UNIVERSITY OF PÉCS

Biological Doctoral School

Botanical and ethnoecological investigation of mountain vegetation in Ghimes (Eastern Carpathians, Romania)

PhD Thesis

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I. Scientific background and objectives

Today's socio-economic and ecological problems affecting the natural resources draw our attention to the resource-management systems by traditional communities and the importance of their research (BERKES et al. 2000, TURNER et al., 2000). The communities relying primarily on local resources are able for the sustainable use of their natural resources (ecosystem services) (ANDRÁSFALVY 2001, BERKES 1999). Their lifestyle is determined by their in-depth ecological knowledge of the natural environment, on which the regulation of the resources used by the given community is based (TURNER et al. 2000).

The Transylvanian anthropogenic-origin grasslands used as (so-called semi-natural) hay meadows or pastures created in place of forests can be considered as such a natural resource, which belong to the habitats richest in species (WILSON et al. 2012). The unfavourable socio-economic changes during the recent decades has had numerous negative consequences and threatened the existence of the grasslands. To maintain them, it is important to research the extensive land use systems which support them, but only partial researches have been conducted in a few places of Europe (GLASENAPP & THORNTON 2011) (except for the French Alps - MEILLEUR 1986, and the Swiss Alps - NETTING 1981). Moreover, it is necessary to explore the traditional ecological knowledge underlying the decisions on land use, which support them (MOLNÁR et al. 2009).

The traditional ecological knowledge is the triad of the knowledge, experience and beliefs of the living and non-living natural environment (BERKES 1999). Knowledge and community regulation system (social norm system), embedded in culture, which dynamically adapts to changes ensures the sustainable use of natural resources, and the community's long-term survival (ANDRÁSFALVY 2001, BERKES et al. 2000, TURNER et al. 2000).

One of the key elements of the natural resources is the flora, its in-depth knowledge is an important part of the traditional ecological knowledge. His research has focused on the use of herbs and the folk's herbal knowledge in the Carpathian basin, and primarily in the Ghimes (In the Ghimes: RÁCZ & HOLLÓ 1968, KÓCZIÁN et al. 1975, 1976, RAB et al. 1981, RAB 1982). However, an important part of the traditional ecological knowledge is related to the well-known folk taxa's habitat, ecology and to the vegetation (PÉNTEK & SZABÓ 1985). The ethno-ecological research, investigating this topic, has recently been launched (e.g. SHEPARD et al. 2001, JOHNSON & HUNN 2010a, LUNA-JOSÉ & AGUILAR 2012). The traditional ecological knowledge has only been documented in four places of Europe (French Alps -

MEILLEUR 1986; Sweden - ROTURIER & ROUÉ 2009; Gyimes - MOLNÁR & BABAI 2009; Hortobágy- MOLNÁR 2012a).

Beyond the knowledge about the flora and vegetation, the people's knowledge about vegetation dynamics is mostly bound to the use of natural resources. Martin (1993), Sillitoe (1998) and Fleck & Harder (2000) have studied the ecological knowledge of Mexican, New Guinea, and Peruvian communities about secondary forest succession. In Hungary, Paládi-Kovács (1979), and later Molnár (2012b) have reported the traditional knowledge about the management of grasslands, and grasslands dynamics.

The overall objective of our research was to explore the traditional ecological knowledge in Ghimes and to learn the traditional treatment of the deforested, species-rich grasslands in order to juxtapose folk and scientific ecological knowledge and ideas about the vegetation and to help the more complete understanding of the effect of human activities on the environment and the vegetation (MOLNÁR et al. 2009).

Our objectives were:

- The better understanding of the little-known flora and vegetation of the Ghimes region and its enrichment with new data;
- Processing the Ghimes' landscape history;
- The exploration of the Ghimes Csangos' ethno-taxonomic, ethno-botanical and ethno-ecological knowledge. In particular:
    - The collection and analysis of local plant names in Ghimes;
    - Exploration and analysis of the folk biological classification (ethno-taxonomy) structure in Ghimes;
    - Exploration of the local knowledge of habitat: A) Which vegetation and habitat types that are known to the people in Ghimes, how do they divide the landscape with the help of recurring patterns, and B) What kind of knowledge do they have of the various types of vegetation, dynamics, and management;
    - How do they determine the habitat needs of the various species;
- Exploring the sustainable use of natural resources, the local knowledge of vegetation dynamics, the reconstruction of the traditional grassland management system in Ghimes, with a focus on species-rich, semi-natural grasslands, as well as on the natural resources and forests.

II. Material and method

Ghimes' culture preserving archaic elements, which is documented in the ethnographic literature in detail (e.g. KALLÓS 1960, PÓCS 2008), its specific land history (ILYÉS 2007), and the richness of semi-natural grasslands in species, maintained by extensive land use system made the existence of rich traditional ecological knowledge predictable. The area lying in the Eastern Carpathians has about 600 km^2 area in which a 60 km^2 study area has been marked in Gyimesközéplok (Lunca de Jos) in the valley of Hidegség stream and the surrounding mountains (the valleys of Hidegség-, Szalamás-, Cokán-, Jávárdi-, Bükkhavas and Barackos) (the centre's coordinates are: N-46°37'22.45", E-25°57'24.06"). In the study area, the typical sandstone bedrock and sedimentary rocks come only in places to the surface (Jurassic limestone and Triassic conglomerate - eg. in Jávárdipataka) (PÁLFALVI 2001).

The climate is montane boreal (PÁLFALVI 1995, 2001), with a strong continental character. The annual average temperature is between 4-6 °C. The annual amount of precipitation in the valleys is 7-800 mm, and in the mountains it reaches 1,000 to 1,200 mm (PÁLFALVI 1995, NECHITA 2003).

From plant geographical aspects, the area belongs to the *Carpathicum* flora range, to the *Transylvanicum* flora zone (ILYÉS 2007). The dominant forest-species is spruce (*Picea abies*), the most typical forest association is *Hieracio rotundati-Piceetum* that appears at (600) 1200 - 1600 m in zones.

The Hungarian-speaking, Catholic, Ghimes Csangos who inhabit the area is the only Hungarian ethnic group living among high mountain conditions. Their culture and ethnography (dance, music, folklore, religion) is one of the best explored among the Hungarian ethnic groups (e.g. KALLÓS 1960, PÓCS 2008).

85% of the population operate semi-subsistent, mixed family farms. The average farm size is 3.8 hectares (SÓLYOM et al. 2011). The main pillar of farming is cattle breeding. The most important arable crop is the potato.

Our results were carried out between 2006-2012, on 232 field days. We have examined the area's landscape history, flora, vegetation and habitats, the traditional knowledge of plants and vegetation in the Ghimes region, people knowledge of habitats, and the local knowledge related to vegetation dynamics and the impact of farming on the vegetation.

To learn these topics, we have used botanical and ecological anthropological methods, as well. To get familiar with the flora of the habitats, the people in Ghimes consider important, coenological pictures were taken (88 relevees). The size of the quadrants was 16 m^2 in grasslands, and it was 150 to 400 m^2 in the forests.

The cover values of the species were given in %. To learn the vegetation, a habitat mapping on 533 hectares, resulting in the delimitation of 486 spots, was added. During the mapping, the following data were recorded: 1) patch number, 2) habitat type (ÁNÉR - General National Habitat Classification System), 3) the type of land use; 4) naturalness (5-point scale), 5), the most important and most typical about 20 vascular plant species on the spot; 6), the spot's short textual description. These methods have contributed to the knowledge of the flora, as well.

The ecological anthropological data were collected using participant observation (qualitative, unstructured, interactive method), free listing (semi-quantitative interview type), semi-structured (qualitative interview type) and structured interviews (questionnaires) (quantitative interview type) (cf. NEWING et al. 2011).

The interviews were conducted in Hungarian. The informants were found with snowball method. Information was gathered from a total of 54 persons. The average age of informants was 56.2 years. 48 people were smallholder farmers, and two persons were industrial skilled workers (four people still attended school).

A total of 72 hours of voice recording is available. The interviews were recorded word by word (2,229,688 characters).

The major topics emerging in these collections were: folk names of wild flora, determining the biological content of the folk taxa, the knowledge of folk taxa's habitat (135 folk taxa, 2908 data - the "In what kind of place does the " x " folk taxa grow?" – the answers given to the question), the knowledge of vegetation dynamics. From the responses, all known folk taxa, their names, the folk habitats and their names, as well as the knowledge of vegetation dynamics were determined.

In relation to the knowledge on the management of habitats as natural resources, the following questions were asked: *(1) What improves a meadow / pasture? What shall we do to make it better? (2) Why does a meadow / pasture deteriorate? (3) What kind of tasks are there in the meadows / pastures during the year? (4) From which plants will be more / less, which disappear during the treatment of hay / pasture? (5) Which grasslands are fertilized, what is*

used for that? What impact does it have on the grasslands? Which species like it? Which species appear as a result of the fertilization?

III. Results and discussion

In the Hidegség, as the permanent population appeared in the 18th century, in parallel with the growth of the population, the forest area decreased rapidly (cf. ILYÉS 2007). The forest coverage at the end of the 18th century was almost 80%, and its majority disappeared during the first half of the 19th century. Today, about a quarter of the study area (27%) is covered by forest.

The settlers created meadows and pastures in place of the forests, which was the colonists' obligations towards the owner Csík villages (cf. ILYÉS 2007). By the mid 19th century, the treeless habitats occupied two-thirds (66%) of the area, their proportion has changed little since then. The developed grasslands provided opportunity for the growing (survival?) of the light-loving flora (HÁJKOVÁ et al. 2011), which, beyond the rich forest flora, significantly increases the diversity of the area.

In the area, 626 vascular plant species were found (27 bracken, 6 gymnosperms, 593 angiosperms). The most populous families are the *Asteraceae* (81 species) and the *Poaceae* (43 species). The Eurasian species give the majority (41%) of the flora. This value is much higher than in Pogányhavas (32%) lying a few kilometres away and in the Nagyhagymás (Hasmasu) mountain group (34%) (cf. PÁLFALVI 2001, NECHITA 2003). However, the ratio of the Carpathian flora elements is lower than in the Nagyhagymás Mountains (9 and 4%), which is explained by the lack of alpine-subalpine belt (NECHITA 2003). The number of endemic species and subspecies is 13 (2%). The most significant floristic result is the appearance of *Tozzia Carpathica* (IUCN Red list, Natura 2000 marker species), a rarity in the mountainous areas of the Carpathians and the eastern half of the Balkan peninsula. Other interesting floristic results are: *Gentiana cruciata subsp.* phlogifolia and *Scabiosa lucida* subsp. *barbata* (both are endemic subspecies, Romanian Red Book). Significant new data is the appearance of *Centaurea kotschyana, Salix daphnoides* and *Dianthus compactus*.

The depleted tree stocks of the woody vegetation types once dominant in the area (beech forests - *Symphyto cordati-Fagetum*, spruce forests mixed with beech and spruce

forests - *Hieracio rotundati-Piceetum*) exhibit smaller or larger deviations, but their grass and shrub layers are similar (with the exception of the early spring aspect of beech forests rich in *Fagetalia* species). Due to the regular grazing in the forests, a number of "good" forest species are absent or suppressed (e.g. *Huperzia selago, Corallorhiza trifida*), and the meadow and weed species are common (*Prunella vulgaris, Urtica dioica* etc.).

The land use (grazing and wood use) impoverishes the forests in species, however, the grasslands are diverse as habitats and in their variety of species, because of the manifold and extensive land use methods. The three major types of the mountain mesophile grasslands are present in a wide area. The types of the meadows with *Arrhenatherum elatius*, the mountain meadows with *Festuca rubra* and the acidofrequent mountain grasslands (*Arrhenatheretum elatioris, Festuco rubrae-Agrostetum capillaris, Anthoxantho-Agrostietum*) linked by several temporary stocks form a continuous grassland-mosaic with continuous transitions. A special feature of the grasslands in Transylvania is patchiness (AKEROYD & PAGE 2011). A large part of the meadows created at the felled forests' sites in higher areas became *Nardus* swards (*Violo declinatae-Nardetum strictae).* The vast majority of their stocks consists of species-poor grassland dominated by *Nardus stricta*, but there are some species-rich stocks, which are considered as Natura 2000 habitats.

The flora rich and the varied vegetation in the Ghimes is combined with the profound ecological knowledge of the local community. In the human communities of the world researched so far, the well-known folk taxa are between 500-600 in tropical regions, and between 200-400 in the boreal areas (BERLIN 1992, TURNER 1988). In Central Europe, the herdsmen in Hortobágy know 243 biological species classified into 162 named folk taxa (MOLNÁR 2011a). In Árapatak 207, in Kalotaszeg 655 (including the cultivated crops), in Gyergyó approx. 400 folk taxa have been described (PÉNTEK & SZABÓ 1976, 1985, RAB 2001).

In Gyimes 207 folk taxa, 286 identified and named species have been found so far, which is 46% of the entire flora and 68% of the 'visible' flora. The recognized and named species are morphologically (e.g. large-sized), ecologically (e.g. habitat indicators) and / or culturally (e.g. utilization) salient (HUNN 1999).

The species and genus-scale folk taxa, as the basic level for classification, are present in the highest numbers, similarly to all the examined folk taxonomies in the world (BERLIN 1992). For 69%, the congruence between the folk taxa and the biological species is 1:1, while 31% of them are biologically complex (one folk name denotes a group of several species) (cf.

BERLIN 1992). The folk taxa are morphologically well known, the empirical knowledge of the people in the Ghimes is reflected in the accuracy of their observations. The case of autumn crocus (*Colchicum autumnale*) illustrates it very well, the clear correlation between its spring and autumn form is clear for the people in Ghimes, they are considered as one taxon (cf. PÉNTEK & SZABÓ 1985, RAB 2001). The confident knowledge of plants is also reflected in connection with the detection of new species (in Ghimes so far *Hippophaë rhamnoides, Onopordum acanthium* and *Telekia speciosa*) (cf. PÉNTEK & SZABÓ 1976).

In a community, not only the knowledge of the plants can be informative, but also the fact which plants the members of the community do not know (PÉNTEK & SZABÓ 1985). While the specialists (persons with recognized knowledgeable) know at least 90% all the folk taxa of the community (207), the common knowledge also covers 75-80% of the folk taxa-list, but the lack of knowledge of the forest's herbaceous flora is an eye-catching example. The woody species are well known due to their versatile use (see SHEPARD et al. 2001), while

IV. Summary

The high nature value, semi-natural grasslands in Central-Eastern Europe is one of the most diverse habitats in the world, and disappeared drastically in Western-Europe. In Eastern and Central Europe these grasslands are managed by extensive, low-input, labor-intensive farming, which is disappearing almost all in our continent, therefore the management of the seminatural grasslands was abandoned or intensificated, which reduced the diversity of these grasslands.

During our research, conducted between 2006 and 2012, we documented the traditional ecological knowledge of flora and vegetation in Gyimes, in Romania, which is underlying the extensive landuse pattern, furthermore analyzed and described the characteristic features of this knowledge. We used botanical and cultural anthropological methods also in order to gain a detailed documentation about traditional knowledge. Our data and findings relating to the folk knowledge of flora, folk biological classification, landscape ethnoecology e.t.c.

- We discovered the flora of the 60 km^2 study area (624 vascular plant species), describing many rare and endemic species (or subspecies) of this area. Among the most important data we mention the confirmation of the occurrence of *Tozzia carpatica* after 190 years, and the detection of *Salix daphnoides*, furthermore some new localities of the endemic *Gentiana phlogifolia*, and *Scabiosa lucida* subsp. *barbata*.

- We prepared the habitat-map of 530 hectares (486 patches). We classified all the patches, using the Romanian and the Hungarian Habitat-Classification System also, and characterized the patches at the same time (habitat type, land use, naturalness, species list, short text description).
- We reconstructed the change of the landscape, from the 18th century until today, based on historical maps, on three sample areas. We documented the capital era of the deforestation, the process of the hay meadows' and pastures' forming.
- We revealed the characteristic features of the groupings of 309 biological species into 207 folk taxa, which are known and named by the locals in Gyimes. We determined the biological background and content of these folk taxa (monotypical and politypical taxa, species groups), furthermore the traditional usage of these species. We analyzed the sources of knowing, and the main features of the folk plant naming.
- We examined and quantified separately the plant knowledge of the informants (specialists and locals with average knowledge) regarding the number of the known and named folk taxa, comparing their proportion to the full folk taxa list (90, concerned cca. 75%), and we analyzed the characteristics of the plant knowledge (best, concerned hardly known taxa). Furthermore we examined and quantified the knowledge of the biomass in the most important habitats (average 84%), as well as determined the knowledge of the plant species in terms of the life-forms, constancy and AD-value, and the typical features of the plant knowledge (e.g. morphological and fenological observations).
- We established, that the ethnoecological knowledge of the locals expands on 146 different folk habitats. More than that is found anywhere else in the world, in the studied communities. We documented it in detail, and we present the characteristic of the multidimensional landscape-partitioning system, which is important to define the habitat of the folk taxa. Furthermore we determined the abiotic (soil features, hydrology, geomorphology) and biotic (landuse, species composition and structure of the vegetation, succession processes, disturbance, built environment) features or factors, which play an important role to determine the habitats (all 9 features). We established the groups of the indicator species, in terms of the definition of the habitats of the folk taxa. We compiled and analyzed the folk flora of the most

important folk habitats, the list of the folk taxa, which are grouped under an important habitat.

- We classified the folk habitats in a topological and topographical scale. We determined three spatial scale (micro-, meso- and macrohabitats), and introduced the partition into the international literature.
- We documented among the first in the world in detail and in a complex system the traditional, local ecological knowledge on vegetation dynamics in Gyimes, especially regarding to HNV seminatural grassland-management.
- We analyzed in detail the types of the hay meadows and pastures, defined by the locals, and also the low-input management of the high nature value, man-made (seminatural) grasslands, which is really important of the European nature conservationist point of view (meadows' 9, pastures 4 management steps). We investigated also the impact of the management steps on the biodiversity, which can have practical benefits of the planning and developing of agri-environmental target schemes.

We analyzed our results in detail, and characterized the elaborated traditional ecological knowledge on flora and vegetation in a Hungarian ethnic group living in Eastern Europe. Furthermore we investigated the role of this traditional ecological knowledge in the forest, but especially in the grassland-management, and considered the impact of these low-input farming on maintaining biodiversity.

V. Final thoughts

In the development and maintenance of species-rich grasslands the extensive land use pattern based on traditional ecological knowledge is essential (POSCHLOD et al. 1998), which, however, brings low yield with great labour investment (POSCHLOD & WALLISDEVRIES 2002, GLASENAPP & THORNTON 2011). This fact significantly increases the risk of abandonment, which became significant during the last 4-5 years also in the Ghimes (DEMETER & KELEMEN 2012). The agro-environmental schemes in Romania, introduced in 2007, cannot sufficiently stimulate the persistence of extensive, labour-intensive farming against the market trends (AKEROYD & PAGE 2011). Moreover, the system of supports does not distinguish between meadow and pasture, although meeting the obligations related to the meadows is much more difficult than the ones related to the pastures (CSERGŐ & DEMETER 2012). This has caused unfavourable changes in the land-use of the meadows also in the Ghimes (DEMETER & KELEMEN 2012). The main reason for abandoning them is the strict EU regulation for the

dairy products, which makes the previously well-functioning dairy production and sales almost impossible.

The dairy industry has shrunk to the level of self-supply, the cattle population decreased in proportion to it (SÓLYOM et al. 2011). As a result, the most valuable, especially species-rich meadows are abandoned or are turned into pastures (GLASENAPP & THORNTON 2011).

To solve the problem, complex socio-economic and nature conservation actions are needed (MASCIA et al. 2003). In Ghimes, we have acquired rich traditional ecological knowledge and knowledge transfer mechanisms, and a traditional land use pattern, which is still in operation, but in the state of transformation. The management and the ecological knowledge resulted in an almost unique biocultural diversity in Europe. When the nature conservation policies and the system of supports are designed, not only the ecological, but also the local socio-economic aspects and the local community's ecological knowledge need to be considered to achieve the social and nature conservation objectives (BERKES & TURNER 2006). Our results - it is hoped - will help the better understanding of the land use of traditional communities and the development of regulations that facilitate their operation.

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