Valea Rece) and its tributaries. The designated study area includes some of the ranges of the Naskalat-hegység (Munceii Nascalat), Pogány-havas and the Nagy-Hagymás (Hăşmaşul Mare) mountains. Its northern edge is represented by the plateau of the mountains stretched along the northern side of the Barackos-patak. At south it is delimited by the valleys of Bandi-patak and Kovás-patak. The eastern border is represented by the ridge of the long range of the Orodik, while in the west the study area is delimited by the ridge of the Naskalat. The study area is therefore constituted by the valleys of the Szalamás-pataka, Cokán-pataka, Jávárdi-pataka and Bükkhavas-pataka, and the more important valleys of the Barackos. Its highest point is the Naskalat (1553 m), while the lowest is located in the valley of Hidegség-pataka (836 m).

1.2. Geomorphological conditions

Gyimes is located in the flysch-belt (sedimentary rocks) of the Eastern Carpathians, in the valley of the Tatros (Trotuş) River, which cuts across the parallel sandstone ranges in a west-east direction. The ranges of the flysch-belt have razed at the same time; following their

erosion, uniformly high wide ridges have developed. These wide ridges characterise the mountains of the Gyimes area. An important role in the development of this morphology was played by the fact that not even the highest ranges of the Eastern Carpathians have been affected by glaciation in the Pleistocene (Karátson 2002).

The base rock is mainly sandstone, but in certain areas sedimentary rocks also come to surface (ex. in Jávárdipataka the Jurassic limestone and calcite Triassic conglomerate (Dobos 1939 cit. Ilyés 2007)).

The most important water flow of the study area is the largest tributary of the Tatros, the Hidegség (Valea Rece), its valley system constituting the study area. The valley bottom is filled up with alluvium from the Quaternary (and Holocene). The sole in the valley of the Hidegség is 60-80 m wide. The stream is escorted by Pleistocene terraces on both sides of the valley. The terraces are the most important sites of habitation and arable farming (Ilyés 2007).

The climate is mountain-boreal (Pálfalvi 1995), modelled by a strong continental influence (Karátson 2002, Huband et al. 2010). The mean annual temperature is 4-6 ˚C. According to the measurements from the meteorological station located in Gyimesfelsőlok (Păltiniş) the highest temperature recorded up till now was +32,6 ˚C (1954), while the lowest was -28,6 ˚C (1954) (Ilyés 2007, Pálfalvi 2010).

The amount of annual rainfall is 700-1200 mm (Pálfalvi 1995, Nechita 2003). A precipitation maximum from early summer (June) is characteristic (Karátson 2002). The number of days with frost can reach 160-180 (Karátson 2002). The number of days with snow cover is 40-80 (Ilyés 2007).

From a plant biogeography point of view the area is classified in the Carpathicum floristic bioregion, the Transylvanicum province. Almost the entire area is potentially forest (spruce). However, as a result of extensive land-use practices, based on forest clearings, a mosaic of habitat patches and related richness of plant species and a diverse vegetation has developed. The most important forest species is the spruce (*Picea abies*); its characteristic plant association is *Hieracio rotundati-Piceetum* Pawl. et Br.-Bl. 1939, with a zonal presence between (600) 1200 – 1600 (1800) m. Beech forests (*Symphyto cordati-Fagetum* Vida 1959) are also present in a small range. The number of quaternary relict species is high. Characteristic endemic species are *Viola declinata*, *Campanula carpathica* and *Hepatica transsylvanica* (Hurdu 2012).

1.3. Landscape history

This area was a distant and extensively used property of the settlements in the neighboring Csík Basin until the 18th century (Bárth 2005). It was also the border area of the Kingdom of Hungary. The first settlers arrived into the valleys of Gyimes in the middle of the 18th century (Ilyés 2007, Hofer 2009), after which the number of inhabitants rapidly increased (Fig 2), and approaches today 15 thousands (Ilyés 2007). The mother tongue of this ethnographic group (csángó) is Hungarian. The distinctive, old Hungarian dialect (also named csángó) and culture of the community have preserved several archaic elements (Pócs 2008). The ethnography and cultural anthropology of the community have been studied in outstanding details (i.e. Kallós 1960, Tánczos 1994, Ilyés 2007, Pócs 2008).

Parallel with the growth of the population, the extent of forests decreased rapidly (Babai 2012). The cleared areas have been transformed into large, extensive pastures and hay meadows, where the settlers could graze their animals freely and produce winter fodder (Ilyés 2007). The result is a mosaic of forests and grasslands, which has been characteristic for the area and fundamentally influences the entire landscape.

The proportion of forests and grasslands changed dynamically during the roughly 50 years that followed colonization in the 18th century. However, equilibrium between forests and grasslands has been reached by the middle of the 19th century as shown by historical maps (Babai 2012). Since then, only small changes have occurred, mainly in the form of transforming hay meadows to pastures, and less frequently pastures into hay meadows.

2. Main grassland types

The study area is characterized by large, species-rich, semi-natural grasslands. These grasslands are of European importance both because of the impressive number of harboured plant species and also because of their extent.

The most important habitat types are: 2.1. Cotton-grass moors, 2.2. False oat-grass grasslands, 2.3. Red fescue meadows, mountain nutrient-poor grasslands, 2.4. Nardus swards.

2.1. Cotton-grass moors

This is a frequently occurring habitat, which is present in small (few sqm), but numerous patches across the landscape, both in hay meadows and pastures. It develops around springs, small streams, gully valleys, soaks at the mountain bases. The characteristic plant association of this habitat is *Carici flavae-Eriophoretum latifolii* Soó 1944. Other, less frequent associations are *Caricetum vesicariae* Chouard 1924, *Glycerietum plicatae* (Kulcz 1928)

Oberdorfer 1954, *Scirpetum sylvatici* Maloch. 1935 em. Schwick 1944, and, only in extraordinary occasions *Typhetum shuttleworthii* Soó 1927. The dominant species, *Eriophorum latifolium*, constitutes up to 50 % of the biomass. Other characteristic, grassland-constituting species are *Carex flava* and *Briza media*. Among the dicots, *Caltha palustris*, *Cirsium rivulare*, *Mentha longifolia* and *Geum rivale* are present in almost every stand. Among the orchids, *Gymnadenia conopsea* and *Dactylorhiza maculata* are frequent, while *Epipactis palustris* is present only sporadically, especially on Szalamáspataka.

2.2. False oat-grass grasslands

Widely present habitat type. Its characteristic association is *Arrhenatheretum elatioris* Br.-Bl. 1919 – *festucetosum rubrae* Tüxen 1951 subassociation. The dominant, grassland-constituting species are *Arrhenatherum elatius* and *Festuca rubra*. It develops on relatively nutrient-rich soils, representing mesophilous hay meadows.

A part of the false oat-grass grasslands belong to the category of nearby hay meadows, which are manured every two-three years. These grasslands have several vegetation levels. The dominant species are: *Arrhenatherum elatius*, *Dactylis glomerata*, *Festuca rubra*, *Anthoxanthum odoratum*. Characteristic dicots in the manured grasslands are *Tragopogon pratensis*, *Salvia pratensis*, and more rarely *Geranium pratense*.

The significant abundance of the clover species is characteristic for the mountain hay meadows, ex. *Trifolium alpestre*, *T. pannonicum*. Other frequent species are *Campanula rotundifolia, Leucanthemum vulgare*.

2.3. Red fescue meadows, mountain nutrient-poor grasslands

This is the most important habitat type, most of the hay meadows belonging to this category. It occurs on nutrient-poor soils. The grasslands belong most often to the associations *Festuco rubrae-Agrostetum capillaris* Horv. 1905, *Anthoxantho-Agrostietum capillaris* Sillinger 1933. These are extremely species-rich grasslands (the highest number of species found up to now is: 81 vascular plants per 16 sqm). The dominants species are: *Festuca rubra, Agrostis capillaris, Anthoxanthum odoratum*.

It is the characteristic habitat especially of extensive, unmanured hay meadows that are mowed once a year.

Because the differentiation between the three above mentioned species-rich mountain hay meadow types is difficult, due to the significant overlap between the species pool, and their definite separation is further hampered by the several transition stands, we did not make any

attempt to make such distinctions. However, the difference in land-uses (ex. pasturing or mowing) result in significant differences also at the level of species composition, therefore the type of the applied practices is an important and determinant feature.

2.4. Nardus swards

Characteristic, species-poor habitats, with the calcifuge, nutrient-poor grassland association: *Violo declinatae – Nardetum* Simon 1966. The habitat type and the association occur especially in upland regions, mainly in the areas used as hay meadows. The dominant (often monodominant) species is *Nardus stricta*. Occasionally *Vaccinium myrtillus* can appear in large number. The denominating species, *Viola declinata* is a frequent element of these stands. Other characteristic species are the representatives of the *Alchemilla* genus, which often reach considerable covers.

2.5. The most characteristic farming practices

The most important farming practices related to grassland management are mowing and pasturing (grazing). Mowed grasslands can be grouped in two major categories: nearby hay meadows and distant hay meadows (Table 1.). Mowing occurs in these sites once or twice per year. A more intensive grassland management (3-4 mowing occasions / year) is characteristic only for the grasslands located nearby the houses.

Mowing is done in a smaller amount with hand scythe and in larger amount with scything machine. The latter method came into practice in the last decade, but became determinant only in the last four-five years. It is a much more efficient method than using hand scythes. According to the accounts of the locals, with this method the one-day's work of seven men with hand scythes can be replaced with one day of machine scything done by a single person.

Table 1. Types of hay meadows in Gyimes

	nearby hay meadow	**distant hay meadow**
location	near settlements, approachable sites, where manure can be shipped to	far from settlements, where manure cannot be shipped to, they are at higher altitudes
mode of use	mowed 2(3) times	mowed once, grazed in autumn
Dominant species group	monocots	dicots
typical species	*Trisetum flavescens, Agrostis tenuis, Anthoxanthum odoratum, Dactylis*	*Festuca rubra, Agrostis tenuis, Arrhenatherum elatius, Anthoxanthum*

	glomerata, Lolium perenne, Trifolium repens, Salvia pratensis, Tragopogon orientalis, Colchicum autumnale, etc.	*odoratum, Nardus stricta, Onobrychis viciifolia, Carlina acaulis, Veratrum album, Vaccinium myrtillus, Trifolium pannonicum, Leucanthemum vulgare,* etc.
quantity of hay	higher (grass height is 1-1.5 m)	lower (grass height is 40-50 cm)
quality of hay	lower, fibrous	higher, leafy
time of mowing	end of June-end of July	beginning of August-beginning of September
manuring	every 2-3 years	rarely
origin	mostly abandoned fields	most never ploughed, in place of forests

Animals are not guarded by herdsmen, they are kept in enclosures instead. Herding is not characteristic. However, this farming method also came into practice in the last years. The herders undertake the guarding of animals in land areas purchased by entrepreneurs. The practice is already present in several areas (Jávárdipataka, Bükkhavas).

The number of animals is determined traditionally, the amount of animals that can be left out in a certain pasture is known according to unwritten traditions. The exact number is not settled.

Table 2. Types of pastures in Gyimes

	nearby pasture	**mountain pasture**	**sheep pasture**
location	near settlements	in the high mountains	on the flat top of the highest mountains
typical vegetation	*Festuca rubra, Agrostis tenuis, Leucanthemum vulgare, Primula veris, Juniperus communis*	*Festuca rubra, Anthoxanthum odoratum, Trifolium montanum*	*Trifolium repens, Bellis perennis, Veratrum album xx*
herder	absent	absent	present (hired shepherds)
summer hut	absent	present	present
mode of herding	owners drive animals every morning and evening to and from the pasture	each evening owners go to the pasture, spends the night there, and returns home with fresh milk	paid shepherds are on the spot day and night
animals	cattle	cattle, horse	sheep (goat), cattle, horse
night spent in	barn in the village	barn in the mountains	open corral
use of produced goods	mostly by the family, rarely surplus (mainly milk) is sold	mostly by the family, surplus (milk and cheese) is sold	commercial (mainly cheese)

3. Methods, studied grassland types

3.1. Methods

During the process of building-up the mapping protocol we considered all grassland types occurring in the area, both in pastures and/or hay meadows. Because of their large extent and often large homogenous vegetation cover these grasslands were surveyed using point sample mapping. Therefore, instead of mapping the 1000 hectares we obtained data from a much larger territory (around 6000 ha) regarding the present situation of grasslands. Based on the spectral characteristics shown on satellite imagery by the exactly located (GPS-coordinates) sampling plots we will be able to give reliable information regarding the species richness and "goodness" of grasslands in the entire area. At the same time we aim to make complete floristic records of the only few sqm extent species-rich alkaline fens.

During mapping we recorded with GPS the exact geographical coordinates of the sample plots. We used 10×10 m sampling units in case of grasslands, and 20×20 m areas in case of forest stands. To each sampling unit we assigned a serial number, land-use type and habitat type. We made photographs of each stand. In the designated sampling areas we also recorded data on the locally rare, endangered vascular plant species (Table 3.). When the low abundance permitted, we recorded the number of individuals, otherwise we estimated percentage cover in the case of every species present in the sampling quadrat. We also studied the incidence of few important indicator species (Table 4.). These selected species indicate the naturalness of individual areas and the more special habitats, respectively.

We further recorded data that give information regarding the particularities of the vegetation and the characteristics of the traditional land-use practices. We recorded bare soil cover, woody plant species cover, abandonment, type of grazing animals, the existence or lack of tread lines, the signs of pasture clearings.

Table 3. The mapped locally threatened or rare plant species

Threatened or rare species				
Pteridophyta	*Alchemilla ssp.*	*Epipactis palustris*	*Linum flavum*	*Pyrola rotundifolia*
Asplenium viride	*Allium victorialis*	*Gentiana asclepiadea*	*Moneses uniflora*	*Ribes alpinum*
Botrichyum lunaria	*Aquilegia vulgaris*	*Gentiana cruciata*	*Myricaria germanica*	*Ribes petraeum*
Dryopteris carthusiana	*Astrantia major*	*Gentianella austriaca*	*Neottia nidus-avis*	*Rosa pendulina*
Dryopteris dilatata	*Clematis alpina*	*Goodyera repens*	*Orchis coriophora*	*Saxifraga paniculata*
Dryopteris expansa	*Coeloglossum*	*Gymnadenia*	*Orchis mascula*	*Scrophularia*

	viride	*conopsea*	*subsp. signifera*	*Bársonyos*
Lycopodium annotinum	*Corallorhiza trifida*	*Helleborus purpurascens*	*Orchis ustulata*	*Sempervivum globiferum*
Lycopodium clavatum	*Dactylorhiza maculata*	*Hieracium aurantiacum*	*Orthilia secunda*	*Thalictrum aquilegifolium*
Huperzia selago	*Dactylorhiza sambucina*	*Hippophae rhamnoides*	*Parnassia palustris*	*Traunsteinera globosa*
Ophioglossum vulgatum	*Daphne mezereum*	*Iris graminea*	*Pinguicula vulgaris*	*Trollius europaeus*
Polystichum lonchitis	*Doronicum austriacum*	*Lathyrus laevigatus*	*Platanthera bifolia*	*Vaccinium vitis-idaea*
Angiosperms	*Epipactis atrorubens*	*Lilium bulbiferum*	*Polygonatum verticillatum*	*Veratrum album*
Aconitum moldavicum	*Epipactis helleborine*	*Lilium martagon*	*Polygonum bistorta*	*Viola biflora*

Table 4. The mapped indicator locally species

Indicator species				
Carlina acaulis	*Nardus stricta*	*Vaccinium myrtillus*	*Trifolium pannonicum*	*Spiraea chamaedryfolia*
Eriophorum latifolium	*Homogyne alpina*	*Helleborus purpurascens*	*Carex spp.*	*Telekia speciosa*

In the case of alkaline fens we recorded their extent, the dominant species (*Eriophorum latifolium*, *Scirpus sylvaticus*, *Equisetum palustre*), and the open turf cover. When recording woody vegetation we considered the following variables: type of forest, average tree diameter, canopy closure rate, signs of tree cutting, signs suggesting grazing, the type of ground vegetation cover (characteristic forest or grassland species).

During our study, we recorded 1036 sampling plots. 242 in woody vegetation, 620 in different grassland types and further 174 in other habitats (gravel bars, alkaline fens, alluvial alder woods etc.).

Table 5 Example of mapping datasheet

Pont sorszáma: 3/ 275	GPS-sorszám:	Koordináta: 46 727 17° 25 81037	Fotó sorszáma (3): 2732; 2733; 2734 / készítés ideje: 12.07.17. 10:57
Élőhely típusa: erdei tisztás		Tájhasználat: [illegible] / legelő	

Védett növények a kvadrátban+egyedszám

Kap-Korp	Avarvi	Füles-Kosb	Kerekl-Kört	Oszt-Tár	Széles-Nősz
Kígy-Korp	Bárs-Görv	Fürt-Kőtör	Két-Sarkv	Oszt-Zerge	Szúnyogl
Rész-Korp	Bérc-Rib	Gömb-Kövi	Kígyó-Kesefű	Palástfű 20%	Tőzegmoha
Kígyónyelv	Bodza-UjjKos	Gömb-Kosb	Korall	Páva-Sal	Turb-Lili
Kis-Hold	Cserm-Cip	Gyöngy-Kört	Köz-Bork	Pir-Huny	Tűz-Lili
Vesepá	EgyvirKört	Győz-Hagy	Lápi-Hízóka	Pol-Kosb	Völgy-Csi
Hegyi-Paj	Erd-Ledn	Harangláb	LászTár	Prém-Tár	Vörös-Áfo
Szálkás-Paj	Fark-bor	Hav-Iszal	Madárfé	Rez-Hölgy	Vörös-Nősz
Széles-Paj	Fecs-Tár 3%	Hav-Rib	Mocs-Nősz	Sár-Ibo	Zászpa (+)
Zöld-Fod	Fehér-Máj	Hav-Rózsa	Mold-sisak	Sár-Len	Zergebog
	Folt-Ujjkos	Homoktöv	Nőszirom	SömKosb	Zöldike

Indikátorfajok a kvadrátban+egyedszámok

Bábakal (+)	Gyapjúsás	Magy-here	Pir-Huny	Szőrfű 25%	
Fek-áfony 10%	Gyöngyvessző	Mirigylapu (+)	Sás-fajok	Teleki	

Erdő: lucos / lombos (bükkös / egyéb)	**Gyep (20*20 m):** kaszáló / legelő	**Selymék:** gyapjúsás / erdei káka / mocsári zsurló
Favágás i / n	Csupasz felszín borítása (%): 0,5%	Szélesség: Nyílt tőzeg borítása
Faátmérő átlag: —	Cserje/fa borítása (%): 1%	Hosszúság:
Luc: szelha / bojt	Reglőtisztítás nyoma: i / n	**Patakvölgy:** magaskórós i / n
Lombkorona zártsága (%): —	Legelő állat: marha / juh / ló	Kavicszátony i / n
Gyepszint: füves / átmeneti / erdei	Taposási lépcső i / n	Csigolyás i / n
Legeltetés nyomai i / n	Felhagyva i / n	**Égerliget** i / n
Erdőszegély: cserjés / magaskórós	Kaszáló: kinnvaló / bennvaló —	Faátmérő
Üde / száraz	Határjel: hangyaboly / kerítés / fasor [illegible]	Magaskórós i / n

Jellemzés: bozótosodó régi borókával; kis facsoportok kihagyva → csak tisztás | 1195 m

Pont sorszáma: 4/ 276	GPS-sorszám:	Koordináta: 46 72367° 25 80153°	Fotó sorszáma (3): 2737; 2738; 2739 / készítés ideje: 12.07.17. 12:20 (35)
Élőhely típusa: kaszáló		Tájhasználat: [illegible] kaszáló	

Védett növények a kvadrátban+egyedszám

Kap-Korp	Avarvi	Füles-Kosb	Kerekl-Kört	Oszt-Tár	Széles-Nősz
Kígy-Korp	Bárs-Görv	Fürt-Kőtör	Két-Sarkv	Oszt-Zerge	Szúnyogl
Rész-Korp	Bérc-Rib	Gömb-Kövi	Kígyó-Kesefű	Palástfű 30%	Tőzegmoha
Kígyónyelv	Bodza-UjjKos	Gömb-Kosb	Korall	Páva-Sal	Turb-Lili
Kis-Hold	Cserm-Cip	Gyöngy-Kört	Köz-Bork	Pir-Huny	Tűz-Lili
Vesepá	EgyvirKört	Győz-Hagy	Lápi-Hízóka	Pol-Kosb	Völgy-Csi 4%
Hegyi-Paj	Erd-Ledn	Harangláb	LászTár	Prém-Tár	Vörös-Áfo
Szálkás-Paj	Fark-bor	Hav-Iszal	Madárfé	Rez-Hölgy	Vörös-Nősz
Széles-Paj	Fecs-Tár	Hav-Rib	Mocs-Nősz	Sár-Ibo	Zászpa 15%
Zöld-Fod	Fehér-Máj	Hav-Rózsa	Mold-sisak	Sár-Len	Zergebog
	Folt-Ujjkos	Homoktöv	Nőszirom	SömKosb	Zöldike

Indikátorfajok a kvadrátban+egyedszámok

Bábakal	Gyapjúsás	Magy-here	Pir-Huny	Szőrfű	
Fek-áfony	Gyöngyvessző	Mirigylapu	Sás-fajok	Teleki	

Erdő: lucos / lombos (bükkös / egyéb)	**Gyep (20*20 m):** kaszáló / legelő	**Selymék:** gyapjúsás / erdei káka / mocsári zsurló
Favágás i / n	Csupasz felszín borítása (%): 0,5%	Szélesség: Nyílt tőzeg borítása
Faátmérő átlag:	Cserje/fa borítása (%): 0%	Hosszúság:
Luc: szelha / bojt	Reglőtisztítás nyoma: i / n —	**Patakvölgy:** magaskórós i / n
Lombkorona zártsága (%):	Legelő állat: marha / juh / ló —	Kavicszátony i / n
Gyepszint: füves / átmeneti / erdei	Taposási lépcső i / n —	Csigolyás i / n
Legeltetés nyomai i / n	Felhagyva i / n	**Égerliget** i / n
Erdőszegély: cserjés / magaskórós	Kaszáló: kinnvaló / bennvaló	Faátmérő
Üde / száraz	Határjel: hangyaboly / kerítés / fasor	Magaskórós i / n

Jellemzés: erdei zsombék; mezei [illegible], fajszegény, [illegible] gyomos valószínűleg trágyázott; hegyi fajokban szegény; [illegible] kaszáló | 1460 m

3.2. Participants

The study was done by the environmental protection engineering students of the Georgikon Faculty of the University of Pannonia, Hungary. They participated as volunteers. The Szent István University from Gödöllő and the University of Szeged (Hungary) was also represented. The participants surveyed the delimited study area in groups of two and recorded the sample plots. An important aim was to involve also the local community in the assessment of vegetation. For this reason, when the situation permitted, we made the records involving local participants. Unfortunately, the extremely dry weather in 2012 had a strong negative influence also on the farming practices in Gyimes. As a result, the hay making in the distant hay meadows begun two weeks earlier, while, in accordance with the EU regulations, mowing begun with considerably high intensity after the 1st of July, therefore during the study period. This made unexpectedly difficult the involvement of local inhabitants in the mapping process, therefore this was realised in a lesser amount in comparison with the original plans.

In total, nine knowledgeable inhabitants and two young persons, with great practical experience in farming were involved in the field studies, for a total of 15 days of mapping fieldwork. Based on the feedback of the volunteers, the students learned many things from these persons regarding landscape history, traditional practices, the secrets and skills of hay making and pasturing; at the same time the inhabitants from Gyimes became acquainted with the scientific methods. We tried to compensate the lost period through evening discussions, when the volunteers could share their experience of the day with the locals and by organizing several evening programs and events in order to meet new families. The good fit-in of the volunteers is also shown by the fact that only after a few days they were invited by the locals to participate in various activities (e.g. milking, hay gathering, forging, introducing hellebore roots into pigs' ears – a traditional medicinal practice used to cure the animals by stimulating their immune system).

3.3 Lessons

Most of the volunteers didn't have botanical knowledge about Gyimes. Their basic knowledge was about species in Hungary that they learned at the university (most of them attend nature conservation engineering course). When compiling the datasheet we took into consideration typical species with prominent flowers; these are suitable for the identification of species rich meadows. The botanical knowledge needed to fill in the datasheet was learned during the first three days of the research. Experience shows that when indicator species are in

their phonological phase (blooming) recognizing them doesn't consist a problem for inexperienced researchers.

We constantly monitored and checked the work of volunteers. This strengthened our belief that learning typical species can be done in three days using intensive methods.

The methodology that we chose proved to be adequate in reaching our goals Both the quality and quantity of the data was satisfying. Some species might not have been identified correctly given the lack of routine in the case of some volunteers, but good preparations (ie. prudent selection of indicator species and the time of research) minimise the amount of erroneous data.

A very important part of the research was the involvement of the local population. The local community holds a good amount of traditional knowledge. Also, the knowledge about natural values (ie. rare and valuables species on local level) affected by their agricultural activities is significant. If the local community is aware about it's natural values, their protection can be more effectively organised and this way traditional agricultural practices can be retained as well.

In Germany one can find good examples of programmes in which local farmers are monitoring changes in rare and protected flora species. The ethno-botanical knowledge of farmers in Gyimes consists a very good opportunity to organize this type of monitoring activity.

Local farmers and researchers could effectively collaborate in mapping natural values. This collaboration could be the key to the exploration and conservation of biodiversity.

3.4. Outlook

The advantage of this method is that it is able to provide informative, reliable data about the area, which extended in a short time. In Gyimes, in Europe's most extended meadows it is not possible to measure, to monitor the areas with traditional methods. It was necessary to develop methods which allow reliable estimations regarding to areas which were not participating in measurements. Visualisation of satellite images about the results of data measurements made in summer of 2012 and the identification of spectral characteristics relating to the points enables further estimations about the areas which were not measured.

4. The study and use of traditional knowledge and practices

One of the prerequisite of communication between science and the locals is the knowledge and understanding of each other's phrasing. In the table below we summarize the

main habitat names used by the inhabitants of Gyimes, mentioning also the corresponding Natura 2000 habitat codes (Table 4.).

Before the beginning of the volunteers' fieldwork we had one day of field training, during which two knowledgeable locals explained the ecology, dynamics, history, and use of the Gyimes landscape. During this encounter, we learned the names of the most important habitats and plant species.

We mention only as a curiosity that in the evening meeting that followed the two weeks of volunteering one of the tasks was to show in "Activity-style" the local habitat names. The results were beyond our expectations, the volunteers being able to describe even as fast as in 3-10 seconds(!) habitats like bezseny, málnavész, ördögbordás (see Table 4. for their English equivalents).

Table 6. Csángó folk habitat names, their botanical meaning, English equivalents (literal translation of names is given in parentheses), and Natura 2000 habitat codes.

Csángó habitat names	Botanical meaning, and English equivalents	Natura 2000 code
bennvaló kaszáló	Hay meadow close to the settlement, fertilized every 2-3 years, mown twice a year, dominated by monocotyledons (lit. in-bye hay meadow)	<6520 *
bennvaló reglő	Pasture, close to the settlement (lit. in-bye pasture)	<6520
bezseny, cseplesz	Dense, 5-10 years old young spruce forest (specific local expressions reflecting on density and small tree size)	=9410
boronaerdő	Forest with trees good for house building, dbh 25-30 cm (lit. beam forest)	<9410
borsikás	Pioneer stands on pastures, dominated by *Juniperus communis* (lit. having *Juniperus.*)	>5130 ?
bükkerdő, bükkös / leveles erdő	Deciduous forest, dominated by *Fagus sylvatica* mostly mixed with *Picea abies* (lit. beechy, beech forest / leafy forest).	=91V0
bundzsák közt	Among mosses (lit. do.)	<6520
csigolyás	Forest stands along streams, dominated by bushy *Salix* spp. (lit. having bushy willow).	=3230
csihányos / lósósdis	Degraded, nutrient rich stands dominated by *Urtica dioica* or *Rumex alpinus* (lit. having nettles / having *Rumex*).	-
csúf hely	Area not mown or grazed, stony or with twigs, or steep, difficult to walk through (lit. ugly place)	-
égetéses hely, perzselés	A burnt area, usually recovered by forest or a singed area, usually *Nardus* or *Juniperus* was singed (lit. burning / singeing)	-
épületek mellett, házak szélén	Close to buildings and houses (lit. do.)	-
erdő	Forest (lit. do.)	>9410
erdőközt, fás közt	In the forest (lit. among forest / among trees)	>9410
erdőszél, erdőszély	Forest edge (lit. do.)	=6430
észkos hely, észok	Northern slope (lit. northy place)	-
fenyőerdő, fenyves, fenyőfás	Coniferous forest, dominated by *Picea abies* and *Abies alba*, rarely mixed with *Fagus sylvatica* (lit. spruce forest, with spruce, with spruce trees)	=9410
fiatal erdő	Young spruce forest, ca. 10 years old (lit. young forest)	<9410

ganyés, trágyázott hely	Manured site, a nutrient rich area (lit. manured place)	-
gyéres erdő	Thinly grown or partly cleared forest (lit. sparse forest)	>9410
gyüngyeményes	Scrub habitat, dominated by *Spiraea chamaedryfolia* (lit. having *Spiraea*).	<6430
hangyaboly	Anthill on the meadows and pastures, the main habitat of *Thymus*-species (lit. anthill)	-
hegy, havas	High mountain grasslands and forests (lit. mountain / snowy)	-
hegyi reglő	Mountain pasture (lit. do.)	<6520
karós erdő	Forest with stake sized trees, dbh 7-20 cm (lit. staked forest)	<9410
kaszáló	Hay meadow (lit. do)	=6520
kert mellett, kertszély	Bushy or tall-herb or weedy vegetation along fences (lit. along a fence / edge of a garden)	<6430
kinnvaló (hegyi) kaszáló	Hay meadow in the mountains, further from settlements, not fertilized, mown once a year, dicotyledons are common (lit. out-bye hay meadow / hay meadow in the mountains)	<6520
kinőtt erdő / öreg erdő / nagy erdő	Old forest, above 70-100 years (lit. adult forest / old forest / large forest)	<9410
kő, szikla	Boulder, rock (lit. do.)	=6150
kövér, zsíros hely	Nutrient rich area (lit. fat place)	-
köves hely	Rocky area with open vegetation (lit. stony place)	-
lokhely / alj / alvidék / falu	Inhabited areas in the valleys at lower elevation (lit. inhabited place / bottom / in low region / village)	-
málnavész, málnás	An area with *Rubus idaeus* on clear cuts (lit. dangerous with raspberries, having raspberries)	-
mocsaras hely	Muddy areas around springs or along streams, with sedge-dominated stands (lit. marshy place)	>7230
mocskos hely	Area full of rubbish, communal and/or twigs, e.g. along fences, on stream banks (lit. dirty place)	-
muzsda	Edge of an arable terrace	-
patak, patak mentén, patak szélén, vizek mentén	Smaller stream or along streams (lit. stream, along streams, at the water)	
porond	Young and old stream banks with gravel (lit. elevated)	>3230
reglő / nyáraló	Pasture used in summer (lit. pasture / to spend the summer)	<6520
sátés, sásos	Rich fens and swamps, dominated by *Carex* spp. (lit. having sedges).	=7230
selymékes, selyke, sepedékes hely, tepsányos	Fens around springs, mainly sedge-dominated stands, rarely with *Sphagnum* (lit. a sinking area)	=7230
sovány, silány hely	Nutrient poor area (lit. thin place)	-
szántófőd szélin	Field margin (lit. do.)	-
szántófőd, pityókafőd, gabonafőd	Field, potato field, cereal field (lit. do.)	-
szőrcsés	Grasslands, mainly pastures, dominated by *Nardus stricta* (lit. having *Nardus*).	=6230
tömör (gyakor) erdő	Dense forest (lit. dense, frequent forest)	>9410
út mellett, útszéleken	On road verges (lit. next to roads / along roads)	-
vad hely	Area where vegetation is not controlled by humans (usually an old forest in narrow valleys) (lit. wild place)	>9410
vágtér / irtás / vész	Cleared area, often turned into a grassland usually with twigs all over (lit. cut-area / clearing / dangerous)	-
verőfényes hely	Southern slope (lit. place with bright sunshine)	-
víz, taploca	Warmer spring and its creek, that never freezes (lit. water, ?)	-
zsanikás	Grasslands, mainly pastures, dominated by *Alchemilla* species (lit. having *Alchemilla*).	<6520

* <1530 a narrower meaning in comparison with the Natura 2000 habitat definition
>1530 a wider meaning in comparison with the Natura 2000 habitat definition
=1530 a meaning relatively equal with the Natura 2000 habitat definition

5. Trends – land-use system, changes in farming practices. Data and personal observations

The trends related to the fate of these grasslands, the changes occurring in farming practices are in strong connection with the changes in the regulations of manufacturing dairy-products, therefore a short overview is necessary.

Based on the international experience, the maintenance of species-rich grasslands is threatened especially by intensification or abandonment. The depopulation of socially and economically disadvantaged upland communities is a characteristic process, and one of its outcomes is also the abandonment of large, extensively managed grasslands. Despite that in Gyimes the decrease in population is not drastic, still, abandonment is one of the main reasons of the loss of species-rich grasslands, and this process is nowadays of increasing importance.

The extent of grasslands changed significantly for the first time in the 20th century, following the abandonment of croplands, in the middle of the century, after World War II. At that time a large extent of cropland was/might have been abandoned, allowing the increase of the size of maintained grasslands, the application of larger amounts of manure in hay meadows, increasing the number of the so called "nearby" hay meadows, accentuating the appearance of the two hay meadow types in the land-use system from Gyimes.

All this seems to change again in the first decade of the 21st century, when the regulations regarding the making of dairy-products have been modified in such a manner that made impossible the entrance between legal bounds on the market of the products obtained through the traditional practices characteristic for Gyimes. This resulted in the decrease in the cattle stocks, and regression to the level of subsistence farming. The decrease in the number of animals is followed by the abandonment of some of the grasslands. This naturally affects especially the more distant, extensively utilized grasslands, which are exactly the most species-rich stands.

The decrease in animal stocks and the increase in the amount of land parcels that became unnecessary brought also another phenomena: selling of land. In the last years an entrepreneur has bought significant amounts of land in Gyimes, mainly in the more distant areas. In a substantial amount, the land-use of these parcels was modified, nowadays these are used mainly as pastures, both for sheep and cattle. This practice ensures the maintenance of the grasslands, but has a negative effect on the plant species composition. Pastures are characteristically poorer in species in comparison with hay meadows (although exceptions do exist). In order to support these observations with quantitative data, further studies are needed.

Intensification has occurred especially in the pastures in the second half of the 20th century. Local farmers were obliged to use chemical fertilizers on the pastures that remained in private property. This farming practice considerably increased the yield, but resulted also in major modifications in grassland species composition. Not only the private pastures were maintained in such way but also the community pastures. There are no data regarding the exact timing of the start of the obligation regarding the use of chemical fertilizers, but the period ended in the 1980s. Also, there are no data regarding the extent of affected grasslands.

The most important outcome of the cessation of using chemical fertilizers is the expansion of the matgrass (*Nardus stricta*). According to the locals, this happened definitely after they gave away the use of artificial fertilisers.

6. Rare species

For now we identified 617 vascular plant species in the study area. The presence of several floristic rarities (endemics, endangered species) was shown by the 2012 survey. In order to evaluate the status of the identified species and considering the particularities of the study area, out of the various red lists existing for the Romanian flora, we decided to use the one referring to grasslands (Negrean 2001).

6.1. Locally rare species, valuable floristic elements:

1.) *Allium victorialis*: Red List (Negrean 2001): rare. Occuring in: Jávárdi-hegy, hay meadow (1344 m a.s.l.) (2009), Bárány-hegy, Fehér-mező (2012). Habitat: nutrient-poor species-rich mountain grassland (hay meadow). Further characteristic species for the habitat: *Luzula luzuloides, Vaccinium myrtillus, V. vitis-idaea*. Stand size: approx. 20 plants in Jávárdi, stagnating.

2.) *Dianthus compactus*: occurrence: the range of the Barackos, hay meadows, 2 localities (1295 and 1324 m a.s.l.) (2012). Habitat: species-rich nutrient-poor mountain grasslands. Further characteristic species for the habitat: *Festuca rubra*, *Vaccinium vitis-idaea*, *Luzula luzuloides*, *Traunsteinera globosa*, *Gentianella austriaca*. Stand size: in the two localities only 4-5 plants, because it was found only in 2012 we are unable to provide data regarding the trend of the stand size.

3.) *Centaurea kotschyana*: Red List (Negrean 2001): rare. Occurrence: Jávárdi-hegy, hay meadow, 3 localities (around 1300 m a.s.l.) (2010-2012). Habitat: mountain species-poor grassland, hay meadow. A smaller population was found nearby the dirt road going down to

the valley. Further characteristic species for the habitat: *Festuca rubra, Trifolium alpestre, Trollius europaeus*. Stand size: approx. 30 plants, stagnating in the known localities.

4.) *Scabiosa lucida* subsp. *barbata*: Red List (Negrean 2001): rare, endemic subspecies. Occurrence: Jávárdi, Barackos, hay meadows, 4 localities (1100-1300 m a.s.l.). Habitat: mountain species-poor grassland, hay meadow. Further characteristic species for the habitat: *Astrantia major, Gentiana utriculosa, Phyteuma tetramerum*.

5.) *Gentiana cruciata* subsp. *phlogifolia*: Red List (Negrean 2001): rare, endemic subspecies. Occurrence: Szalamáspataka, Pornyáló, 1 locality (1401 m a.s.l.).Habitat: open calcareous soil grasslands. Further characteristic species for the habitat: *Sesleria heufleriana, Cotoneaster integerrima, Sempervivum globifera*. Stand size: 9 plants, stagnating.

6.2. Further, locally rare species identified in 2012:

Further on we present the floristic records of the 2012 survey, concentrating especially on the species that are new for the flora of Gyimes (Hidegség), and on those that are red listed.

Anacamptis pyramidalis – its only known locality is the rocky meadow of the southern slope of the Kőrösös-hegy (3 plants). *Bruckenthalia spiculifolia* – its only known locality is the Pogány-havas (the species was found earlier in the area also by Gusztáv Jakab). *Corallorhiza trifida* – one locality (Pogány-havas). *Cypripedium calceolus* – occurring in several places in Gyimes (Szép-havas, Pogány-havas), no data for Hidegség. Red listed (Negrean 2001): vulnerable/rare. *Gladiolus imbricatus* – two localities: valley of Bandi-patak, and Pogány-havas. *Goodyera repens* – currently known from three localities: Bandi-patak, Jávárdi-Kőkert, and the Pogány-havas. *Iris ruthenica*: found on the Pogány-havas. *Leontopodium alpinum* – Red listed (Negrean 2001): vulnerable; several localities, exclusively on the rock humps of the Nagy-Hagymás mountains. *Lilium bulbiferum* – Red listed (Negrean 2001): rare; three localities: Kováspataka, Szalamáspataka (present in several species-rich hay meadows), Hidegség-patak (on the grassy gravel bars near the stream, approx. 80-100 plants). *Microstylis* (*Malaxis*) *monophyllos* – one locality: Pogány-havas (the species was found earlier in the area also by Anna-Mária Csergő). *Pinguicula vulgaris* – Red listed (Negrean 2001): rare; four known localities in the Hidegség (Cokánpataka, Hidegségpataka, Barackos, Mohos-patak), further locality: Pogány-havas. It is interesting that out of its four stands two are found on former gravel bars. *Polygonum* (*Persicaria*) *bistorta* – known from one locality: Jávárdipatakán, sporadic in several areas on the Pogány-havas. *Pseudorchis* (*Gymnadenia*) *albida* – Red listed (Negrean 2001): rare; two known localities:

Jávárdi-Kőkert, Bagoly-kő. *Trisetum macrotrichum* – endemic, Red listed (Negrean 2001): rare, the only known locality is the Pogány-havas.

6.3. Red listed species, not rare in the study area:

According to Negrean 2001 (R: rare, V: vulnerable, NT: not threatened): *Carex davalliana* – V/R; *Cirsium eriophorum* – R; *Cirsium furiens* – NT; *Coeloglossum viride* – R; *Dactylorhiza maculata* s. l. – R; *Dactylorhiza maculata* subsp. *transsilvanica* (?) – R; *Dactylorhiza sambucina* – R; *Dianthus tenuifolius* – NT; *Diphasium complanatum* (?) – R; *Epipactis palustris* – R; *Gentiana acaulis* – R; *Gentiana lutea* – V; *Orchis coriophora* subsp. *coriophora* – R; *Orchis mascula* subsp. *signifera* – R; *Orchis morio* subsp. *morio* – R; *Orchis ustulata* – R; *Phyteuma tetramerum* – R; *Plantago atrata* – R; *Scorzonera purpurea* subsp. *rosea* – R; *Traunsteinera globosa* – R; *Trollius europaeus* subsp. *europaeus* – R; *Viola jooi* (?) – R.

We can conclude that according to our present knowledge in the study area 33 red listed (Negrean 2001) species are present. The number of species newly found or for which new localities were added following the 2012 survey is three.

The most important is the species-richness of the meadows. There occur many protected and rare species on the mapped areas. According to these Gyimes is one of the most species-rich regions of Europe.

Important results are also the new data about endemic species and subspecies: *Gentiana cruciata* subsp. *phlogifolia*, *Scabiosa lucida* subsp. *barbata*, *Trisetum macrotrichum*. The most important habitats are the extensively managed mountain hay meadows in large extent. Besides its dominance in the landscape it is also the most important habitat of rarities. The reason for this is that – based on the intermediate disturbance hypothesis – the species richest habitats are the actual intermediate disturbance habitats, which in Gyimes are the outer hay meadows (mountain hay meadows, Natura 2000: 6520).

These meadows are not managed besides the yearly mowing that happens once. This is considered as ’small amount of disturbance’ and it’s just enough to stop the closure of *Poaceae*-species that form the matrix of the meadow. The gaps that are created this way allow plants with less competitiveness (e.g. *Orchidaceae* spp.) to be present on the meadows on the long run. In the last 5-10 years these meadows started to be abandoned or their management regime changed to pasture.

On the basis of the above mentioned things there are especially rich areas in protected values (landscape, rare species in the region) for instance Pogány-havas, Barackos, Jávárdi.

Rare species' populations appear in significant numbers often in large numbers on all three model areas.

Pogány-havas is one of the most suitable places from the point of view of visibility and accessibility and at the same time it would not be favoured to mark out it for being the center of ecological tourism because of long term maintenance of its outstanding botanical values (ex. *Anemone narcissifolia*, *Malaxis monophyllos*, *Bruckenthalia spiculifolia*), and its extremely species-rich meadows.

Valuable, species-rich thin mountain meadows are in the areas of Barackos, which are higher than 1200 m. particularly the meadows dominated by Vaccinium myrtillus and Vaccinium vitis-ideaeus are significant. In Jávárdi there are also species- rich meadows, the number of floral values are significant too due to the ragstone stacks (Pl. *Centaurea kotschyana*, *Tozzia carpathica*). In the latter two areas the subsistence of valuable species are influenced by abandonment respective by changing the cultivation branch (from meadow to pasture).

7. Some preliminary quantitative results

The average number of rare and protected plant species recorded in the sample plots located in forest-related habitats (spruce forests, young spruce stands) is 2,5 per plot, while the number of indicator species is in average 0,6 per plot. In the case of grasslands plots the average number per plot was 2,49 for protected species and 1,27 for indicator species. In the further habitats (gravel bars, alkaline fens etc.) the average number of protected species is 2,12 per plot, while that of indicator species is 1,1 per plot. Summarizing: in the case of the 1036 samples, the average number of protected species is 2,42 per plot, while that of indicator species is 1,1 (Figure 2.).

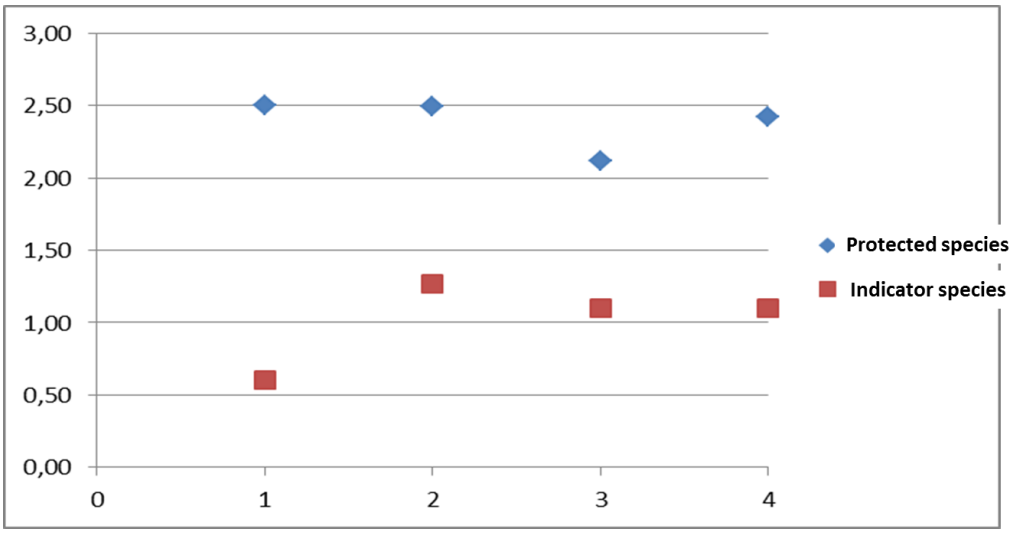

Figure 2. Average number of protected and indicator plant species in the sampling plots (based on data from 1036 quadrats 1.) quadrats in forest sampling sites; 2.) quadrats in grasslands; 3.) quadrats in other habitats (gravel bars, alkaline fens etc.); 4.) all quadrats)

The repartition of sampling sites according to land-use (forest, hay meadow, pasture) in function of elevation (metres a.s.l.) clearly shows the location of the different land-use categories in the landscape (Figure 3.).

The elevation of pastures is the lowest (1121 m), these grasslands being located in the median zone of mountains. Hay meadows, except the lowest areas located at the base of mountains, are located above the pasture zone, therefore the average elevation level is higher than in the case of the former (1130 m). The average elevation level is the highest in the case of forests. Forests are located on extremely steep mountain slopes and in the upper regions (1147 m).

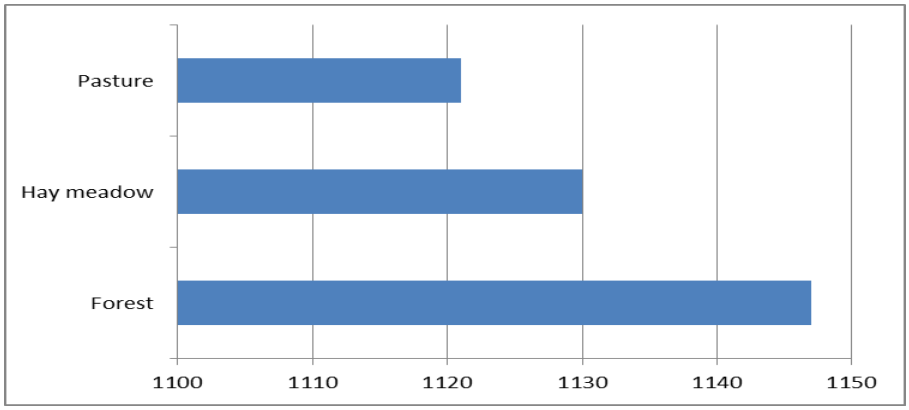

Figure 3. Average elevation according to land use types.

Regarding the distribution of sampling plots according to land-use types, we can notice that 44 % are located in hay meadows (361 sampling plots), 41 % in pastures (336 plots) (85 %, 697 plots in total in the semi-natural species-rich grasslands). Abandoned hay meadows count for 1 % of the sampling plots. Forest was recorded on 106 occasions, representing 14 % of the total number of sampling plots (Figure 4.).

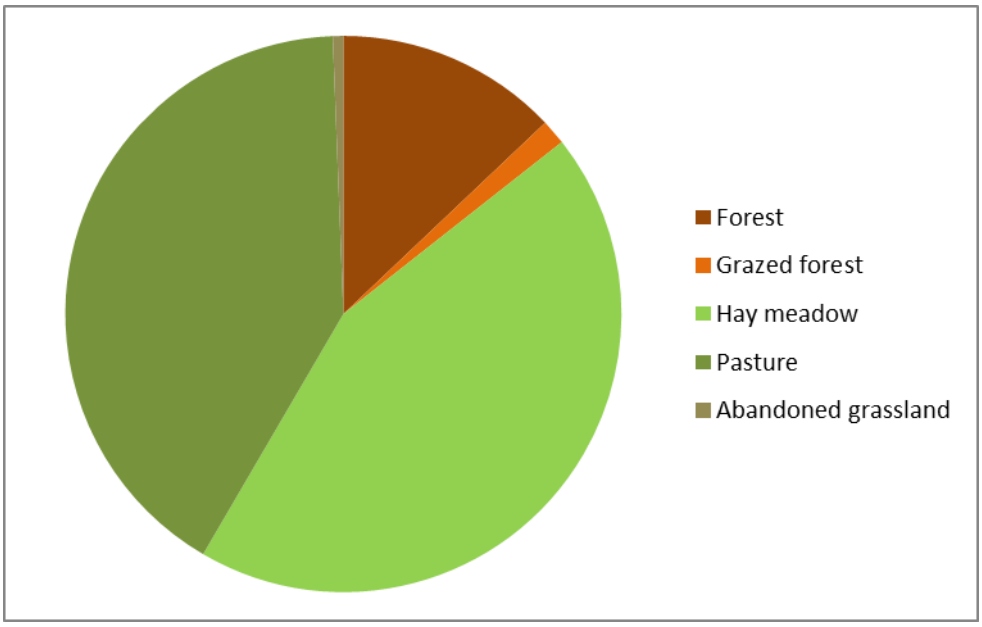

Figure 4. The distribution of sampling points according to land-use.

Summarizing the obtained results, 41 % of the designated sampling plots, 388 quadrats belong to the semi-natural grassland category, without a more detailed determination (Figure 5). The proportion of grasslands dominated by *Nardus stricta* (54 points, 6 %), *Agrostis tenuis* (26 points, 3 %), *Arrhenatherum elatius* (33 points, 4 %) and the proportion of patches invaded by *Pteridium aquilinum* (10 points, 1 %) can be determined more precisely.

Quadrats recorded in forest represent the 15 % (147 points) of the total amount of quadrats. Out of this 45 % represent spruce forest, 10 % beech forest, the remaining 45 % represent forests without precise definition. 7 % (66 points) were sampled in young spruce stands. Further 60 points (6 %) at forest edge.

Only 5 quadrats (1 %) were recorded in the clear-cut areas developed following forest clearings, although this habitat type is represented in a much larger proportion in the landscape (Figure 5).

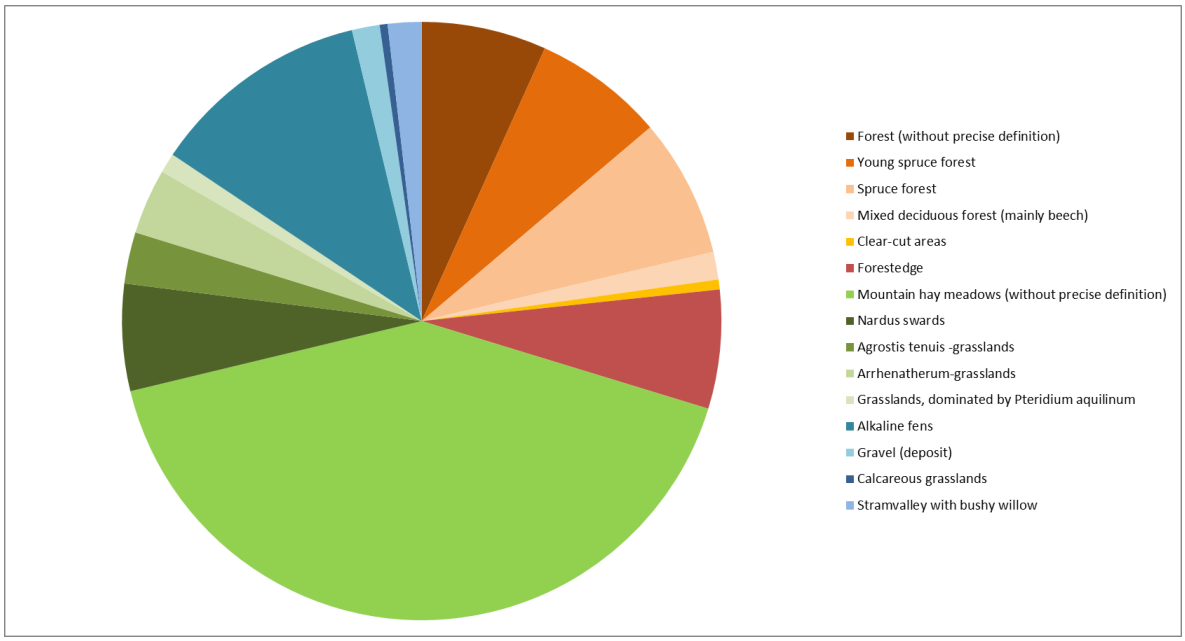

Figure 5. The distribution of sampling points according to habitats

8. Policy measures and their effects

During those 6 years since Romania joined the European Union (1 January 2007) there have been many changes in the regulations that influence mountain farming in Gyimes. The ordinances that regulate the production of milk and dairy created a legal environment that made the traditional milk and dairy system impossible to function. Microbiological requirements regarding raw milk (germ count: 100,000/ml, somatic cell count: 400,000/ml at 30° C) are not achievable in the traditional milk production system of Gyimes.

The most important issue is that the structure of the traditional mountain milk production system (kalibázás) can't comply with the new, strict rules about milk storage, primarily cooling the milk. This makes raw milk unmarketable. These rules changed the traditional way of living in Gyimes and attenuated very much the kalibázás. Further consequences were the continuous decrease of livestock which might lead to a pullout from managing the species rich, semi-natural meadows.

The above mentioned process started the sale of land which consists another problem because even if compliance with regulation was solved there would be no space to increase the volume of milk production since this would require more hay meadows; if land was sold then obviously there wouldn't be enough left and the rental of hay meadows would be costly. Redeeming (i.e. rebuying) land is not an option in the current economical situation for local families.

In the present the sale of land is a problem because they weren't bought by local farmers or producers who wanted to upgrade their farm; they are in the hands of an entrepreneur who's renting them out at a high price; in the same time he's changing the cultivation methods (i.e. hay meadows are used as pastures) and this implies a change in species.

Regulations bring serious socio-economical changes and the consequences in nature conservation are also important. Biologists Csergő and Demeter (2012) included a sample area in their research and results showed a significant decrease in the number of species after abandoning a species rich mountain hay meadow.

Furthermore, it's important to take into consideration both from a nature conservation and socio-economic point of view the potential effects land abandonment might have on tourism. Species rich meadows were made on former woodland (i.e. through deforestation), thus people created a mosaic cultural landscape which is in an unstable state and capable to change dynamically. If the management of these meadows stops then they will rapidly (2-5 years) be covered by goat willow (*Salixcaprea*), aspen (*Populustremula*), silverbirch (*Betulapendula*) or spruce (*Piceaabies*). Forestation of abandoned pieces of land terminates the mosaic view of the cultural landscape on the mountains of Gyimes, the main motivation of tourism. A wild, wooded landscape means fewer tourists, a fact that adversely affects most of the local community.

Unfavourable changes in the economy and the current framework of regulations all point towards more economical, social, nature conservation and tourism related problems.

9. Monitoring trends, methodological proposals

The usage of species rich, semi-natural grasslands in Gyimes seems to be ensured. The traditional ecological knowledge of local people, and their knowledge regarding to the plants are enough for long time maintenance of this lands. At that very moment the economic and social changes are urging the abandonment of tilling these meadows. That is why continuous monitoring of the abandoned meadow parcels' situation, latitude is important. Particularly this can be carried out in autumn, at the end of the mowing season, when unmown territories can be easily identified.

The development of locally rare species also can be an important factor. This can be monitored by biological and cultural anthropological methods as well. Some of the locally rare species are well known by the local community, more races have also a popular name. A rich material can be collected regarding to these. In summer of 2012 we asked one of our

volunteers to make interviews with the people from Gyimes. The theme of the interview was about the mapped protected species. Locals were asked about the ecology and population dynamics of 20 species from Gyimes. According to our preliminary data there are species of which many data can be collected, there are also others of which little data can be collected and there are some rare species, which are not known by the locals from Gyimes.

Besides the popular botanical knowledge there may be necessary monitoring by biological methods the locally rare substance in species.

The agro-environmental subventions may play a very important role in preserving these. Subventions will be paid when the farmers take into account also the maintenance of natural values during their activity. We have a similar example in Austria.

Because species rich, semi-natural grasslands meadows are found in wide areas and in several localities, point wise sampling is suggested to be used in the programme. Near forming the correct datasheet design, this helps us to gain many data in a short time about the condition of grasslands.

A further possibility is shadowing, locally rare grass species' substance variations. This offers an acceptable solution particularly in the case of populations which are known in small numbers and at few places.

10. Recommendations for political measures, for monitoring

For the long time sustainability of grasslands, extensive farming activity is more important than anything. This is why it would be necessary to solve the problems related to milk and milk productions. Enabling production would make necessary the maintenance of present grasslands. Development of economic motivation could create a solution to economic and social problems caused by this and it would be especially desired from an environmental point of view as well.

One of the most important characteristics of extensive landscape usage is the large labour force investment associated with low income. This is necessary for making this cultivation economical. During to this, extensive farming like the maintaining branch of local community and like the most important sustainable environmental usage could be held up for a long time.

In order to solve the outlined goals and problems it is necessary and desirable to convert the support system in a way to maintain the species-rich grasslands.

For this some changes would be necessary:

- The most important is maintaining not just the grasslands but also the biodiversity conservation. A subsidy system is needed that supports not only the land use, but also encourages maintenance of biodiversity.
- The area support schemes, where farmers have to manage at least 7% of the total farm area as ecological compensation areas. In this are included the non-fertilized extensive grasslands which are mowed once a year.
- Since the biggest problem is the abandonment of mountain hay meadows, additional support should be provided, or a certain portion of payment should be given if these meadows are cultivated.
- Because the mountain hay meadows are more species-rich and much more work is needed on them, the payment should be higher.
- It would be necessary to do something with the mowing date also. In case of the individual parcels, the farmer's decisions yearly give/gives a significant diversity in mowing date. This can be important from the point of the biodiversity of meadows. The current schemes freeze the mowing date in the entire landscape and does not allow flexibility eg for the extreme drought weather conditions experienced in 2012. This policy is deteriorating not only the quality of hay but also can deteriorate the compositions of species which result can be biodiversity loss. We are suggesting cancelling the mowing date or moving to 1 June. Like this we can prevent the intensification (use of manure, making silage), at the same time we are giving the opportunity to use the traditional mowing date.
- Monitoring the system of activities carried out by farmers is important. This would allow the involvement of local communities to explore the natural values. Also would allow the differentiation of payments in function of the protectable values.
- In case of grasslands we consider that it is necessary to give the opportunity for the forest regeneration (in patches, in a small proportion of the area) wto restore the previous landscape dynamics.
- It is important to stop converting the meadows to pastures, especially in case of the mountain haymeadows. One method would be to gmeadows a higher subsidy than pastures.

We recommend a support scheme in which cultivating the meadows is not the only requirement but also which maintains the species diversity. For this a preliminary survey of

farmer's plots is necessary. After this indicators can be selected which can be monitored by the farmer. This system can take into consideration and to respond to the changes of farmlands' natural values.

References

Babai D 2012: Magashegyi növényzet etnoökológiai értékelése a Keleti-Kárpátokban (Gyimes). (Ethnoecological evaluation of mountain vegetation in the Eastern Carpathians (Gyimes). PhD Dissertation, University of Pécs.

Bárth J. 2006: A csíkszentmiklósi havashasználat és a Tatros-völgy korai népessége. (The use of the snow-covered mountains from Nicoleşti and the early population of Trotuş valley) A Csíki Székely Múzeum Évkönyve 2005, 17-36.

Csergő A.M. & Demeter L. 2012: Plant species diversity and traditional management in Eastern Carpathian grasslands European Forum on Nature Conservation and Pastoralism 1-41.

Hofer T 2009: A gyimesi csángó népcsoport kialakulása. (Origin of the Gyimes Csángó ethnic group.) In: Hofer T. (ed.): Antropológia és/vagy néprajz. Tanulmányok két kutatási terület vitatott határvidékéről. (Antropology and/or ethnography. Studies from the border region of two disciplines) Budapest: L'Harmattan Kiadó; pp. 66-77.

Huband, S. & McCracken, D.I. 2010: Understanding High Nature Value Agriculture in the Romanian Carpathians: a case study. In: Knowles, B. (ed.): Mountain hay meadows: hotspots of biodiversity and traditional culture. Society of Biology, London. Pogány-havas Association 2011.

Hurdu, B.I. 2012: Floristic and phytogeographic characterisation of areas of endemism from the Romanian Carpathians. PhD-Thesis, Babeş-Bolyai University of Cluj-Napoca, pp. 35.

Kallós Z 1960: Gyimesvölgyi keservesek. (Said songs from Gyimes) Néprajzi Közlemények 5: 3–51.

Karátson D. 2002: A Keleti-Kárpátok. In Karátson D. (ed.): Pannon Enciklopédia. Magyarország földje. CD-ROM. Arcanum Adatbázis Kft.

Ilyés Z. 2007: A tájhasználat változásai és a történeti kultúrtáj 18-20. századi fejlődése Gyimesben. (Landscape changes and the 18-20. century development of the historical cultural landscape in Gyimes.) Eszterházy Károly Főiskola, Eger, 191 pp.

Merunková K., Preislerová, Z. & Chytrý, M. 2012: White Carpathian grasslands: can local ecological factors explain their extraordinary species richness? *Preslia* 84: 311-325.

Nechita, N. 2003: Flora şi vegetaţia cormofitelor din Masivul Hăşmas, Cheile Bicazului şi Lacu Roşu. Muzeul de Ştiinţe Naturale Piatra-Neamţ.

Negrean, G. 2001: Lista rosie a plantelor din Romania existente in pajisti (inclusiv endemite si subendemite). Pp. 30-58. In: Gheorghe Coldea, Gavril Negrean, Ion Sarbu & Anca Sarbu. 2001. Ghid pentru identificarea si inventarierea pajistilor seminaturale din Romania. Bucuresti Edit. Alo. 58 p.

Pálfalvi P. 1995: A Gyimesi-hágó (1164 m) környékének florisztikai vázlata. (Floristic sketch of the surroundings of the Gyimes Pass (1164 m)) Múzeumi Füzetek (Az Erdélyi Múzeum Egyesület Természettudományi és Matematikai Szakosztályának Közleményei) 4: 107-114.

Pálfalvi P. 2010: A Gyimesi-hágó környékének flóralistája (Keleti-Kárpátok, Románia). The floristic list of the Ghimeş-pass area (East Carpathians, Romania). Kanitzia 17: 43-76.

Pócs É 2008: Előszó. (Foreword.) In: Pócs É. (ed.): Vannak csodák, csak észre kell venni. Helyi vallás, néphit és vallásos folklór Gyimesben I. (There are miracles, if you see them. Local religion, folk beliefs and religious folkore in Gyimes I). Budapest: L'Harmattan Kiadó; pp. 7-14.

Tánczos V 1994: Gyimesi archaikus népi imádságok és ráolvasások. (Archaic prayers and incantations in Ghimes region.) In Zakariás E, Keszeg V. (eds.): A Kriza János Néprajzi Társaság Évkönyve 2. (Annals of the Kriza János Ethnographic Society. 2.) Kolozsvár, Kriza János Néprajzi Társaság, pp. 211–243.

Wilson, J.B., Peet, R.K., Dengler, J. & Pärtel 2012: Plant species richness: The world records. Journal of Vegetation Science 23: 796-802